NORTH LINCOLNSHIRE GREEN ENERGY PARK

Planning Act 2008

Infrastructure Planning (Applications Prescribed Forms and Procedure) Regulations 2009

APFP Regulation 5(2)(q)

North Lincolnshire Green Energy Park

Volume 5

5.3 Design and Access Statement

PINS reference: EN010116

March 2023

Revision number: 2

Contents

Version: 2
Version date: March 2023
Comment: Final Report

This document has been prepared and checked in accordance with ISO 9001:2015

Contents Continued

List of Figures

Terms and acronyms

NAME	DESCRIPTION
AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
AGI	Above Ground Installation
BEIS	Department for Business, Energy & Industrial Strategy
BESS	Battery Energy Storage Scheme
BGS	British Geological Society
CBMF	Concrete Block Manufacturing Facility
CCUS	Carbon Capture and Utilisation Facility
CEMP	Construction Environmental Management Plan
CHP	Combined Heat and Power
CO_2	Carbon Dioxide
DAS	Design and Access Statement
DCO	Development Consent Order
DHN	District Heating Network
DHPWN	District Heat and Private Wire Network
EBG	Emergency Backup Generator
EIA	Environmental Impact Assessment
ERF	Energy Recovery Facility
ES	Environmental Statement
EV	Electric Vehicle
FGTr	Flue Gas Treatment Residue
FGT	Flue Gas Treatment
GHG	Green House Gas
HGV	Heavy Goods Vehicle
IBA	Incinerator Bottom Ash
IDB	Internal Drainage Board

NAME	DESCRIPTION
IED	Industrial Emissions Directive
LNR	Local Nature Reserve
LVIA	Landscape and Visual Impact Assessment
NCA	National Character Area
NCN	National Cycle Network
NIC	National Infrastructure Commission
NLGEP	North Lincolnshire Green Energy Park
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
oLBMMP	Outline Landscape and Biodiversity Management and Maintenance Plan
PEIR	Preliminary Environmental Information Report
PINS	Planning Inspectorate
PPG	Planning Practice Guidance
PRF	Plastic Recycling Facility
PRoW	Public Right of Way
PV	Photovoltaic
PWN	Private Wire Network
RDF	Refuse Derived Fuel
RHTF	Residue Handling and Treatment Facility
SAC	Special Area of Conservation
SoCC	Statement of Community Consultation
SoS	Secretary of State
SPA	Special Protection Area
SPD	Supplementary Planning Document
SuDS	Sustainable Drainage Systems

NAME	DESCRIPTION
UK	United Kingdom
WFD	Water Framework Directive
ZTV	Zone of Theoretical Visibility

TERM	DESCRIPTION
Applicant	North Lincolnshire Green Energy Park Limited.
Railway Re-instatement Land	An area of land within the Application Land within which the railway line will be reinstated.
The Application Land	The limits of the land covered by the development consent order.
The Energy Park	The core elements of the Project (ERF, CCUS, RHTF, CMMF, PRF and electric vehicle and hydrogen refuelling station, hydrogen production and AGIs).
The Energy Park Land	An area of land within the Application Land, containing the elements of the Energy Park.
The Project	The whole of the NLGEP and associated project elements.

Project Vision

The North Lincolnshire Green Energy Park (NLGEP) ('the Project') will be a hub for low-carbon and renewable energy generation, set within a sustainable landscape of wetlands and woodland corridors. The Project will act as a catalyst for regeneration of the Flixborough Industrial Estate, and other existing and proposed development, providing a source of jobs and facilitating the transition to low-carbon living through research and education.

The Project will manage waste in a more sustainable way. Instead of burying it, the waste will be turned into energy to power and heat local homes and businesses. The by-products from processing the waste will be captured and re-used, ensuring minimal waste goes to landfill.

The Project seeks to maximise the opportunities to enable circular resource strategies and low carbon infrastructure as an integral part of the design, for example capturing and utilising waste heat generated by the processing of the waste, which will be used within the Energy Park as well supplying heat to local businesses and homes.

The Project will also empower other renewable energy sources by creating a battery storage facility, alongside a new way of generating and storing energy - through the utilisation of hydrogen electrolysis. The hydrogen will be used to power hydrogen fuelled vehicles, energy storage, or back-up fuel to support the district heating network, with an aspiration for it to be used within the gas grid to help heat our homes.

A Carbon capture, utilisation and storage facility will filter out carbon dioxide and allow it to be stored and utilised, further enhancing the low-carbon aspirations of the Project. The stored gas will be used to manufacture concrete blocks and aggregates or used offsite for other commercial uses.

Through association with the Zero Carbon Humber Partnership and a partner to the East Coast Cluster, NLGEP will become the flagship for future energy recovery developments with the potential to achieve a carbon negative status when the infrastructure for carbon storage is in place.

The overarching aim of the Project is to support the UK's transition to a low carbon economy as outlined in the Sixth Carbon Budget (December 2020), the national Ten Point Plan for a Green Industrial Revolution (November 2020) and the North Lincolnshire prospectus for a Green Future.

The Project will help transform the Humber area from a traditionally carbon intensive to an area focussed on clean-growth.

To help deliver the Project Vision, a set of project principles were developed at an early stage to set out the aspiration, and guide the Project throughout the design, planning and consultation process. The project principles are based on the NIC's Design Principles for national infrastructure that identifies focus areas covering People, Value, Places and Climate, which have been developed to respond to the context and the nature of the Project

The Design Principles reflect the Project's vision and its core values. They provide a set of design statements that have underpinned the approach to design and guided design decisions to realise the Project vision leading up to the DCO Application.

To help guide the delivery of the Project Vision and principles, a set of Design Codes have been prepared and submitted as part of the DCO Application.

The Design Principles and Codes (Document Reference 5.12) provide clarity over what constitutes acceptable design quality and where there have been important design decisions that shape the application, and thereby they provide a level of insight for designers, and control for the planning authority and other stakeholders.

Compliance with the Design Codes will ensure the high-quality outcome is achieved as envisaged. As the Design Codes will form the basis of design assessment for the development of the Project site as it comes forwards, it is recommended that a Design Codes Compliance Statement will help demonstrate how the detailed design submitted to discharge requirements relate to the Design Codes.


Stather Road Drain

1.0 Introduction

1.1 Introduction

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

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

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

a) a bottom ash and flue gas residue handling and treatment facility (RHTF);

b) a concrete block manufacturing facility (CBMF);

c) a plastic recycling facility (PRF);

d) a hydrogen production and storage facility;

e) an electric vehicle (EV) and hydrogen (H2) refuelling station;

f) battery storage;

g) a hydrogen and natural gas above ground installations (AGI);

h) a new access road and parking;

i) a gatehouse and visitor centre with elevated walkway;

j) railway reinstatement works including, sidings at Dragonby, reinstatement and safety improvements to the 6km private railway spur, and the construction of a new railhead with sidings south of Flixborough Wharf;

k) a northern and southern district heating and private wire network (DHPWN);

l) habitat creation, landscaping and ecological mitigation, including green infrastructure and 65 acre wetland area;

m) new public rights of way and cycle ways including footbridges;

n) Sustainable Drainage Systems (SuDs) and flood defence; and

o) utility constructions and diversions.

1.1.4 These are outlined in more detail in Section 3.2.

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

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

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

1.2 What is a Green Energy Park

1.2.1 North Lincolnshire Green Energy Park Limited (the Applicant) is a renewable energy infrastructure company which is part of a renewable energy infrastructure company with offices in the UK, Ireland and Italy. It has niche knowledge in the pre-planning and development of biomass, biogas and ERFs. It is currently managing a number of projects through the development construction and operation.

1.2.2 At Flixborough, the Project will provide a vital public service through new efficient energy recovery and generation and focus on sustainable energy storage and research. The Project will create a number of new jobs and help power local homes and businesses.

1.2.3 The Project will be centred around a new efficient ERF with an emphasis to reuse as many by-products as possible. An RHTF will be linked to a CBMF, whilst heat will be distributed through a District Heating Network (DHN). A large amount of electricity will be fed into the grid whilst

some will be used to produce and store hydrogen and be stored in batteries on-site to meet demand during peak hours. A new refuelling station for both electric and hydrogen powered vehicles will also be delivered, helping the transition to a net-zero environment. Finally, a PRF will be delivered to help plastics being recycled rather than being recovered as energy.

1.3 Purpose of the DAS

1.3.1 This DAS is prepared pursuant to Regulation 5(2)(q) of The Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009 and forms part of a suite of supporting documents for the Development Consent Order (DCO) application.

1.3.2 The DAS provides a summary of the design process from analysis, through to engagement, development of design principles, design testing and development. Section 6 and 7 set out the strategy for phasing and the vertical parameters and relationship to Works Plans.

1.3.3 The document summarises the context appraisal and analysis that was carried out and is submitted as part of the DCO application. More detailed information can be found in these supporting reports.

1.4 Report Structure

1.4.1 The DAS is structured around 8 sections:

- Section 1 provides an introduction to the Project, document and team behind the proposals.
- Section 2 presents a thorough analysis of the context within which the Project is based.
- Section 3 - provides a summary of the individual parts of the Project.
- Section 4 summarises consultation activity and design decisions made in response to feedback.
- Section 5 presents the vision and project principles which will help to deliver the Project. The section also covers the design evolution of the Project, illustrative detail on the landscape, drainage, access and other proposals.
- Section 6 sets out the indicative phasing of the delivery of the Project, should consent be obtained.
- Section 7 sets out the design parameters, giving some certainty to what will be delivered on site
- Section 8 summarises the Project and community benefits that it can achieve.

1.5 Planning Context

1.5.1 The DCO process for NSIPs is established through the Planning Act (the 2008 Act) as amended. The legislative framework for DASs is set out at Part 3, Article 9, paragraph 3 of the Town and Country Planning (Development Management Procedure) (England) Order 2015 which states that: *'A design and access statement must—*

a) explain the design principles and concepts that have been applied to the development;

b) demonstrate the steps taken to appraise the context of the development and how the design of the development takes that context into account;

c) explain the policy adopted as to access, and how policies relating to access in relevant local development documents have been taken into account;

d) state what, if any, consultation has been undertaken on issues relating to access to the development and what account has been taken of the outcome of any such consultation; and

e) explain how any specific issues which might affect access to the development have been addressed.'

1.5.2 The 2008 Act does not require DCO applications to be accompanied by a DAS. Nevertheless, the Applicant recognises the importance of development proposals achieving good design and the increasing focus of national planning policy towards creating high quality buildings and places, and has thus chosen to prepare this DAS in response to this trend.

1.6 Application of this Document

1.6.1 Section 5.1 of this document contains project principles developed based on the NIC focus areas and the site context. Along with the Design Principles and Codes (**Document Reference 5.12)**, these will help guide the detailed design of the Project.

1.6.2 Parameters for what is proposed are summarised in Section 7.1 and provide a framework for more detailed design at the next stage.

1.6.3 Detailed designs have not been submitted for approval for any elements of the Project. The layout, scale and external appearance of the buildings will be designed in accordance with the Works Plans (**Document Reference 4.4**) and the written parameters in Table 7.1 of the DAS. They will be designed in general accordance with the Design Principles and Codes (**Document Reference 5.12)**.

1.6.4 Illustrative information on access, drainage, landscape proposals, accessibility, etc is also provided to show the intent and aspirations of the Project as well as a means of testing that the principles set out are deliverable and create a high quality environment within which the Project will be located.

1.7 Project Team

1.7.1 A multi--disciplinary team has been engaged on behalf of the Applicant in helping to design, assess and present the DCO application.

PROJECT TEAM	
MEMBER	**RESPONSIBILITIES**
BURO HAPPOLD	• Project managing • Transport • Drainage and civil engineers • Flood Modelling
ERM	• Assess impacts on the historic and natural environment • Environmental Impact Assessment lead
LDA DESIGN	• Masterplanning • Landscape design
NORTHERN PLANNERS	• Planning
BOWLAND ECOLOGY	• Ecological advice and surveys
FICHTNER	• Design of the ERF and associated infrastructure
GSDA	• Architectural design of the buildings
WBD	• Legal advice
ARDENT	• Land referencing mapping
NIC	• Cost Consultants
SEC Newgate	• Communities and Consultation
DDM	• Land Agents

Table no. 1.1: Project Team

Figure 1.1: Site Location

Site Location Plan

Legend

- DCO Limits
- Land excluded from DCO Limits

Open Access Land within the eastern extents of the Site

2.0 Site Overview

2.1 Introduction

2.1.1 The following section provides a summary of the context analysis that the design team has acquired through site visits, surveys, desktop analysis and stakeholder engagement and consultation.

2.1.2 The analysis is grouped into relevant sub-sections, covering key site considerations. Further detail on the individual topics can be found in the Environmental Statement (**Volume 6**).

2.1.3 The extents of the Order Limits (the Application Land) as shown on Figure 1.1 extends to 263.55ha and is located to the north and west of Scunthorpe.

2.2 Site Location and Context Summary

Historic Context

2.2.1 Based on the geoarchaeological context and the distribution of known and/or suspected archaeological sites three north-south zones of differing archaeological potential (see figure 2.3) have been identified across the Application Land.

2.2.2 Zone 1 - There is potential for earlier prehistoric activity and material to occur, although this is likely to be buried beneath overlying warp deposits.

2.2.3 Zone 2 - There is the potential for significant archaeological remains to occur in this zone, from settlement of the Neolithic or Bronze Age periods, to potentially seasonal occupation in the Iron Age, Roman and medieval periods.

2.2.4 Zone 3 - It is possible that this area has been subject to historic sand/gravel quarrying which could have disturbed earlier archaeological remains.

Topography and Geology

2.2.5 The Application Land is situated at an elevation of approximately 2m to 8m Above Ordnance Datum (AOD). Land in the vicinity of the Application Land is generally flat to the north and south in line with the River Trent (adjacent to the west), with an increase in elevation towards the east.

2.2.6 British Geological Survey (BGS) digital mapping indicates that (made ground notwithstanding) the central and northern parts of the Application Land are directly underlain by superficial deposits of alluvium. At the southern end of the Application Land superficial deposits are shown as predominantly Warp (clay and silt). Towards the east the Application Land is underlain by blown sand, whilst at the far east of the Application Land, including the Dragonby Sidings, no superficial deposits are indicated to be present.

2.2.7 The underlying bedrock across the majority of the Application Land is mapped as Mercia Mudstone Formation.

Watercourses and Drainage

2.2.8 The River Trent runs adjacent to the western edge of the Application Land and is ultimately the receiving body for the surface water within the Application Land via an existing pumping station. There are a number of existing ditches across the Application Land, that convey surface water to the River Trent.

2.2.9 Critical to the successful function of flood defence along the River Trent is the operation of the Internal Drainage Board (IDB) pumping station located on Stather Road, north of Neap House. This pumping station pumps water from the Lysaght's Drain over the flood defences when levels in the River Trent are high, preventing the free discharge of the Lysaght's Drain.

2.2.10 Existing drainage system across the agricultural land within the Application Land predominantly consists of land drains. The ditches eventually drain to Lysaght's Drain.

Transport and Access

2.2.11 Stather Road provides the main vehicular access route to/from Flixborough Industrial Estate and Flixborough Wharf. A weight restricted access via Flixborough Village provides secondary access to Flixborough Industrial Estate.

2.2.12 National Cycle Network (NCN) Route 169 is located approximately 2.8km to the east of the Application Land and travels north to south through Scunthorpe.

2.2.13 There are existing pedestrian footway connections to/from NCN 169 via a number of residential streets between Ferry Road West and Luneburg Way, which also provide quiet routes for cyclists.

2.2.14 Numerous Public Right of Ways (PRoW) also exist within the Application Land and its close proximity.

2.2.15 The nearest bus route serving the Application Land (Bus Route 60) runs along Stather Road adjacent to Flixborough Industrial Estate / Flixborough Wharf.

Landscape and Ecology

2.2.16 The Application Land is not covered by any statutory landscape designations.

2.2.17 There is an area of Open Access Land within the Application Land, found at the eastern edge. There is also an accessible Local Nature Reserve (LNR) in proximity, known as Phoenix Parkway LNR.

2.2.18 Much of the Application Land is relatively inaccessible to the public, however to the northern extent it contains a number of PRoWs.

2.2.19 In terms of national landscape designations, the majority of the Application Land lies in NCA 39 Humberhead Levels.

2.2.20 The Local Landscape Character Assessment, defines the Application Land as situated mainly in the Trent Levels Character Area, and it adjoins the Lincolnshire Edge Character Area, both very distinctive in character.

Visual Context

2.2.21 Long distance views are available from a number of local communities and surrounding villages. Views from Scunthorpe are limited to the northern edge of the town.

2.2.22 A footpath and permissive path at Amcotts affords some close range views across the River Trent. Views from footpaths between Burton-upon-Stather and Flixborough Industrial Estate are dominated by Grange Wind Farm, and those around Luddington by overhead power lines.

2.2.23 Views are available from a number of roads passing the Application Land, including Lodge Lane, Stather Road and the B1216 Ferry Road West. Elevated but filtered views are available from Burton Road and the B1430 Normanby Road to the north west of the Application Land.

2.3 Planning Context

2.3.1 Full details of the policy and legislative context within which the Project is proposed to be developed are provided in the Planning Statement (**Document Reference 5.1**). However, this section of the DAS summarises the design related legislative context and policy framework in respect of the Project with particular emphasis on the relevant National Policy Statements.

National Policy Statements

Overarching National Planning Policy Statement for Energy (EN-1) (DECC, 2011a)

2.3.2 NPS EN-1 sets out the national policy for the delivery of energy infrastructure and, at section 4.5, establishes the criteria for good design for such infrastructure. Paragraph 4.5.1 in particular makes the following statement: *'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.'*

2.3.3 Recognising the importance which the 2008 Act places on good design and sustainability, paragraph 4.5.3 of NPS EN-1 outlines that the Secretary of State (SoS) *'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'*. In doing so, the SoS *'should satisfy itself that the applicant has taken into account both functionality (including fitness for purpose and sustainability) and aesthetics (including its contribution to the quality of the area in which it would be located) as far as possible.'*

2.3.4 Paragraph 4.5.3 continues and states *'Whilst the applicant may not have any or very limited choice in the physical appearance of some energy infrastructure, there may be opportunities for the applicant to demonstrate good design in terms of siting relative to existing landscape character, landform and vegetation. Furthermore, the design and sensitive use of materials in any associated development such as electricity substations will assist in ensuring that such development contributes to the quality of the area.'*

National Policy Statement for Renewable Energy Infrastructure (EN-3) (DECC, 2011b) and National Policy Statement for Electricity Networks Infrastructure (EN-5) (DECC, 2011)

2.3.5 NPS EN-3 and NPS EN-5 reiterate the principles for good design outlined in section 4.5 of NPS EN-1.

2.3.6 In relation to proposals for renewable energy infrastructure, paragraph 2.4.2 of NPS EN-3 states that such proposals *'should demonstrate good design in respect of landscape and visual amenity, and in the design of the project to mitigate impacts such as noise and effects on ecology.'*

2.3.7 In relation to proposals for electricity networks infrastructure specifically, paragraph 2.5.2 on NPS EN-5 details that such proposals *'should demonstrate good design in their approach to mitigating the potential adverse impacts which can be associated with overhead lines'*, particularly those relating to: biodiversity and geological conservation, landscape and visual, noise and vibration and electric and magnetic fields.

Local Planning Policy

2.3.8 In local planning policy terms, the Project lies entirely within the administrative district of North Lincolnshire Council.

2.3.9 The Planning Statement (**Document Reference 5.1**) contains a summary of the adopted and emerging local plan policies considered relevant to the Project, but for the purposes of this DAS, the policies specifically relevant to design are detailed below:

- Saved Local Plan Policy DS1 'General Requirements' expects development proposals to achieve a high standard of design in both built-up areas and the countryside and details a number of design criteria which all proposals will be considered against.
- Core Strategy Policy CS5 'Delivering Quality Design'. This policy details that all new development in North Lincolnshire should be well designed and appropriate for their context. This policy makes it clear that proposals should contribute to creating a sense of place
- Emerging Local Plan Policy SS3p 'Development Principles' requires new development in North Lincolnshire to contribute towards the creation of sustainable communities and a sense of place. The policy outlines key principles which all proposals for development in North Lincolnshire should reflect.
- Emerging Local Plan Policy DM1p 'General Requirements'. Requires all new development proposals achieve high quality sustainable design that contributes positively to local character, landscape and townscape, and supports diversity, equality and access for all.

2.4 Carbon and Energy Context

2.4.1 The UK has a growing body of energy and climate change law, policy and guidance which, collectively, outlines the urgent need for new energy generation infrastructure, including energy from waste and carbon capture equipped power stations. The Planning Statement (**Document Reference 5.1**) provides an overview of said law, policy and guidance.

2.4.2 Alongside the drive for new energy generation, the UK Government has a legally binding commitment to achieve net zero in terms of greenhouse gas emissions by 2050.

2.4.3 In local policy terms, North Lincolnshire Council's adopted and emerging Local Plan policies are generally consistent with the UK government's approach in seeking to

reduce carbon emissions and divert waste away from landfill. Of particular relevance is: Core Strategy Policy CS18 (Sustainable Resource and Climate Change), Saved Local Plan Policy DS21 (Renewable Energy) and emerging Local Plan Policies DQE8p (Climate Change and Low Carbon Living) and DQE9p (Renewable Energy Proposals). Together these policies promote development that utilises natural resources as efficiently and sustainably as possible and reduces carbon emissions to meet the climate change challenge.

2.4.4 In addition to the policies referred to above, North Lincolnshire Council's Planning for Renewable Energy Development Supplementary Planning Document (SPD) (2011) strongly supports renewable energy and views it as being a key part of the transformation of North Lincolnshire's economy. In particular, the SPD recognises the importance of North Lincolnshire in the power generation industry, producing around 7% of the country's electricity requirement.

2.5 Transport and Access

Site Location

2.5.1 The Application Land is situated 6km north-west of Scunthorpe town centre, 23km south-west of the Humber Bridge, 54km west of Grimsby and 47km north-east of Doncaster. The Application Land is located approximately 4km north of the M181 / M180 and 1.5km north-west of the A1077. The M180 is accessed via the A1077 / M181 roundabout.

2.5.2 The M180 connects eastwards via Brigg to Grimsby, and westwards approximately 18 kilometres to the M18, which provides onward connections to the M62 to the north and the M1 to the south via Doncaster. There are additional connections to/from the north via the A1077 and the A15 Humber Bridge at Hull, which connects to the A63 and A164.

Local Highway Network

2.5.3 A plan showing the local highway network is shown in Figure 2.1.

2.5.4 Stather Road provides the vehicular access route to/from Flixborough Industrial Estate and Flixborough Wharf.

2.5.5 Heavy Goods Vehicles (HGVs) currently take access to/from the south along Stather Road via Neap House and the B1216 Ferry West Road. A 7.5T weight restriction is imposed along Stather Road to the east of Flixborough Industrial Estate preventing HGVs access through Flixborough village.

2.5.6 The existing section of Stather Road via Neap House is approximately 5.3m wide making it too narrow for two-way HGV movements so there are currently traffic signals provided at this location to control vehicle movements in either direction.

2.5.7 A detailed description of the local highway network and existing uses are included in the Transport Assessment (**Document Reference 6.2.13**).

Pedestrian/Cycle Access

2.5.8 A plan showing the existing pedestrian and cycle infrastructure in the vicinity of the Application Land is shown in Figure 2.2.

2.5.9 NCN Route 169 is located approximately 2.8km to the east of the Application Land and is known locally as the Scunthorpe Ridgeway. The route travels north to south through Scunthorpe and is approximately 8km in length.

2.5.10 There are existing pedestrian footway connections to/from NCN 169 via a number of residential streets between Ferry Road West and Luneburg Way, which also provide quiet routes for cyclists.

2.5.11 Numerous PRoW also exist in the vicinity of the Application Land.

2.5.12 Flixborough village is within a 20-minute walk and Ferry Road West to the south of the A1077 is within a 30-minute walk.

2.5.13 Whilst Scunthorpe and Althorpe railway stations are outside reasonable walking distances, they are accessible within a 20-30 minute cycle. Scunthorpe town centre is located approximately 20-25 minutes cycle ride from the Application Land, where a wide range of amenities can be found.

Public Transport

Bus

2.5.14 The nearest bus route serving the Energy Park (Bus Route 60) runs along Stather Road adjacent to Flixborough Industrial Estate / Flixborough Wharf. Bus Route 60 runs north-south from Whitton via Burton upon Stather and Flixborough to Scunthorpe via the bus and railway stations to John Leggott sixth form college situated to the south of Scunthorpe town centre.

2.5.15 The 'Flixborough Stather Wharf' bus stops are situated on Stather Road adjacent to the Flixborough Wharf access. There is no physical bus infrastructure provided at this location as this bus route forms part of North Lincolnshire Council's rural bus network, which operates an on-demand bus service via 'JustGo North Lincs'.

2.5.16 There are additional bus services (Routes 7 and 8) available via Ferry Road West with bus stops located approximately 90 metres south of the A1077. These bus stops are within a 10-minute cycle ride / 30-minute walk of the Energy Park.

National Rail

2.5.17 Althorpe railway station is the nearest station serving the Application Land, which is located approximately 4.3 kilometres south-west of the Energy Park on the opposite side of the River Trent, adjacent to Keadby Bridge. It is approximately 20-minute cycle ride from the Energy Park via Stather Road and the B1216 Neap House.

2.5.18 Scunthorpe railway station is located a short walk from Scunthorpe town centre, which is approximately 4.5 kilometres south-east of the Energy Park and can be reached by bus (approximately 15 to 20-minute bus journey) or by cycle (approximately 20-minute cycle ride).

2.5.19 Scunthorpe and Althorpe stations are both served by Northern Trains and the TransPennine Express. Scunthorpe offers train services to destinations including Grimsby, Cleethorpes, Doncaster and Manchester while train services to Crowle, Doncaster and Sheffield operate from Althorpe station.

Existing entrance to Flixborough Wharf from Stather Road

Local highway network

Legend

Order Limits

BURO HAPPOLD

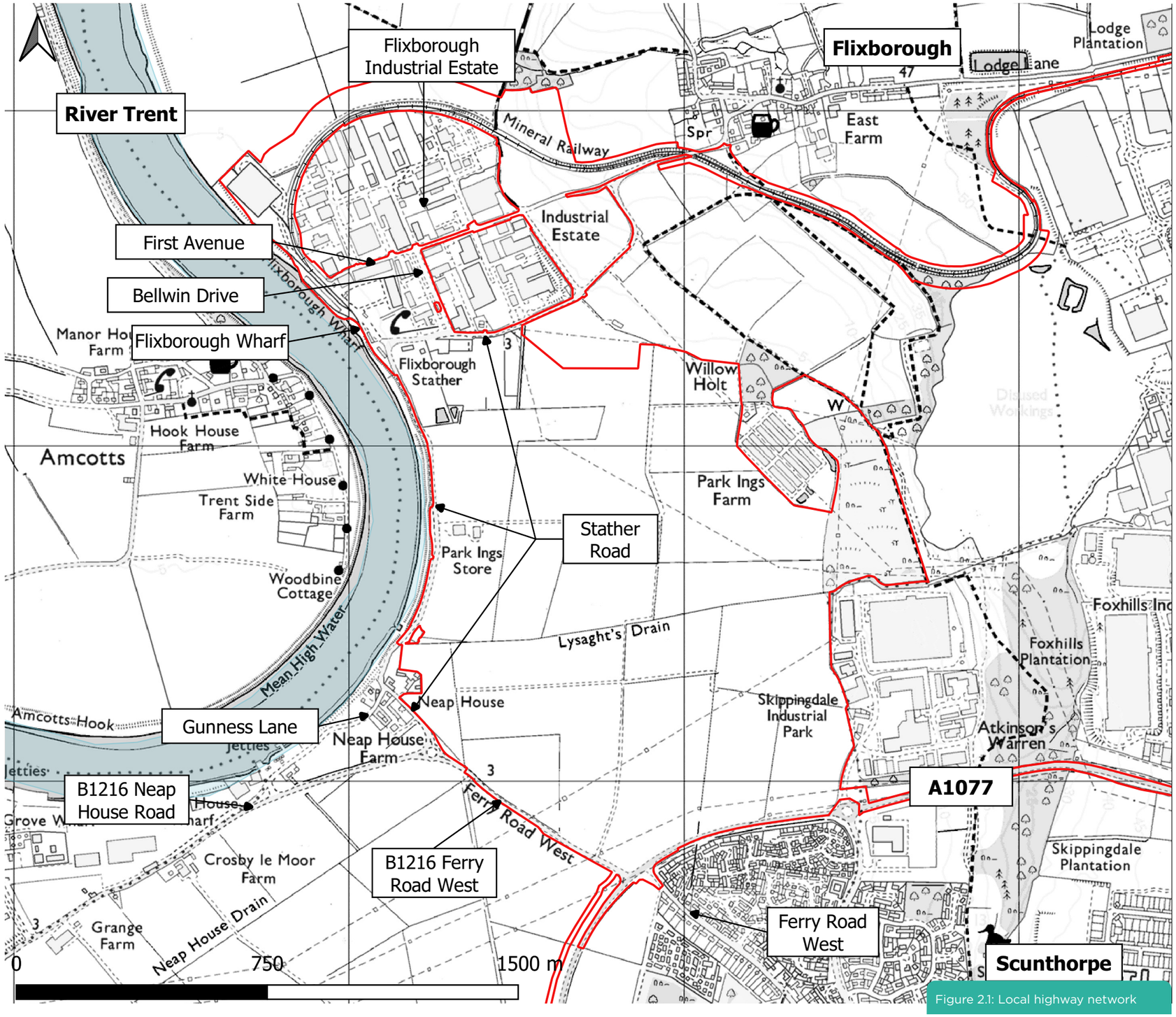


Figure 2.1: Local highway network

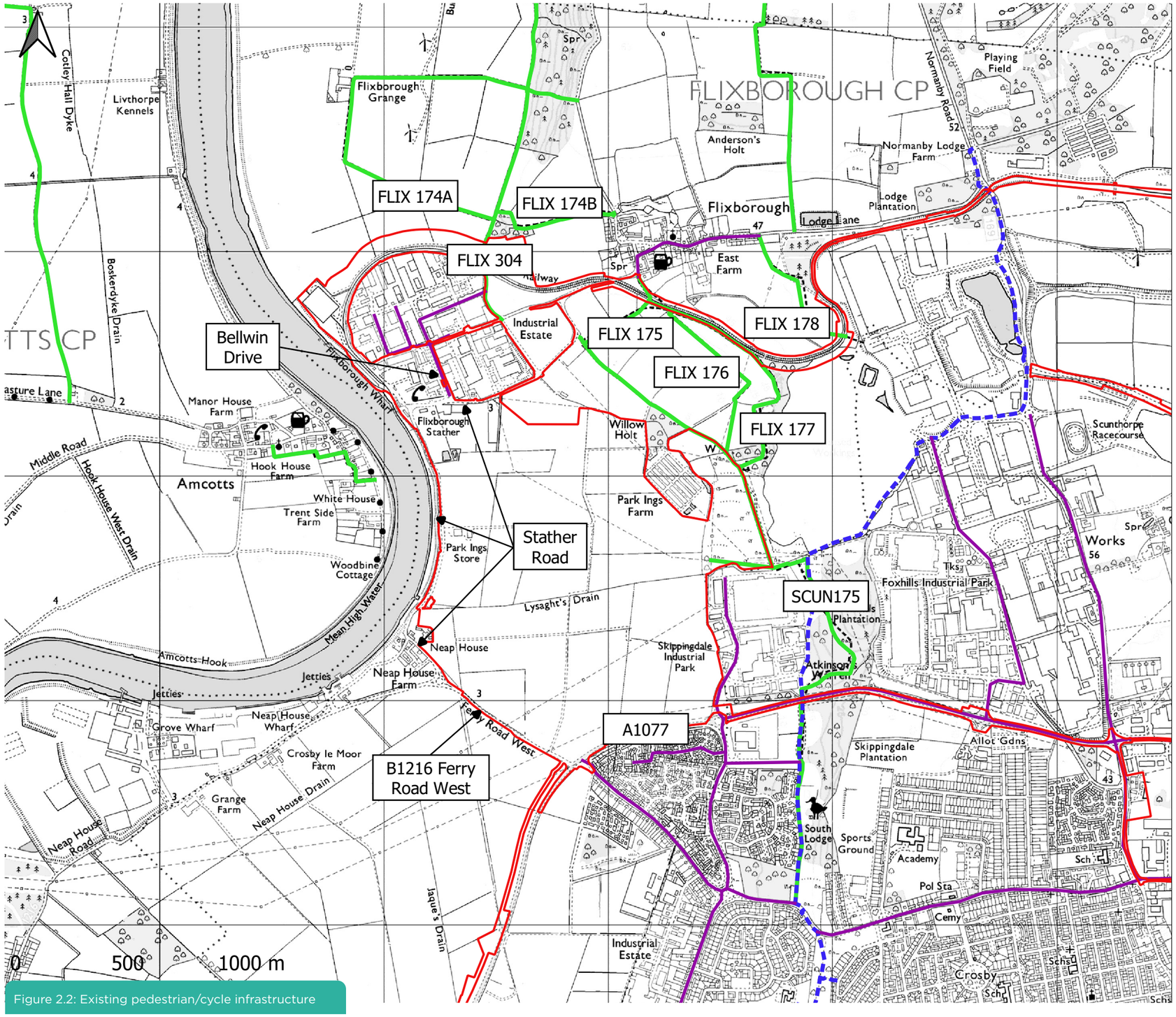


Figure 2.2: Existing pedestrian/cycle infrastructure

Existing pedestrian/cycle infrastructure

Legend

- Order Limits
- Existing On-road footways
- National Cycle Network
- Public Right of Way

BURO HAPPOLD

2.6 Site Location and Context

Historic Context

2.6.1 Based on the geoarchaeological context and the distribution of known and/or suspected archaeological sites, three north-south zones of differing archaeological potential have been identified across the Application Land.

Zone 1 – Trent Valley Alluvium

2.6.2 This comprises the portion of the River Trent floodplain that lies immediately east of the current river channel and within which deep deposits (up to c.12-13m deep) of peat and/or peaty clay have been recorded in boreholes. Until the drainage and warping schemes of the seventeenth century onwards, this zone would have been too wet for cultivation and intermittently flooded for much of the year. It is unlikely that significant remains of settlement will be encountered in this area, with the possible exception of Flixborough Stathe itself (the site of the proposed ERF) where medieval riverside activity is known to have occurred. There is potential for earlier prehistoric activity and material (eg flint scatters, wooden revetments, boats, votive deposits of metalwork) to occur, although this is likely to be buried beneath overlying warp deposits.

Zone 2 – Trent Valley Fringe

2.6.3 This zone lies to the east of Zone 1 and runs up to the base of the west-facing slopes of the higher ground. Here, on the floodplain fringe, the alluvial deposits are much shallower, as the underlying blown sand rises up, forming small islands in places. Much of this zone was historically occupied by uncultivated and unenclosed common land, including areas of sandhills on Brumby Common, at the southern end of the Application Land. There is the potential for significant archaeological remains to occur in this zone, from settlement of the Neolithic or Bronze Age periods, to potentially seasonal occupation in the Iron Age, Roman and medieval periods. In particular, there are a number of cropmark sites in the area to the west of the Foxhills Industrial Estate which could well be late prehistoric or Roman.

Zone 3 – Blown Sand Slopes

2.6.4 The sandy slopes to the east of the valley are rich in archaeological remains, including the mid-late Anglo-Saxon settlement at Flixborough. The sand and gravel quarry at Willow Holt, immediately south of the Flixborough Industrial Estate, has produced significant multi-period remains of Neolithic, Bronze Age, Iron Age and Roman date. The nationally significant remains of a possible Anglo-Saxon monastery were excavated in a similar topographical position 1km to the south. Furthermore, this area sits directly above the loop of the River Trent at Flixborough Stathe and a short distance west of the historic settlement of Flixborough itself. It is possible that this area has been subject to historic sand/gravel quarrying which could have disturbed earlier archaeological remains.

Designated Heritage Assets

2.6.5 There are three Scheduled Monuments within 1km of the Application Land. The nearest of the three is Flixborough Saxon nunnery & site of All Saints medieval church & burial ground, which is located immediately adjacent to the Application Land. There is a single Grade II* listed building within 1km of the Application Land: Former Church of St John, located within approximately 100m of the Application Land, and 16 Grade II listed buildings within 1km of the Application Land, the nearest of which is The Smithy in Flixborough village. It is located approximately 30m outside the Application Land.

View from Stather Road within Zone 1 looking north east over Zones 1, 2, 3 and 4

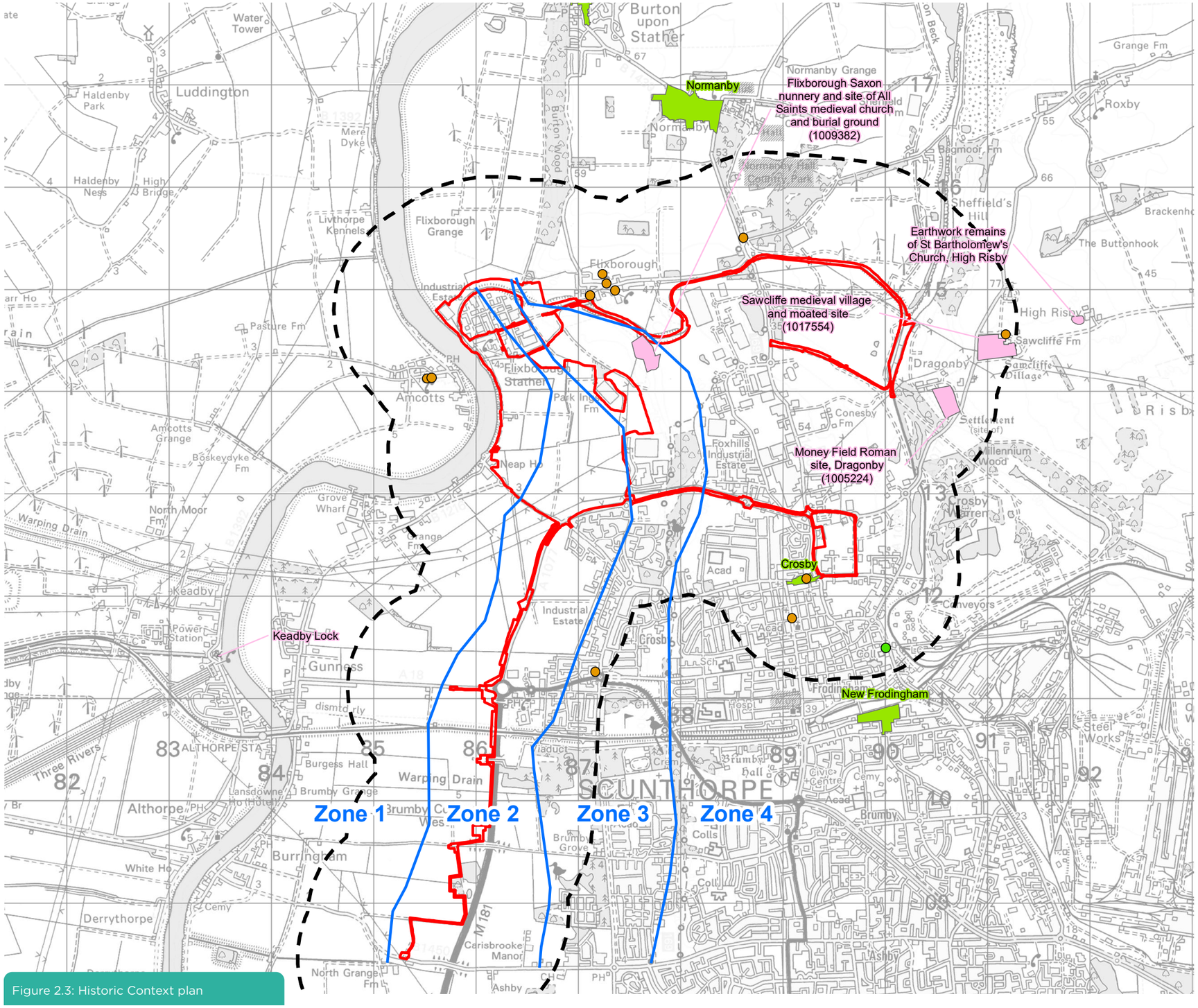


Figure 2.3: Historic Context plan

Historic Context Plan

Legend

- Order Limits
- 1km buffer
- Zones of Archaeological Potential
- Conservation Area
- Scheduled Monument
- Grade I Listed Building
- Grade II Listed Building
- Grade II* Listed Building

ERM

2.7 Topography and Geology

2.7.1 The Application Land is situated at an elevation of approximately 2m to 8m AOD. Land in the vicinity of the Application Land is generally flat to the north and south in line with the River Trent (adjacent to the west), with an increase in elevation towards the east.

2.7.2 BGS digital mapping indicates that (made ground notwithstanding) the central and northern parts of the Application Land are directly underlain by superficial deposits of alluvium (principally composed of silt, clay, sand and gravel but also containing interbedded peat layers). At the southern end of the Application Land superficial deposits are shown as predominantly Warp (clay and silt), described as alluvium deposited by artificial flooding. Towards the east the Application Land is underlain by blown sand, described as 'sand that has been transported by wind, or sand consisting predominantly of wind borne particles' whilst at the far east of the site, including the Dragonby Sidings, no superficial deposits are indicated to be present.

2.7.3 The alluvial deposits, including the Warp, are identified as being in the region of three to 17m thickness and the blown sands are identified as being approximately 1.5m in thickness. Published information indicates that the alluvium, warp and blown sands are all underlain by sand and gravel of the Vale of York Glacial Lake Deposits. All the superficial deposits are classified as Secondary A aquifers, which are permeable layers that can support local water supplies and may form an important source of base flow to rivers.

2.7.4 The underlying bedrock across the majority of the Application Land is mapped as Mercia Mudstone Formation. Immediately to the east of the Mercia Mudstone Formation is the Penarth Group (mudstone). At the eastern side of the Application Land the underlying bedrock is mapped as the Scunthorpe Mudstone Formation with the Frodingham Ironstone Member (Ironstone) being recorded beneath the very eastern extent. These (bedrock) deposits are listed as extending deeper than 30m.

2.7.5 The Mercia Mudstone and Penarth Mudstone are classified as Secondary B aquifers, described as lower permeability layers that may store and yield limited amounts of groundwater through characteristics such as fissures, openings or eroded layers. The Frodingham Ironstone Member is classified as a Secondary A aquifer, whilst the Scunthorpe Mudstone Formation is classified as a Secondary Undifferentiated aquifer meaning it is not possible to classify as a Secondary A or Secondary B aquifer due to its variable characteristics.

Bedrock Geology Plan

Legend

- Order Limits
- Mercia Mudstone Group
- Penarth Group Mudstone
- Scunthorpe Mudstone Foundation
- Scunthorpe Mudstone
- Frodingham Ironstone
- Charmouth Mudstone Formation
- Pecten Ironstone

ERM

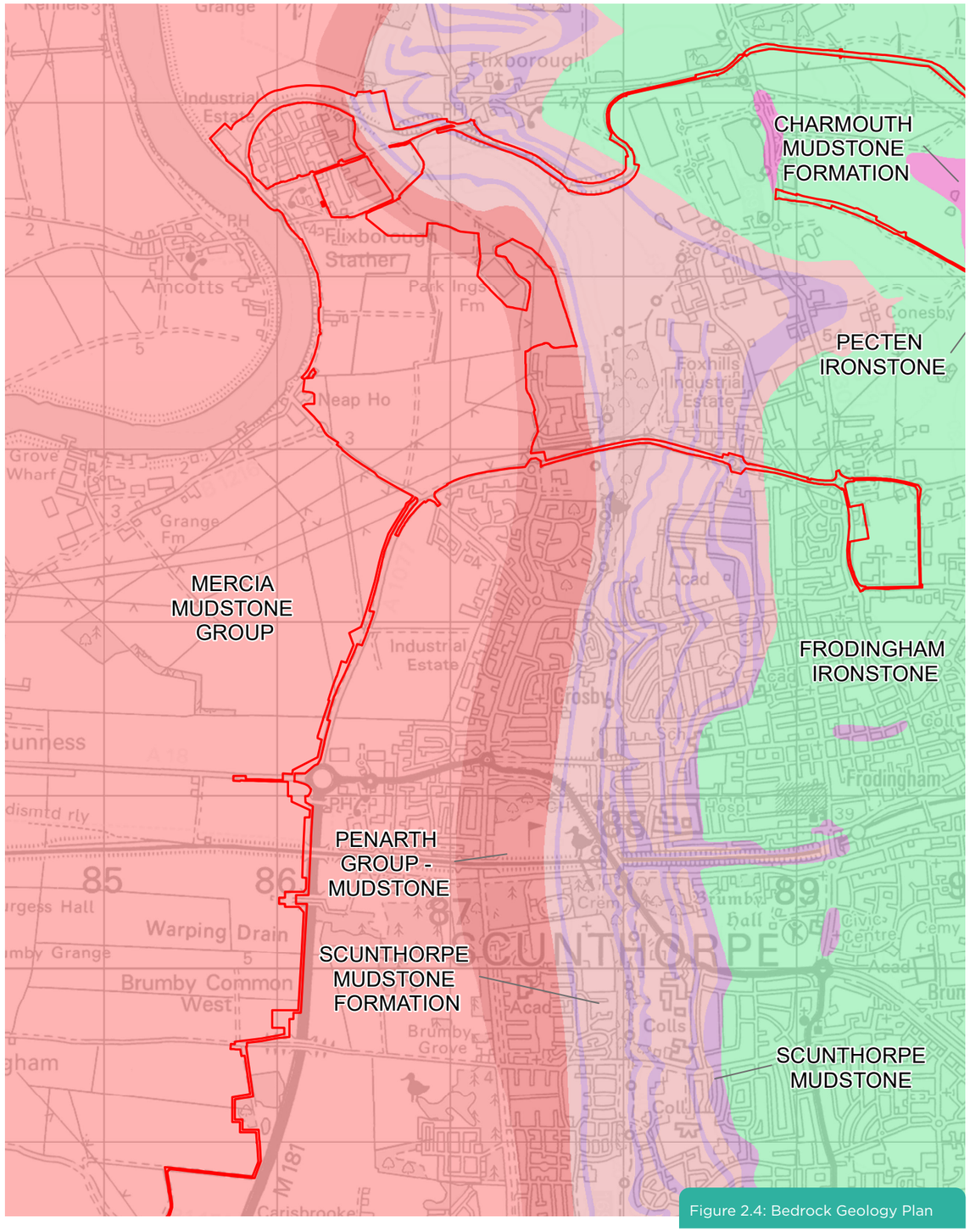


Figure 2.4: Bedrock Geology Plan

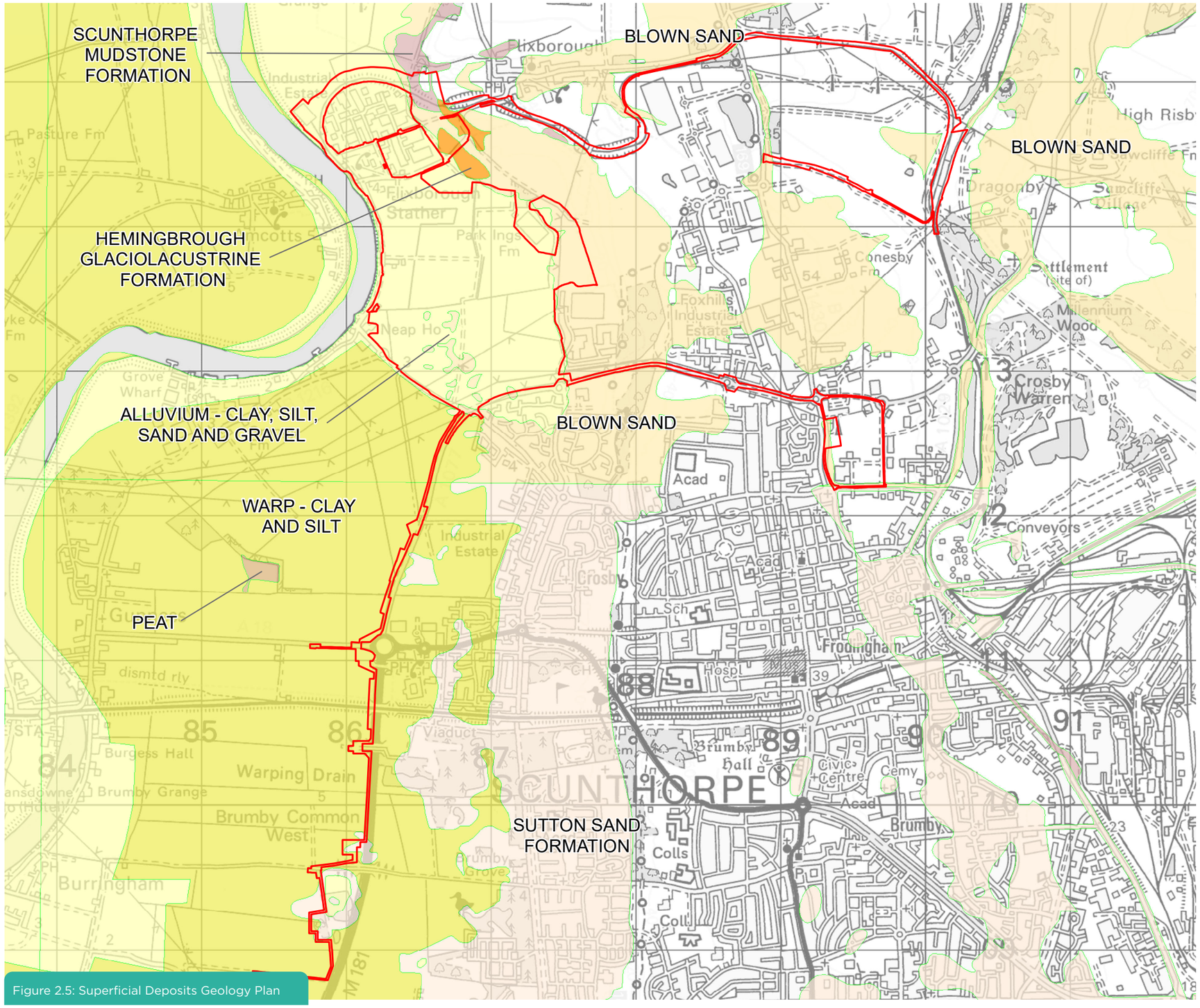


Figure 2.5: Superficial Deposits Geology Plan

Superficial Deposits Geology Plan

Legend

- Order Limits
- Warp - Clay and Silt
- Alluvium - Clay, Silt, Sand and Gravel
- Peat
- Scunthorpe Mudstone Formation
- Blown Sand
- Sutton Sand Formation
- Hemingbrough Glaciolacustrine Formation

ERM

2.8 Watercourses and Drainage

Existing Waterbodies

2.8.1 The Application Land falls within three separate surface water sub-catchments of the River Trent and Humber Estuary. These are the Bottesford Beck, Winterton Beck, and the River Trent catchments respectively.

2.8.2 Within these catchments there are a large number of watercourses that are hydraulically connected to the Project. However, the Winterton Beck is the only Water Framework Directive (WFD) waterbody to be in direct hydraulic connection, with all other waterbodies being classed as artificial, agricultural, or IDB controlled land drains.

2.8.3 The River Trent is tidal from the Humber Estuary to Keadby Bridge, approximately 5.5km upstream of Flixborough Wharf.

2.8.4 The whole of the River Trent along the length of the Application Land is protected by raised earth embankments (see image on page 27). These embankments provide protection from tidal flood events up to and including the 0.5% annual exceedance probability (AEP) event (1 in 200 chance of flooding in any given year). Critical to the successful function of these defences, is the operation of the IDB pump station located on Stather Road, north of Neap House. This pump station pumps water from the Lysaght's Drain over the flood defences when levels in the River Trent are high, preventing free discharge of the Lysaght's Drain.

2.8.5 The River Trent runs adjacent to the western edge of the Application Land and is ultimately the receiving body for the surface water within the Application Land. There are a number of existing ditches across the Application Land and these convey surface water to the River Trent.

Existing Drainage

2.8.6 Existing drainage system within the Application Land predominantly consists of agricultural ditches. Stather Road drains to either the existing agricultural fields or to adjacent ditches along its length. Whereas a piped drainage system exists within the Flixborough Industrial Estate.

2.8.7 The agricultural ditches eventually drain to Lysaght's Drain, which runs east-west through the centre of the Application Land and in turn discharges to the River Trent, via a pumping station.

2.8.8 The location of the existing on-site ditches are shown in Figure 2.6, where the main ditches are numbered for reference.


Ditch 6


Ditch 1


Ditch 7


Ditch 2


Ditch 8


Ditch 3


Ditch 9


Ditch 4


Ditch 10


Ditch 5

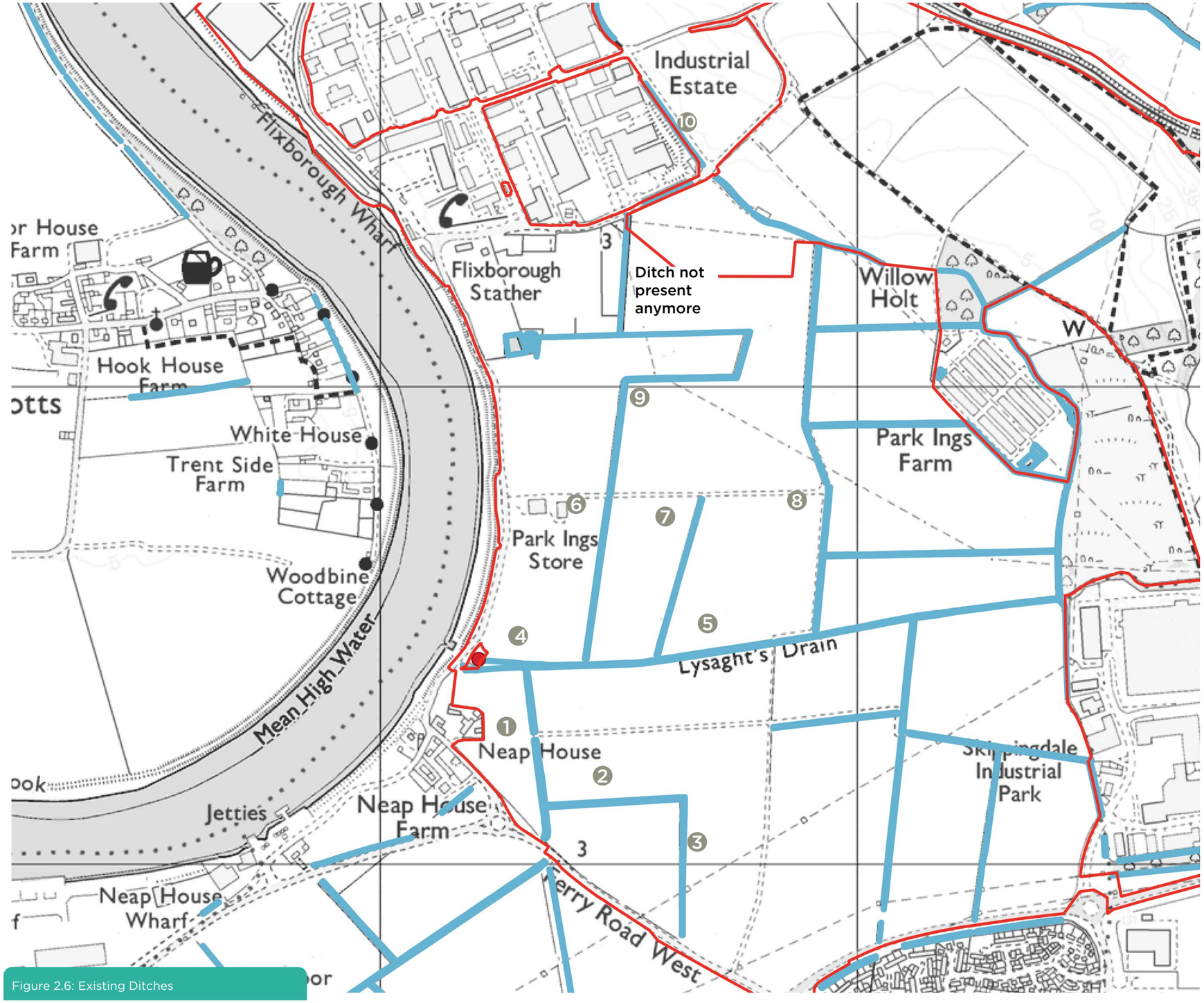


Figure 2.6: Existing Ditches

Watercourse and Drainage plan

Legend

- Order Limits
- Existing Ditches
- Pumping Station
- 1 Location of ditches shown on page 22

BURO HAPPOLD

2.9 Landscape Character

2.9.1 The Application Land is not covered by any statutory landscape designations.

2.9.2 There is an area of Open Access Land within the Energy Park Land, found at the eastern edge, close to the intensive poultry farm and at the base of the escarpment. There is also an accessible LNR in proximity, known as Phoenix Parkway LNR.

2.9.3 Much of the Application Land is relatively inaccessible to the public, however within the northern extent it contains a number of PRoWs. These provide views of Site, with those from the higher ground of the escarpment being of higher sensitivity.

2.9.4 The Open Cast Way passes immediately adjacent to the Application Land, it is a 32 mile circular walk around Scunthorpe utilising the Scunthorpe Ridge Walk and public footpaths. The route is titled after the method of extraction of the many and varied mineral deposits which was historically practised in the Scunthorpe area. All of the route is associated with The Lincoln Edge. It connects to Normanby Hall Country Park to the north of the Application Land.

2.9.5 NCN route 169, known locally as the Scunthorpe Ridgeway, travels north to south through Scunthorpe and passes through green, open spaces with views of the River Trent Valley.

National Landscape Character Areas

2.9.6 In terms of national landscape designations, the majority of the Application Land lies in NCA 39 Humberhead Levels, it is described as:

2.9.7 *"The Humberhead Levels is a flat, low-lying and large scale agricultural landscape bounded to the west by the low ridge of the Southern Magnesian Limestone and to the east by the Yorkshire Wolds (north of the Humber) and the Northern Lincolnshire Edge with Coversands (south of the Humber). To the north it merges into the slightly undulating landscape of the Vale of York, at the line of the Escrick Moraine, and in the south it merges in to the Trent and Belvoir Vales and Sherwood"*

Local Landscape Character

2.9.8 The North Lincolnshire Landscape Character Assessment and Guidelines (1999) provides a county level assessment of landscape character and type. As shown in Figure 2.7, the Application Land is situated mainly in the Trent Levels Character Area, and it adjoins the Lincolnshire Edge Character Area. The following extracts outline the key characteristics and opportunities of these character areas described in the assessment which are relevant and appropriate for the Application Land.

2.9.9 The overall strategy for the Trent Levels is one of enhancement to repair and restore features that have become lost to agricultural intensification.

2.9.10 The Application Land is clearly at a convergence of two very distinct Landscape Character Areas as described by the National Character Areas and the Local Landscape Character Assessments.

2.9.11 Within the 'Trent Levels' the Application Land exhibits many of the described key characteristics, with its predominant character being that of an: *"Essentially flat, open floodplain landscape with occasional rising ground and little vegetative cover."*

2.9.12 The flat and open landscape contains a network of drainage ditches – these linear features are typical of the local and national character of the landscape, but in their current state have a purely utilitarian character – which could be much improved by following the landscape guidance set out by North Lincolnshire and Natural England to naturalise and encourage habitat creation.

2.9.13 This low and level topography offers the expansive views characteristic of "The Trent Levels" which are surrounded by woodland blocks and rising ground – in this case seen by Burton Woods, Willow Holt and the enclosure of the steeply rising escarpment to the west.

2.9.14 Within the 'Lincolnshire Edge', the area of the Application Land lying within the escarpment conforms to the area description of a ridge which *"rises prominently from adjacent low-lying land, forming the Edge or Cliff, and giving panoramic views out, in particular to the west"*.

2.9.15 It presents some limited woodland cover in the form of the ancient semi natural woodland of Burton Wood and Willow Holt which lie immediately adjacent to the Energy Park Land. The area of open access land adjoining the Phoenix Park LNR exhibits birch and oak, which are naturally regenerating and are a recognised character feature of this area. These woodlands and clustered tree groups create vistas and provide a sense of protection and overlooking to the flat lands beyond.

2.9.16 Adjacent to the Application Land, settlements such as Flixborough and Burton upon Stather are well treed. Their extents puncture the horizon and provide contrast in the landscape and represent character of occasional shelterbelts and patches of woodland.

2.9.17 Within The North Lincolnshire Landscape Character Assessment landscape type classifications, the Industrial Landscape at Flixborough Industrial Estate, which edges the Order Limits boundary and will provide an interface, exhibits the key characteristics such as being well defined and visually prominent. Its presence marks a harsh transition from that of the open agricultural and rural character.

2.9.18 The influence of industry is felt across the Application Land and the surrounding area as a result of the dominant structures and the presence of power lines crossing the fields, another characteristic typical of this type of landscape. Whilst the industrial estate and farms all sit disconcordantly and are inward looking, it is possible to gain occasional views beyond the industrial landscape, which can help to counteract this confinement.

Photo of Phoenix Parkway LNR

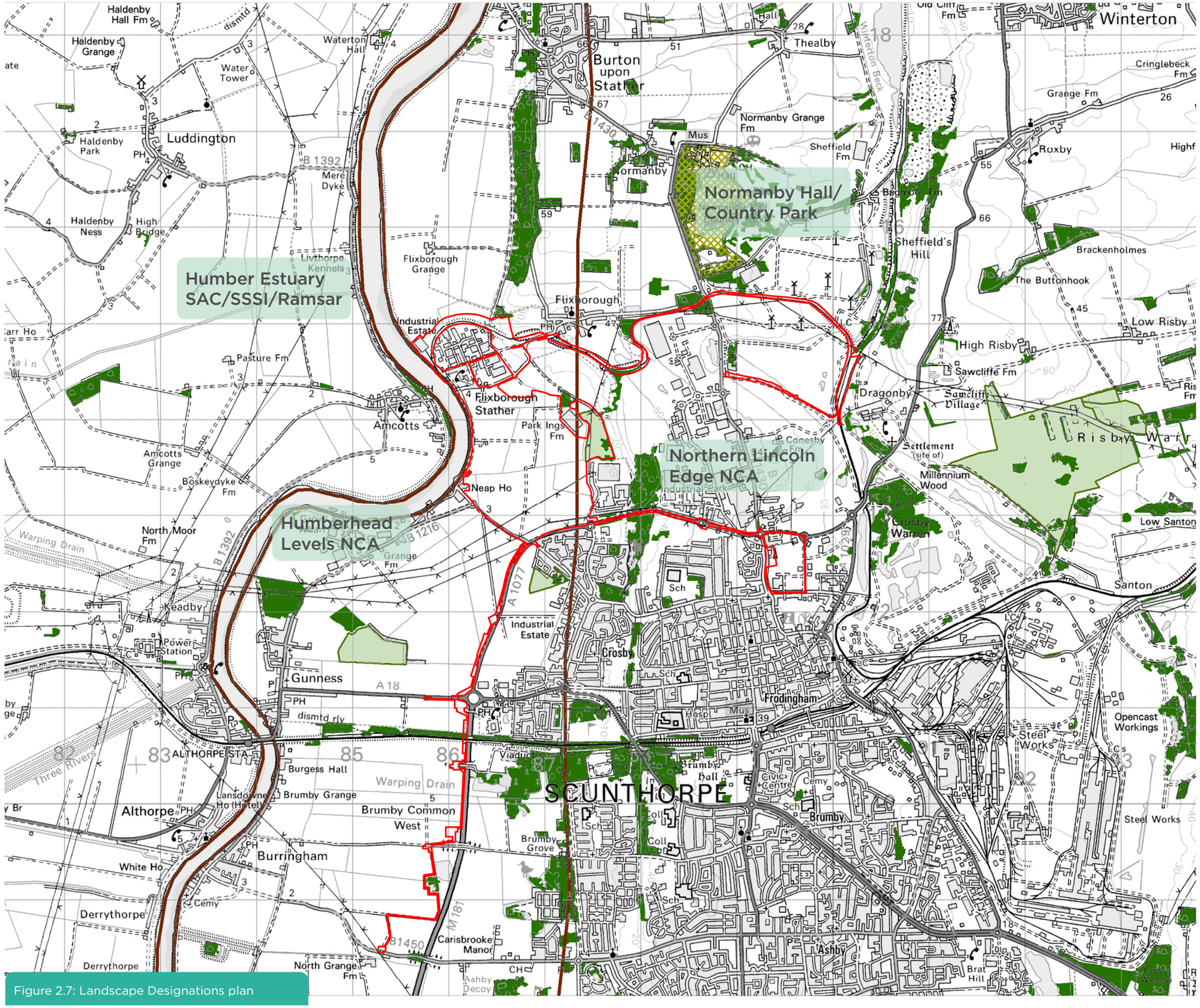


Figure 2.7: Landscape Designations plan

Landscape Designations Plan

Legend

- Order Limits
- National Character Area Boundary
- Country Park
- Woodland
- Open Access Land

2.10 Visual Context

2.10.1 The flat, open landscape of the area to the west of the Application Land allows long views across farmland. The more undulating landscape further west offers a range of views, from more enclosed areas on low ground, to open views from elevated locations. To examine the likely visibility of the Project, a Zone of Theoretical Visibility (ZTV) has been generated, based on the maximum height of the proposed ERF stack (120m). The ZTV incorporates buildings and woodlands, which would screen views to the development. The ZTV is shown in Figure 2.8.

Views from Local Communities

2.10.2 The closest settlements are the villages of Amcotts and Flixborough. Views from Amcotts looking towards Flixborough Industrial Estate and Flixborough Wharf are filtered through a belt of vegetation bordering the river. Lying to the east on higher ground, buildings in Flixborough village screen some views towards the Flixborough industrial estate, though it is visible from Stather Road, backgrounded by Keadby Grange Wind Farm. The villages of Burton-upon-Stather and Normanby offer glimpsed views in the direction of the Energy Park Land, albeit limited by the wooded ridgeline at Burton Wood. Outward views from Scunthorpe are largely restricted to the northern and north easterly edges of the town.

2.10.3 From the settlements of Keadby, Althorpe and Burringham, which lie along the banks of the River Trent, the existing outlook is typified by built development including Grove Wharf, with Flixborough Industrial Estate and Grange Wind Farm in the distance. Long, open views are available from the villages of Adlingfleet, Garthorpe, Luddington and Eastoft, across the flat farmland towards the rising ground east of the Trent. Views from Dragonby, High Risby, and Low Risby are locally screened such that there would be no views to the Energy Park Land.

Views from Public Rights of Way

2.10.4 The PRoW within the local area primarily follow the patterns of field boundaries and drainage ditches, particularly in the west. Footpaths provide north-south linkages between Flixborough and Scunthorpe and offer views west from elevated locations, looking across Flixborough Industrial Estate and the River Trent to the landscape beyond. A footpath and permissive path (Tiddy Mun Trail) at Amcotts affords some close range views across the River Trent. Views from footpaths between Burton-upon-Stather and Flixborough Industrial Estate are dominated by Grange Wind Farm, and those around Luddington and by overhead power lines.

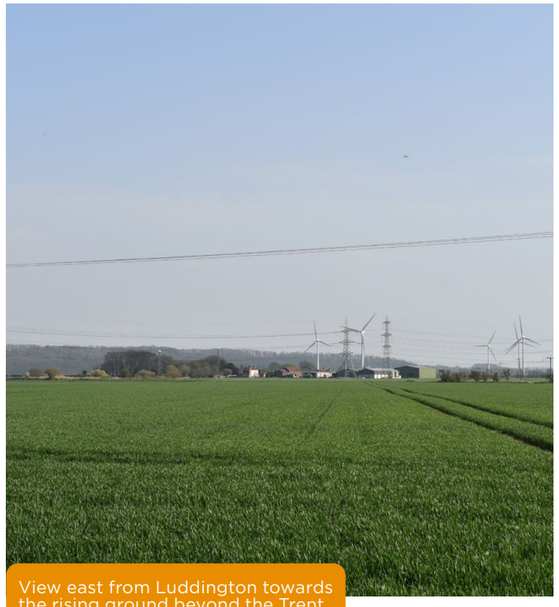
Views from Roads

2.10.5 Views are available from a number of roads passing the Application Land, including Lodge Lane, Stather Road and the B1216 Ferry Road West. Elevated but filtered views are available from Burton Road and the B1430 Normanby Road to the north west of the Application Land. Users of these routes currently have views of Flixborough Industrial Estate. The A1077 offers open views across the Energy Park Land from the edge of Scunthorpe. The nature of the undulating landform further east results in occasional open views from the A1077 between Winterton and Scunthorpe. Views from the A18 and M181 further south include overhead power lines and industrial land at Grove Wharf. West of the River Trent, views from the B1392 and minor roads are characterised by farmland and the presence of wind energy development at Keadby Grange, Grange and Twin Rivers.

Representative Viewpoints

2.10.6 A number of viewpoints have been used to represent and assess the visual effects of the Project on views from these locations. Photomontage visualisations have been prepared to illustrate the potential appearance of the Project from these locations. The viewpoints are shown in the Environmental Statement Chapter 11 (**Document Reference 6.2.11**).

View north from the A1077 at the edge of Scunthorpe, looking towards Flixborough Industrial Estate and Grange Wind Farm



View east from Luddington towards the rising ground beyond the Trent

View north-west from a local footpath north of Scunthorpe, looking across the Trent to Keadby Wind Farm

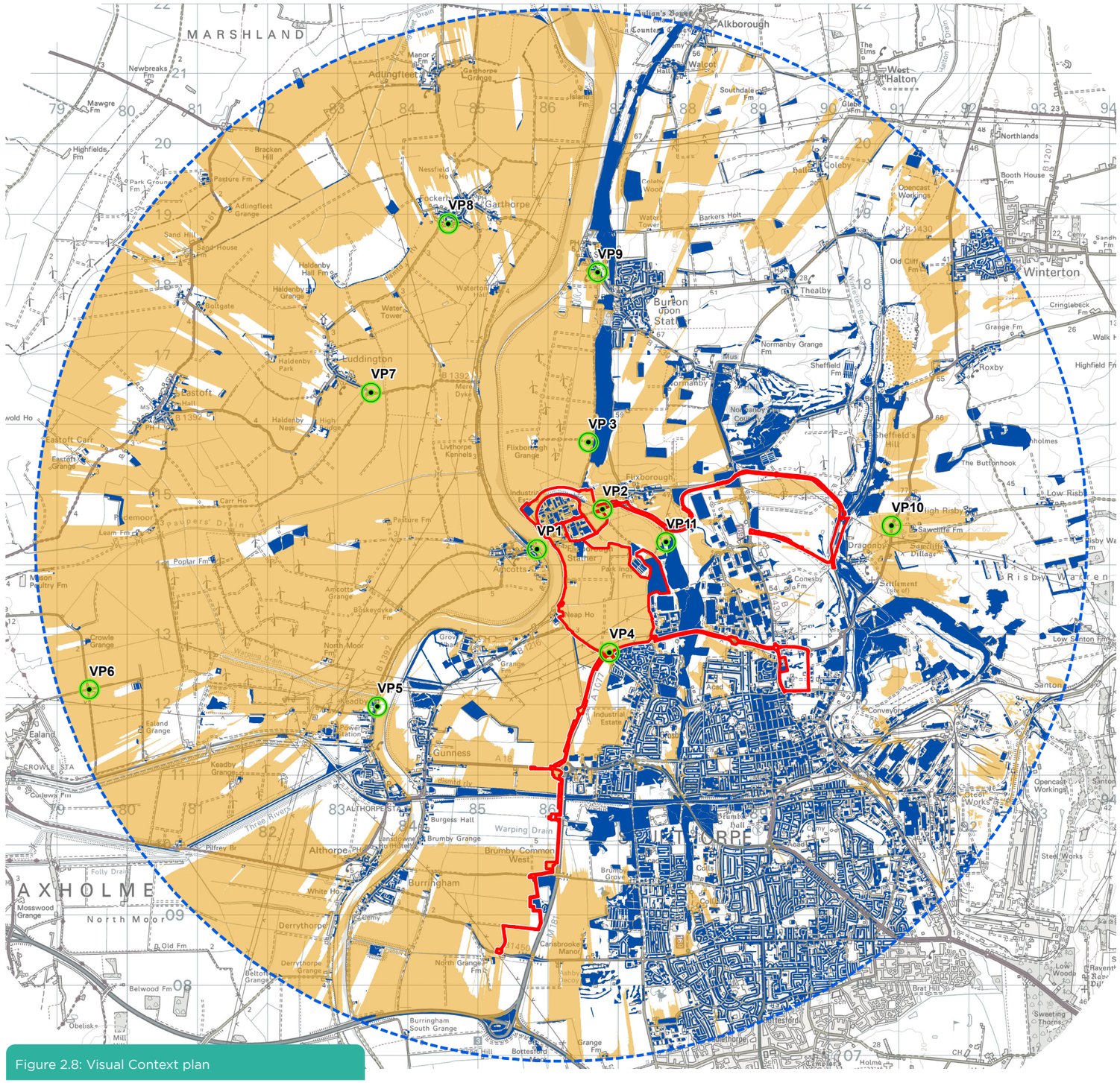


Figure 2.8: Visual Context plan

Visual Context plan

Legend

- Order Limits
- Visual Study Area (7.5km)
- Screening Features (e.g. woodland and buildings)
- ERF Stack Visible

List of viewpoints

1. Trent Side, Amcotts
2. Stather Road, Flixborough
3. Footpath at Grange Wind Farm

3.0 Proposed Development

3.1 Overview

3.1.1 The Project will provide a vital public good through new efficient energy recovery and generation and focus on sustainable energy storage and research. The Project will create a number of new jobs and help power local homes and businesses.

3.1.2 The Project will help transform the Humber area from a traditionally carbon-intensive to a clean-growth focussed, through new jobs and training. This will all contribute to achieving Government's 10 point plan on tackling climate change, and it's legally binding commitment to achieving net-zero carbon emissions by 2050. The Applicant is a member of the Zero Carbon Humber Partnership.

3.1.3 The Project will be centred around a new efficient ERF and an emphasis on reusing as many by-products as possible. The RHTF will be linked to a CBMF, whilst heat will be distributed through a DHN. The electricity will be fed into the grid and the private wire network in support of the North Lincolnshire Council Towns Investment Fund, whilst some will be used to produce and store hydrogen or be stored in batteries on site. A new charging station for both electric and hydrogen powered vehicles will also be delivered, helping the transition to a net-zero environment. Finally, a PRF will be created to help recycle plastics using spare heat and electricity from the ERF.

3.1.4 All of the components of the Project are described in more detail below.

3.2 Principal Components of The Energy Park

Energy Recovery Facility

3.2.1 The ERF will consist of the below key components:

- Tipping hall;
- Bunker hall;
- Boiler hall;
- Turbine hall (with air cooled condensers / air blast chillers on the roof);
- Flue Gas Treatment;
- District heating equipment;
- Switchyard;
- Water treatment facility;
- Bottom ash hall;
- Administration and control room, offices;
- Exterior storage tanks for ammonia, diesel and fire water; and
- Carbon Capture, Utilisation and Storage.

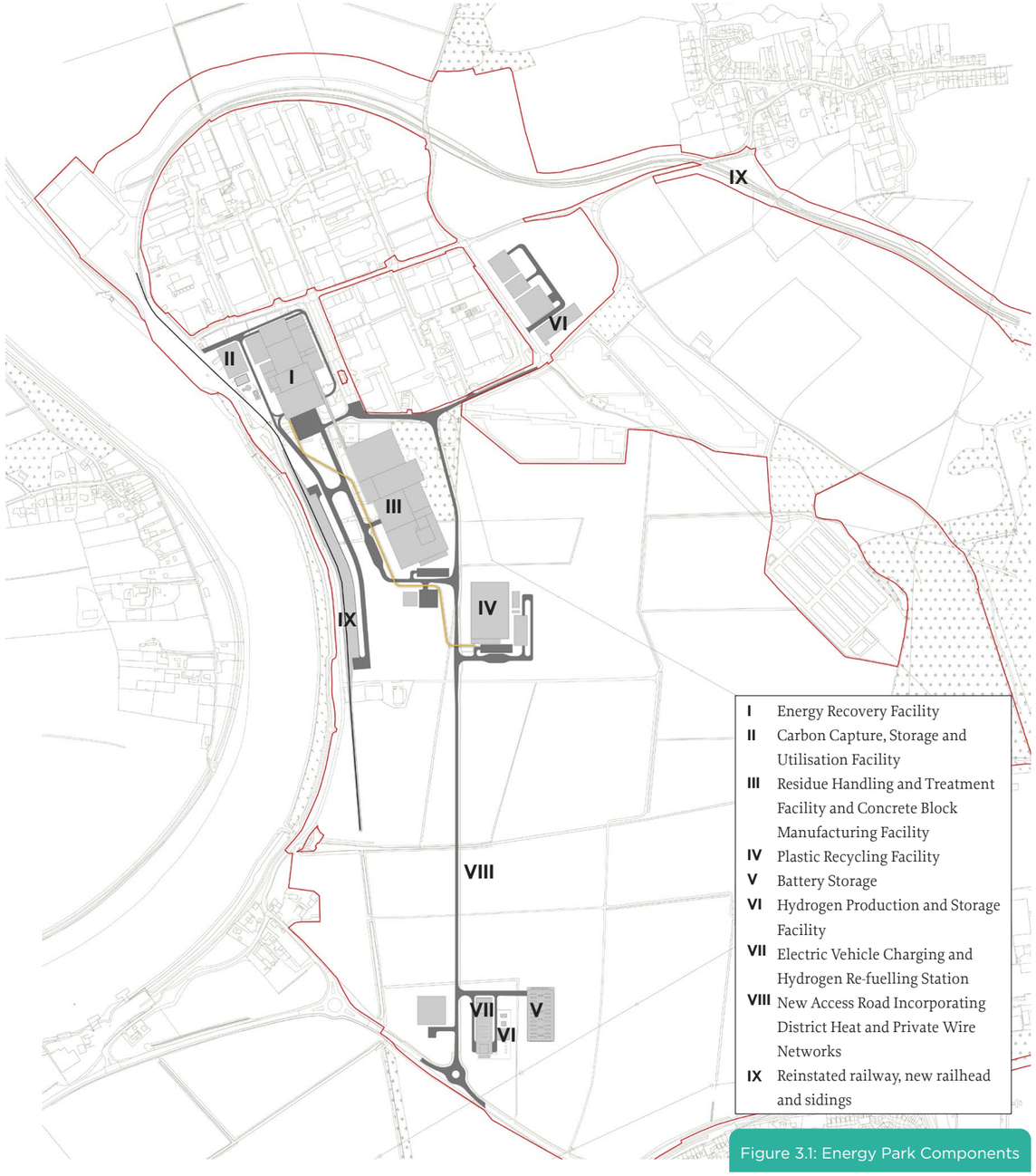


Figure 3.1: Energy Park Components

3.2.2 The ERF will combust incoming Residue Derived Fuel (RDF) to generate high temperature flue gas. This flue gas will be cooled as it passes through a boiler, raising high pressure superheated steam. The superheated steam will be expanded through a steam turbine to generate electrical power. The cooled flue gas will be cleaned using a flue gas treatment plant. Hydrated lime will be dosed to control acid gases, with ammonia dosed to control nitrous oxide emissions and activated carbon to control heavy metals. The flue gas will pass through a bag filter to remove dust and particulates. A portion of the flue gas is then directed to the carbon capture facility, before being discharged from the stacks.

Carbon Capture, Utilisation and Storage Plant

3.2.3 The Carbon Capture, Utilisation and Storage Plant will be located to the north and west of the main ERF building, where combustion gasses from the ERF are diverted for treatment and CO_2 removal prior to being emitted through the ERF stack. The facility will contain the equipment needed to capture the CO_2 and store it on site before it is shipped off-site or removed by train.

3.2.4 The selection of the East Coast Cluster, which Zero Carbon Humber is a partner to, provides future potential for all CO_2 to be captured and stored under the North Sea. This would establish the Project as one of the first carbon negative ERFs in the world.

Residue Handling and Treatment Facility and Concrete Block Manufacturing Facility

3.2.5 The RHTF and CBMF will accept the residues from the ERF and reprocess them into useful aggregates. The residue reprocessing facility will reprocess bottom ash and Flue Gas Treatment residue (FGTr) and produce aggregates. These aggregates mixed with CO_2 will be combined with light aggregates and cement to manufacture concrete blocks.

3.2.6 Cement produced using CO_2 has been shown to extend the life of concrete and improve the resistance to weather corrosion.

Plastic Recycling Facility

3.2.7 The PRF will take in pre-segregated plastics, formed of PET, HDPE and PP. The waste plastic will be processed by washing, grinding, sorting and extruding to reform the polymers that form plastics and a range of products derived from hydrocarbons, free of contaminants, which can be used to manufacture new plastic products. The facility will use heat from the ERF to heat wash water or other polymer derived products for the process and will be powered by the private wire network originating in the ERF.

Battery Storage

3.2.8 The Battery Storage will be supplied with power by the ERF and the electrical grid. It will store power, for use in EV charging, energy arbitrage, on-site balancing services and grid services, such as frequency and voltage regulation. The batteries are typically housed in shipping container structures.

Hydrogen Production

3.2.9 There will be up to two hydrogen production areas within the Energy Park Land. Hydrogen will be produced on site using electrolysers, and will be used initially for hydrogen-fuelled vehicles, energy storage or back-up fuel to support the district heat network, with an aspiration to be used for injection to the gas grid in the future.

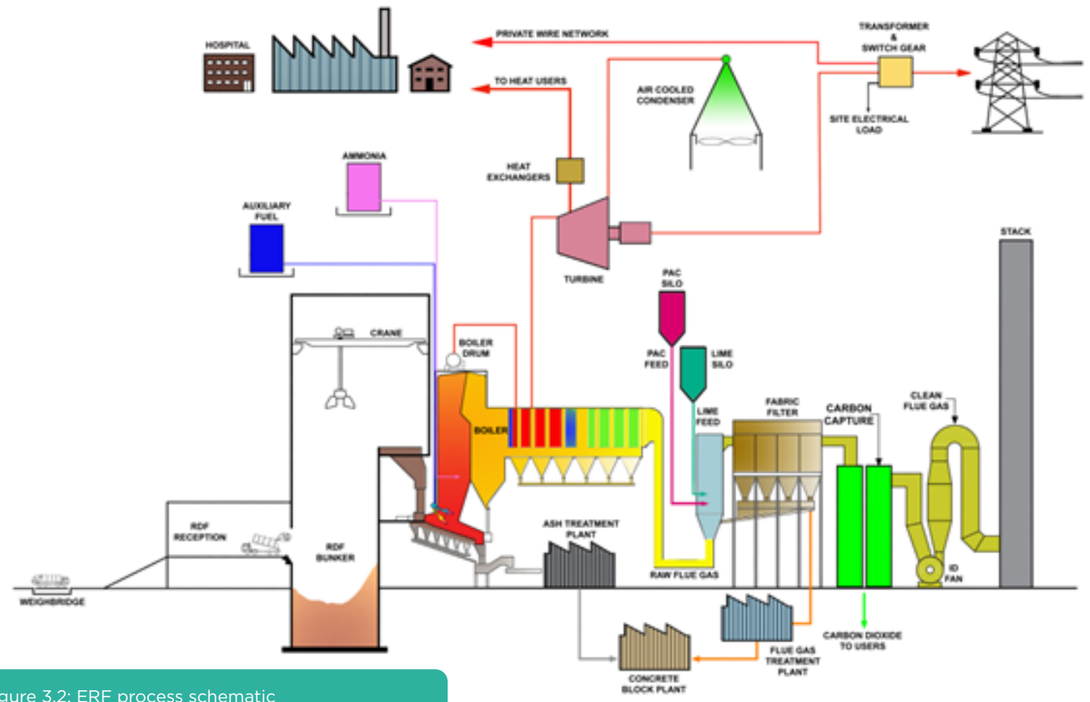


Figure 3.2: ERF process schematic

Electric Vehicle Charging and Hydrogen Re-fuelling

3.2.10 EV and hydrogen re-fuelling station will be located in the south of the Energy Park Land. This area will provide a hydrogen vehicle re-fuelling space, and spaces for EV to recharge. There will also be a building providing space for necessary servicing of the re-fuelling facility.

District Heat and Private Wire Network

3.2.11 The District Heat and Private Wire Network (DHPWN) will consist of buried pipework and cabling. The DHPWN will originate within the ERF, and will supply heat and power to the other facilities within the Energy Park, as well as potentially supplying heat to a new hospital, a business park, a housing estate outside of the development and other commercial off takers in the region. A detailed local heat map for the immediate catchment area has identified a peak demand for 70 MWth of heat with the potential to remove CO_2 from local heat and power requirements.

3.2.12 Cooling will be provided where needed to other third party commercial off takers in the region which may include the proposed new hospital using site located absorption chillers. This will have a significant impact on achieving Net Zero by 2050 for the North Lincolnshire region.

Workforce, maintenance and technical requirements

Energy Recovery Facility

3.2.13 The staff will access the facility via a dedicated access road to a car park off Stather Road. The ERF will require periodic maintenance and replacement of parts. This will typically occur during plant outages, which will take place annually. The ERF requires access to the road, rail and river transport network for deliveries of fuel and collection of residues, for staff access and for delivery of spare parts. The ERF also requires a close physical connection to the residue reprocessing and concrete block manufacturing facility, to allow ash and flue gas treatment residue to be exported via conveyor.

Residue Handling and Treatment Facility and Concrete Block Manufacturing Facility

3.2.14 Staff will access the facility along the internal access road to a dedicated car park. The facility has been designed to follow process requirements, with unprocessed residues entering the facility in the north and concrete blocks exiting the facility in the south. The facility requires a connection to the road, rail and river transport networks for importation of aggregates and cement and for export of recovered metals and concrete blocks.

Plastic Recycling Facility

3.2.15 Staff will access the PRF via a dedicated access road. The PRF will operate independently to the ERF, but will be supplied with heat and power by the ERF. The PRF requires access to the potable and foul water networks, as well as the road network to import and export plastics.

Battery Storage

3.2.16 The Battery Storage will require limited staff to operate a centralised control function. Maintenance will be carried out periodically on the battery storage facility, which will consist of replacing cells or entire containers as required. The battery storage facility requires a connection to the electrical grid.

Hydrogen Production

3.2.17 The hydrogen production will not have a permanent on site workforce. Maintenance activities will be carried out on an annual basis. The facility will require a connection to the potable and foul water systems, and to the electrical grid. If hydrogen is to be exported to the gas grid, an above ground installation will be required.

Electric Vehicle and Hydrogen Re-fuelling

3.2.18 The EV and hydrogen charging area will have a small workforce. The facility will require access to the road network to access traffic. The facility will also require access to the potable and foul water networks, as well as access to the electrical grid..

District Heat and Private Wire Network

3.2.19 The DHPWN does not require a permanent on site workforce. The network will require maintenance, with valves to be exercised and pipework and cabling to be inspected. The positioning of the network and route taken is driven by the location of the users identified.

Ancillary Functions

3.2.20 The Project will provide opportunities for local businesses. Throughout the operation of the Project, there will be a need for haulage, railway and port operators and security staff. The areas proposed for landscape and habitat creation will require ongoing annual management and maintenance, providing opportunities for local businesses.

Flixborough Wharf

Drains north of Flixborough Industrial Estate

4.0 Consultation and Design Response

4.1 Introduction

4.1.1 As part of the application for the DCO, a Consultation Report (**Document Reference 7.1**) has been submitted pursuant to Section 37(3)(c) of the 2008 Act.

4.1.2 Pre-application consultation is a legal requirement for NSIPs. In accordance with the 2008 Act, the Consultation Report outlines the pre-application consultation undertaken by the Applicant, sets out the relevant responses received, and explains how the design has had regard to these.

4.1.3 This chapter provides an overview of the consultation undertaken and how the Applicant took the comments into account and had regard to these in the design of the Project.

4.1.4 In addition to the consultation requirements, regular briefings and design sessions were had with the relevant stakeholders, including local authority and other public body officers.

4.2 Consultation process

4.2.1 The Applicant recognises the importance of consulting on the Project at an early stage in the project development, and the benefits this can bring in terms of delivering an improved design.

4.2.2 It has consulted extensively in developing its DCO application. This included a round of non-statutory public consultation from 26 May 2020 to 14 July 2020 and a round of statutory consultation in fulfilment of the requirements of the 2008 Act from 14 June 2021 to 25 July 2021.

4.2.3 A full summary of the consultation and the way that the Applicant has had regard to feedback is included in the Consultation Report (**Document Reference 7.1**) submitted with the DCO application.

Non-Statutory Consultation

4.2.4 The Applicant conducted a period of non-statutory consultation between 26 May 2020 and 14 July 2020. The purpose of this period of non-statutory consultation was to support the design development and the process of environmental impact assessment, by gathering feedback from consultees on the Project at an early stage in the design process.

Scope

4.2.5 The consultation introduced the Applicant's vision for the Project, its approach to developing proposals in more detail and the process for seeking development consent.

4.2.6 The Applicant therefore presented information both on the elements of the Project that would require a DCO, referred to during the consultation as 'the DCO Scheme', and the further potential growth opportunities using the heat generated by the ERF that would require planning permission from North Lincolnshire Council.

Consultation Methods

4.2.7 The consultation took place in a period when the country was subject to legal restrictions on social contact due to the COVID 19 pandemic. The Applicant therefore used a range of techniques to allow consultees to find out more and respond:

- Sending a consultation booklet to more than 2,400 addresses in the area of the Project;
- Writing to elected representatives and community groups in the local area;
- Holding a series of webinars offering the chance for people to ask questions about the Project;
- Inviting residents to take part in telephone surgeries offering a chance to speak to members of the project team individually;
- Publicising the consultation in the local media and online;
- Launching a dedicated website, www.northlincolnshiregreenenergypark.co.uk, with details of the consultation and the proposals; and
- Inviting responses online, by email or by Freepost .

Outcomes

4.2.8 The Applicant received 41 responses to the non-statutory consultation. Details of responses to the consultation and the regard had to them are included in Chapter 2 of the Consultation Report (**Document Reference 7.1**).

4.2.9 Following the non-statutory consultation, the Applicant responded by making a number of changes to the Project:

- Adding a PRF to the Project;
- Withdrawing proposals to extend Flixborough Wharf;
- Focusing the ERF on brownfield land;
- Including new wetland and woodland landscapes;
- Proposing new foot/cycle routes opening access to the River Trent; and
- Extending the DHPWN.

Statutory Consultation

4.2.10 The Applicant conducted a period of statutory consultation on the Scheme from 14 June 2021 to 25 July 2021.

4.2.11 The purpose of the consultation was to seek the views of statutory consultees and the public on the Project; the potential short and long term impacts of the Project during construction, operations, and decommissioning; and the Preliminary Environmental Information Report (PEIR). Statutory consultation is also a requirement of the 2008 Act and the EIA Regulations 2017

Scope

4.2.12 The Applicant conducted consultation under sections 42, 47 and 48 of the 2008 Act and Regulation 13 of the EIA Regulations 2017 in parallel. This meant that all materials made available for consultation under sections 47 and 48 of the 2008 Act were available to consultees under section 42 of the 2008 Act and Regulation 13 of the EIA Regulations 2017.

4.2.13 Consultees were provided with 42 days to comment. This exceeded the 28-day minimum set out in section 45(2) of the 2008 Act and Regulation 4(3)(i) of the APFP Regulations.

Consultation Methods

4.2.14 The consultation took place while the country was still subject to social distancing legislation, although the Applicant was able to meet with consultees in person. The Applicant therefore used a range of techniques to consult the community. These were designed to allow people with different needs across the community to take part in the consultation in a way that is convenient to them whilst complying with Government guidance on COVID 19.

- Writing formally to statutory consultees and other stakeholders sharing the consultation materials and inviting them to respond;
- Sending a consultation booklet, supplementary consultation booklet and questionnaire to more than 18,000 addresses in the local area;
- Inviting residents to ticketed consultation hub events, which included a public exhibition and opportunity to discuss the Project;
- Hosting a virtual public exhibition on the Project website;
- Holding a series of webinars offering the chance for people to ask questions about the Project;
- Inviting residents to take part in telephone surgeries offering a chance to speak to members of the project team individually;
- Making information available at deposit points (public libraries and drop in centres) in the local area;
- Publicising the consultation in the local media and online; and
- Inviting responses online, by email or by Freepost.

Outcomes

4.2.15 The Applicant received 234 responses. Details of responses to the consultation and the regard had to them are included in Chapter 5 of the Consultation Report (**Document Reference 7.1**).

4.2.16 The responses received during the statutory consultation, were used to develop a set of Design Codes which will be used to control the detailed design of the Project. The Design Codes, build upon the Project Design Principles which were consulted upon during the statutory consultation. Further details can be found with the Project's Design Principles and Codes Document (**Document Reference 5.12**) submitted as part of the DCO application.

CONSULTATION ACTIVITY UNDERTAKEN	DATE
NON-STATUTORY CONSULTATION: Q2 2019 – Q2 2021	
Early engagement with local authorities and statutory consultees	May 2019 – May 2020
Non-statutory public consultation	26 May 2020 to 14 July 2020
Ongoing stakeholder engagement to inform design development	July 2020 – June 2021
STATUTORY CONSULTATION: Q2 2021 – Q3 2021	
Consultation of host local authorities on the Statement of Community Consultation (SoCC) as prescribed by secton 47(3) of the 2008 Act	1 March 2021 – 30 March 2021
Notice of availability of SoCC in the vicinity of the proposal as prescribed by section 47(6) of the 2008 Act	3 June 2021
Proposed application publicised as prescribed by section 48 of the 2008 Act	14 June 2021, 17 June 2021 and 24 June 2021
Notification of the Inspectorate of proposed application as prescribed by section 46 of the 2008 Act	14 June 2021
SoCC made available in the vicinity of the proposal as prescribed by section 47(6) of the 2008 Act	3 June 2021 – 25 July 2021
Consultation as prescribed under section 42 of the 2008 Act	14 June 2021 – 25 July 2021
Consultation in accordance with the SoCC as prescribed under s47(7) of the PA 2008	14 June 2021 – 25 July 2021
Targeted statutory consultation under s42(1)(d) on changes to the Order Limits	15 September to 13 October 2021
Consultation with new consultees under s42(1)(d) identified through ongoing due diligence -	August 2021 - February 2022

Figure 4.1: Summary of consultation activities

4.3 Overview of the Design Response

4.3.1 The progress of the design response from site selection, to option development, testing and refinement has always been informed by community and stakeholder consultation.

4.3.2 The non-statutory public consultation at the beginning of the design process also brought to the attention of the design team the concerns and considerations from local people on the impact of a development of this scale, which has stayed at the forefront of the design agenda and been a key consideration in the decision making

4.3.3 Recognising the importance of the matters highlighted during the non-statutory consultation, the project team established a set of Design Principles to which would be used to inform design decisions moving forward.

4.3.4 The statutory consultation feedback was reviewed against the Project's design principles. This approach helped develop and refine the design of the Project, while keeping a consistent design response / narrative in order to deliver the overall Project Vision. The full scope of responses is summarised within the Consultation Report (**Document Reference 7.1**).

4.3.5 In summary, a number of issues were raised which related to the assessment, detailed development or long term management of the Project, which did not necessitate an alteration of the proposed design of the Project and included:

- Resilience of forests to changing climate;
- Assessment of heritage/archaeology, air quality, light and other impacts;
- Impact on ecology of the site;
- Agricultural land classification;
- Consideration of health impacts;
- Landscape and visual impacts; and
- Other considerations fully detailed in the Consultation Report (**Document Reference 7.1**).

Computer generated view from Bellwin Drive, Flixborough Industrial Estate

5.0 Delivering Good Design

5.1 Project Vision

5.1.1 The Project will be a hub for low-carbon and renewable energy generation, set within a sustainable landscape of wetlands and woodland corridors. The Project will act as a catalyst for regeneration of the Flixborough Industrial Estate, and other existing and proposed development, providing a source of jobs and facilitating the transition to low-carbon living through research and education.

5.1.2 The Project will manage waste in a more sustainable way. Instead of burying it, the waste will be turned into energy to power and heat local homes and businesses.

5.1.3 The by-products from processing the waste will be captured and re-used, ensuring minimal waste goes to landfill.

5.1.4 The Project will also empower other renewable energy sources by creating a battery storage facility, alongside a new way of generating and storing energy, through the generation, storage and utilisation of hydrogen on site.

5.1.5 A Carbon Capture, Utilisation and Storage Plant will filter out carbon dioxide and allow it to be stored and utilised, further enhancing the low-carbon aspirations of the Project. The stored gas will be used to convert flue gas treatment residue to aggregates or used offsite.

5.1.6 Through association with the Zero Carbon Humber Partnership and a partner to the East Coast Cluster, the Project would become the flagship for future energy recovery developments with the potential to achieve a carbon negative status when the infrastructure for carbon storage is in place.

5.2 Project Principles and Delivering Good Design

5.2.1 To help deliver the Project, a vision and project principles were developed at an early stage to set out the aspiration, and guide the Project throughout the design, planning and consultation process. The project principles are based on the NIC's Design Principles for national infrastructure that identifies focus areas covering People, Value, Places and Climate, which have been developed to respond to the context of the Application Land and the nature of the Project.

5.2.2 Paragraphs 1.1.11 and 4.9.2 of the Design Principles and Codes (**Document Reference 5.12**) explain that the DAS includes illustrative design material which has been submitted to demonstrate how the parameters have been tested and set, and to also provide a context and understanding of scheme. Section 8 of the DAS explains how sustainability has been part of the design process and the Design Principles and Codes secure elements of sustainable design.

5.2.3 The National Design Guide (NDG) expectations and approach relating to good design, have been enveloped in the project under the NIC principles which are considered appropriate and more comprehensive for the type of development. Being based on the NIC principles, the project specific design Principles incorporate NDG expectations under the NIC headings. Reference is made to the project's adoption/ endorsement of the objectives in Section 4.5 of NPS EN-1, the NPPF, and the NIC guidance on design principles 'Design Principles for National Infrastructure'.

5.2.4 Connecting information provided in the DAS (indicative design outcomes) to the project design principles set out in the Design Principles and Codes (**Document Reference 5.12**), the following table is intended to signpost how the Design Principles and Codes document references design guidance, good practice, and national and local policy relating to good design.

5.2.5 The project principles and their relationship to the NIC focus and themes are shown in Figure 5.1.

5.2.6 Collectively, the project principles, with the Design Principles and Codes (**Document Reference 5.12**) help demonstrate how the Project has delivered 'good design' as required within in Overarching National Policy Statement for Energy (EN-1) (NPS EN-1), NPS EN-3 and NPS-EN5.

5.2.7 The Design Codes contain different levels of instruction and prescription. They are a series of rules to be applied to the on-going design of the Project, and thereby help to steer some aspects of the design detail at the next stages of the development and implementation of the Project. They help provide the next level of detail beyond those set out in the project parameters, which reflect Environmental Impact Assessment (EIA) decisions.

5.2.8 The Design Codes provide clarity over what constitutes acceptable design quality and where there have been important design decisions that shape the application, and thereby they provide a level of insight for designers, and control for the planning authority and other stakeholders.

5.2.9 Compliance with the Design Codes will ensure the high-quality outcome is achieved as envisaged. As the Design Codes will form the basis of design assessment for the development of the Project as it comes forwards, it is recommended that a Design Codes Compliance Statement will help demonstrate how the detailed design submitted to discharge requirements relate to the Design Codes.

NIC FOCUS	THEMES	PRINCIPLES	ADHERES TO/ REFERENCES
PEOPLE	Prioritising people	Bring new job opportunities and contribute to education and vocational training.	NIC Design Principles
		Provide a high quality place to work for the entire workforce.	NIC Design Principles CS5: DELIVERING QUALITY DESIGN IN NORTH LINCOLNSHIRE NPPF NMDC/NDG
		Protect and where possible enhance the amenity of our neighbours.	NIC Design Principles CS5: DELIVERING QUALITY DESIGN IN NORTH LINCOLNSHIRE NPS EN-1 Section 4.5 NPPF
	Open engagement, reflected in design	Take into account local people's views and opinions.	NIC Design Principles NPPF NMDC/NDG
PLACES	Identity of landscape and built development	Respect the history and setting of local historic and cultural assets.	NIC Design Principles CS5: DELIVERING QUALITY DESIGN IN NORTH LINCOLNSHIRE NPS EN-1 Section 4.5 NMDC/NDG
		Respond and contribute positively to character of the local landscapes.	NIC Design Principles CS5: DELIVERING QUALITY DESIGN IN NORTH LINCOLNSHIRE NPS EN-1 Section 4.5 NPPF NMDC/NDG
	Environment	Protect, restore and promote the rich biodiversity and ecology of local terrestrial ecosystems.	
VALUE	Affordability	Balance time, cost, quality and programme.	NIC Design Principles NPS EN-1 Section 4.5 NMDC/NDG
	Be efficient	Optimise input to the design to maximise the efficiency and output from the project.	NIC Design Principles NPS EN-1 Part 4, Section 4.5 NPPF NMDC/NDG
	Add value	Provide a positive legacy beyond the supply of low carbon electricity.	NIC Design Principles CS5: DELIVERING QUALITY DESIGN IN NORTH LINCOLNSHIRE NPS EN-1 Part 4, Section 4.5 NMDC/NDG
	Innovate	Build on experience of other relevant projects.	
CLIMATE	Sustainability	Maximize the energy and carbon that is recovered from waste that cannot be recycled.	NIC Design Principles CS5: DELIVERING QUALITY DESIGN IN NORTH LINCOLNSHIRE NPS EN-1 Section 4.5
		Maximise sustainable methods and approaches.	NIC Design Principles CS5: DELIVERING QUALITY DESIGN IN NORTH LINCOLNSHIRE NPS EN-1 Section 4.5 NPPF NMDC/NDG
		Sustainably manage resources and re-use/ re-cycle.	NIC Design Principles CS5: DELIVERING QUALITY DESIGN IN NORTH LINCOLNSHIRE NPS EN-1 Section 4.5 NMDC/NDG
	Resilience	Ability to respond to change.	NIC Design Principles CS5: DELIVERING QUALITY DESIGN IN NORTH LINCOLNSHIRE NPS EN-1 Section 4.5 NPPF NMDC/NDG

Figure 5.1: Project Principles

5.3 Overview of Design Process to Date

5.3.1 In order to arrive at a design that would be able to deliver the vision an iterative design process was followed. The layers of site analysis and surveys helped identify most appropriate locations for built development as well as opportunities for biodiversity improvements, new active travel connections and multi purpose drainage systems.

5.3.2 Throughout these iterations several elements of the Project were refined and re-adjusted until an optimal layout was found that delivered the vision, responding to the project principles.

5.3.3 The approach to the design process is outlined in the DAS principally under sections 4.3, 5.1, 5.2 & 5.3. The DAS is the appropriate place for the narrative describing the design approach and process, and the DAS includes sections that set out the findings from the design, consultation process, and design outcomes that relate to the Proposed Development.

5.3.4 Further explanation focused on the overall design process and design approach is provided below in the annotated design process diagram and narrative, that sets out the context for the findings and outcomes currently presented in the DAS.

5.3.5 To avoid complexity and repetition, the Design Principles and Codes (**Document Reference 5.12**) sets out only the Principles and Codes and does not repeat the detailed description of the approach to design found in the DAS.

5.3.6 Section 3.0 of the Design Principles and Codes (**Document Reference 5.12**) provides however an overview of the design process and describes the application of the Design Principles to the project. However, the Design Principles and Codes document does explain the approach to the Project's Design Principles in reference to the NIC's Design Principles for National Infrastructure on which they are based and closely reflect, with the rationale that this is important introduction to the DCO project Principles.

5.3.7 The DAS is not intended to be a certifiable DCO document as the illustrative material contained in the DAS is an expression of how the Project could be implemented, when applying the Principles and Codes as required by Requirement 3 of the DCO.

5.3.8 Paragraphs 1.1.11 and 4.9.2 of the Design Principles and Codes (**Document Reference 5.12**) explain that the DAS includes illustrative design material which has been submitted to demonstrate how the parameters have been tested and set, and to also provide a context and understanding of scheme. Section 8 of the DAS explains how sustainability has been part of the design process and the Design Principles and Codes secure elements of sustainable design.

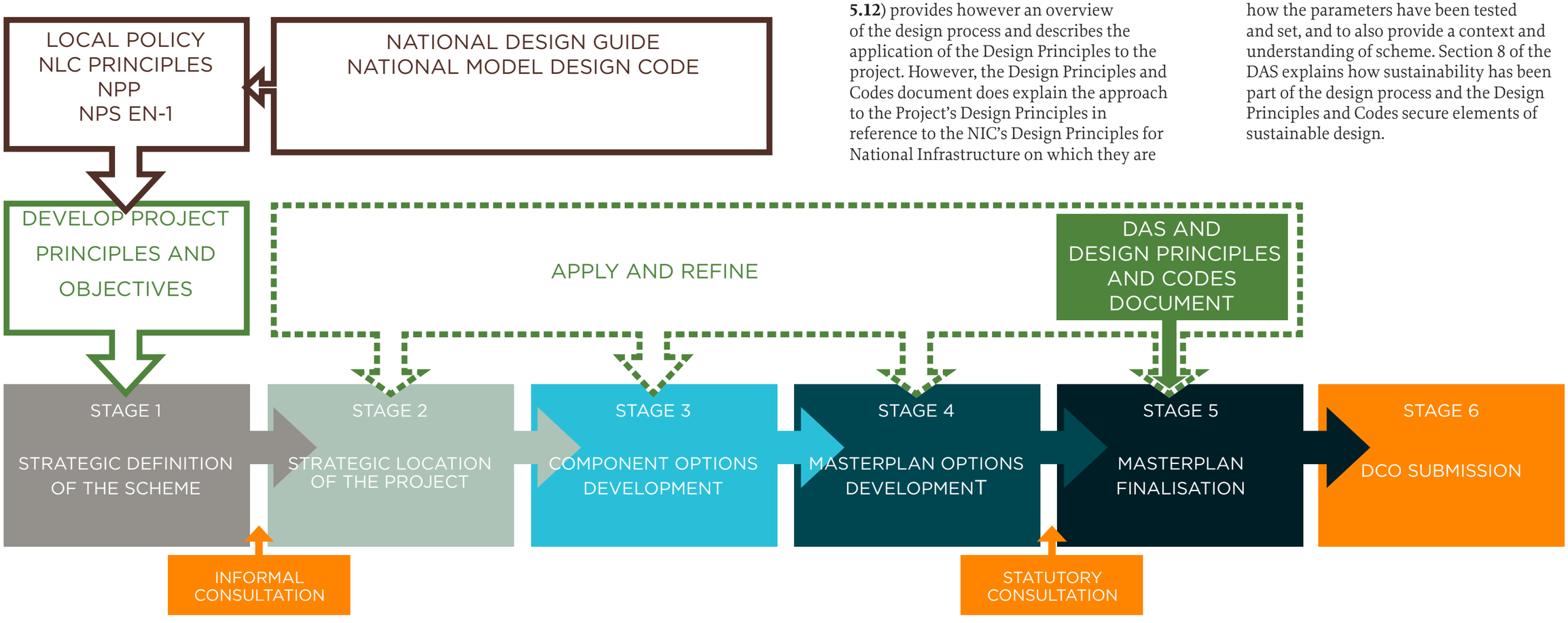


Figure 5.2: Design process diagram

5.4 Position Within the Application Land

5.4.1 At the outset of the project, the potential impacts of flooding on the Project were a key consideration in the design development. Given the type of infrastructure proposed at the Project and the need for it to be operational 24/7, early consideration and testing of how the Project could improve the existing flood defence protecting Flixborough Industrial Estate were considered. One option considered was the raising of the flood defences between Burton upon Stather and the Stather Road / Gunness Lane junction, however the flood modelling demonstrated that this would result in an extensive increase in flood levels to the west of the River Trent and was therefore discounted. An alternative to increasing the height of the flood banks was the option for the provision of additional flood storage areas to the north of Flixborough Industrial Estate, or to the south of the Flixborough Industrial Estate, which included lowering the existing flood bank level and setting back the flood defence line, neither of these options provided sufficient storage for the displaced flood volumes associated with the raised development platforms due to overtopping occurring along the majority of the river banks and the locations at which storage could be located.

5.4.2 In the knowledge that strategic interventions were unlikely to be viable, flood modelling was undertaken for each of the options considered as part of the initial siting work undertaken by the team. The initial siting work was focussed on the ERF, RHTF and CBMF as these buildings have a strong functional relationship and are required to be located within close proximity to maximise the efficiency and output of the Energy Park. The design and placement was focussed to within the area of land identified for the Project as publicised within the informal consultation in Summer 2020. This area of land was identified as it was located in close proximity to the existing wharf, rail infrastructure and the road network allowing waste to be readily delivered by road, river and rail. Although the site is within both Flood Zone 3a and 3b (high risk from flooding and functional floodplain), essential infrastructure is permitted if it can be demonstrated that flood risk is not increased elsewhere, is safe and operational during a flood and avoids loss of floodplain storage and therefore the following three primary locations. were considered:

a) **Northern option** - north of the Flixborough Industrial Estate, within open countryside;

b) **Central option** - partially within the Flixborough Industrial Estate and the port on brownfield land; and

c) **Southern option** - south of the Flixborough Industrial Estate on agricultural land.

5.4.3 The project team undertook an appraisal of these options, with reference to the Project principles.

Northern Option

5.4.4 It was considered that the northern option would be perceived as extending Flixborough Industrial Estate into an area of relatively undeveloped countryside when compared with the central and southern options. The northern edge of the industrial estate is clearly defined by the existing railway line, beyond which the landscape character is noticeably different. The existing railway line also meant that the northern option was constrained in terms of functional and operational relationship with Flixborough Industrial Estate. The northern option would have required greater levels of traffic movements through the industrial estate to accommodate the delivery of RDF by road and river, increasing the impact of traffic, noise and air quality on the existing users of the industrial estate. The flood modelling assessed the impact of raising the development platforms and the railway line however this resulted with an extensive increase in flood levels to the west of the River Trent including the village of Amcotts, north of the site and within Flixborough Industrial Estate. The northern option was therefore discounted.

Southern Option

5.4.5 The location south of Flixborough Industrial Estate would have required the railhead to be located further south nearer Neap House and away from the ERF. This would have resulted in increased turnaround times of the trains and distance that RDF would need to travel to the tipping hall. This location was also further away from the Flixborough Industrial Estate and would occupy a greater area of agricultural land in comparison to the central option. The flood modelling similarly identified that a raised development platform, for the ERF and RHTF and CBMF, up to the edge of the flood embankment would have resulted in increased flood extents and depths to the north and south of the Energy Park Land and within the solar farm to the east. For these reasons the southern option was discounted.

Central Option

5.4.6 In comparison to the northern and southern option, the central option maximised the use of brownfield land and had a stronger relationship with the industrial estate, railhead and wharf. The redevelopment of previously developed land was considered an appropriate response to the local landscape in comparison to the northern and southern options, with built development form integrated into the existing industrial context. The flood modelling work identified that the central option had the least impact in comparison to the northern and southern option, with flood depths increasing only on agricultural land to the south. This option was then further developed and tested through a number of cross-disciplinary workshops and design sessions to mitigate any increase in flood risk as well as in response to PEIR stakeholders, feedback and consultation.

5.4.7 For all three options, an extension to the wharf was considered to accommodate additional vessel movements, however this was discounted as the Harbour Authority identified that the capacity constraints of the tidal River Trent would not support additional berthing space and that the existing Wharf had sufficient capacity to facilitate the Project requirements.

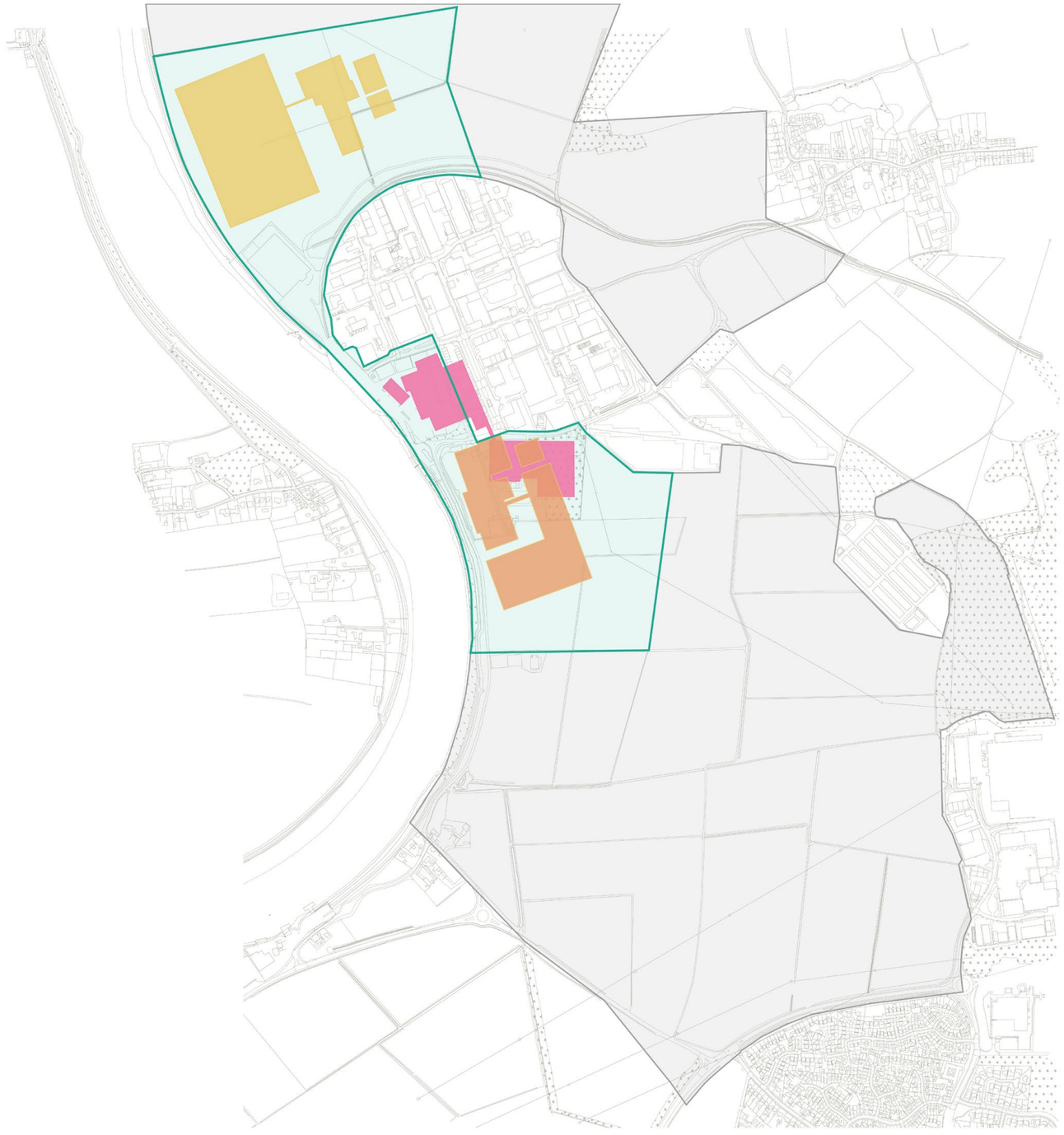


Figure 5.3: Initial option study

Option Testing

Legend

- Area identified for DCO scheme within non-statutory consultation
- Area dentified for further growth and enhancement within non-statutory consultation
- Northern option
- Central option
- Southern option

5.5 Project Layout

5.5.1 Following the selection of the preferred central option, the layout and design of the Project underwent further testing and analysis as the indicative details of the different elements of the Project were developed. This section provides an overview of the different options that have been considered in the evolution of the layout of the Project.

5.5.2 A framework masterplan was developed, to test how the infrastructure associated with the ERF, RHTF and CBMF could be integrated into the surrounding landscape context. At this stage in the design cycle the relationship between the River Trent and the wooded Lincoln Edge escarpment were important considerations in establishing the identity of the landscape and built environment to help frame the design development of the Project. Through the consideration of these existing natural capital assets, it enabled the project team to consider how wider benefits for the environment and people could be delivered as an integrated part of the design process. The opportunities for wetland habitat along the River Trent and new woodland planting extending Burton Wood to the south were two key anchors within the initial landscape strategy, both of which protect, restore and promote the rich biodiversity and ecology of the local terrestrial ecosystems and contribute positively to the character of the local landscape.

Project Layout

Legend

- Hydrogen production and storage facility
- Gas Above Ground Installation (AGI)
- Energy Recovery Facility (ERF), water treatment facility and feedstock storage
- Carbon Storage and Utilisation Plant
- Residue Handling and Treatment Facility and Concrete Block Manufacturing Facility
- Plastic Recycling Facility
- Electric vehicle (EV) and hydrogen re-fuelling station
- Battery Storage
- Railhead

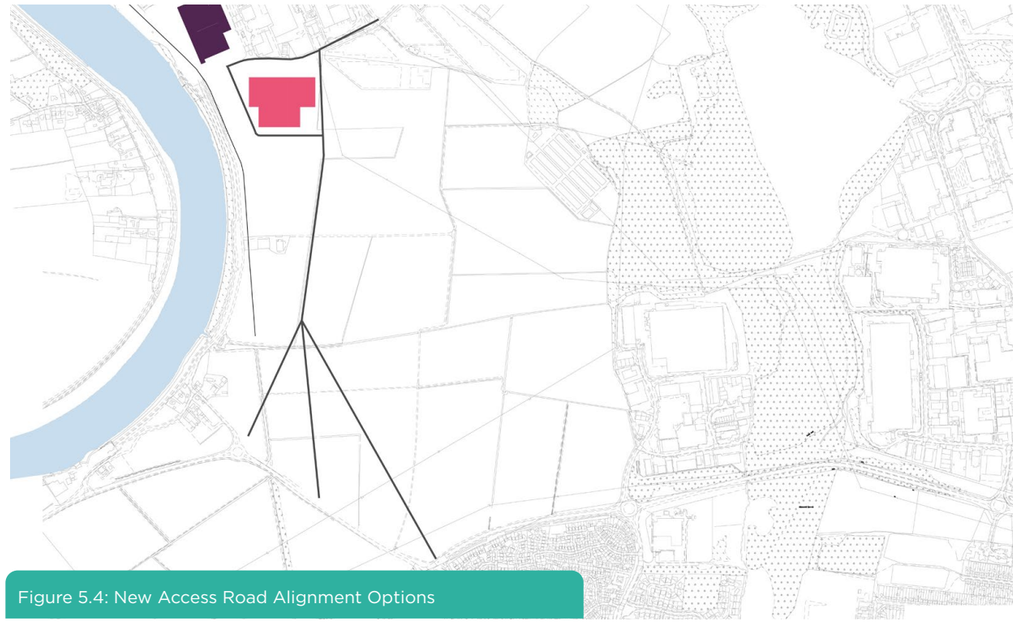


Figure 5.4: New Access Road Alignment Options

5.5.3 The provision for new access road was required to facilitate increased movements to the ERF and associated infrastructure, as Stather Road is not adequate to accommodate such movements as in places it is not possible for HGVs to pass side by side along the route between Neap House and the Flixborough Industrial Estate. A new access road was therefore proposed to connect Flixborough Industrial Estate and Ferry Road West, by-passing Neap House The design of the new access route needs to provide a safe access and egress to the ERF for emergency services and staff during a flood event and therefore be raised above the predicted flood levels. As a result, the new access road was located to the east of the River Trent, away from the foot of the flood bank so not to act as a barrier to the flow of flood water during a flood event.

5.5.4 At its southern end, three locations were considered for the new junction along Ferry Road West, as indicatively shown on Figure 5.3. The western option, introducing a fourth arm on the existing roundabout was discounted as this would have required substantial works to culvert a large ditch and would have required the relocation of protected species. The eastern option would have required significant upgrades to the Ferry Road West/ A1077 Junction which would have caused disruption to the operation of the existing junction and users along the A1077. The eastern option would have also resulted in a longer access road being constructed which would have run parallel to Ferry Road West, increasing construction activities and material required for construction. In comparison the preferred central location, allows for a new roundabout to be constructed 'offline' minimising the disruption to existing users of Ferry Road West, reduces its length and the amount of material, including fill required to construct the new access road.

5.5.5 The orientation of the RHTF and CBMF was realigned so the footprint of the buildings ran north south rather than east west. The change in orientation and the introduction of the internal road between the buildings reduced the flood risk within parts of the Flixborough Industrial Estate providing some benefits.

Figure 5.5: Spatial relationship to surrounding area and road/rail access

5.5.6 The re-alignment of the RHTF and CBMF allowed space for the alignment of the new access road to be refined at its northern end to reduce the number of drain crossings, minimising the impact on the existing drainage network and associated ecology.

5.5.7 In response to stakeholder feedback, and the principle of maximising sustainable methods and approaches a PRF was included within the Project, to allow for waste to be managed sustainably and re-cycled instead of being treated as RDF. The PRF was initially located immediately to the east of the ash maturation plant.

5.5.8 The railhead was sited south of Flixborough Industrial Estate, allowing the trains to be loaded and unloaded within close proximity to the tipping hall ramp, reducing the distance travelled by transfer vehicles along the internal access roads, providing a more efficient and sustainable circulation route. The railhead is not required for the 24/7 operation of the ERF and therefore is not critical infrastructure so it can be allowed to flood. This allowed the railhead to be located adjacent to the riverbank as it would not significantly impede the flow of flood water during a flood event. By utilising the space between the raised development platform and the riverbank allows for a more compact layout maximising the use of previously developed land, reducing the need for agricultural land take.

5.5.9 The electric vehicle and hydrogen re-fuelling station was located at the southern end of the new access road instead of being co-located with the ERF at the northern end of the new access road. The southern location can more easily serve vehicles associated with the Project and Flixborough Industrial Estate as well as being within close proximity and prominence to the A1077 and Scunthorpe. Its location and proximity to the A1077 was an important consideration in helping to promote and make renewable fuelling infrastructure more readily accessible to local businesses, the local authority and the public as society transitions from the use of fossil to renewable fuels. In this location, the facility is co-located with the existing gas infrastructure, enabling the ability for hydrogen to be injected into the gas grid.

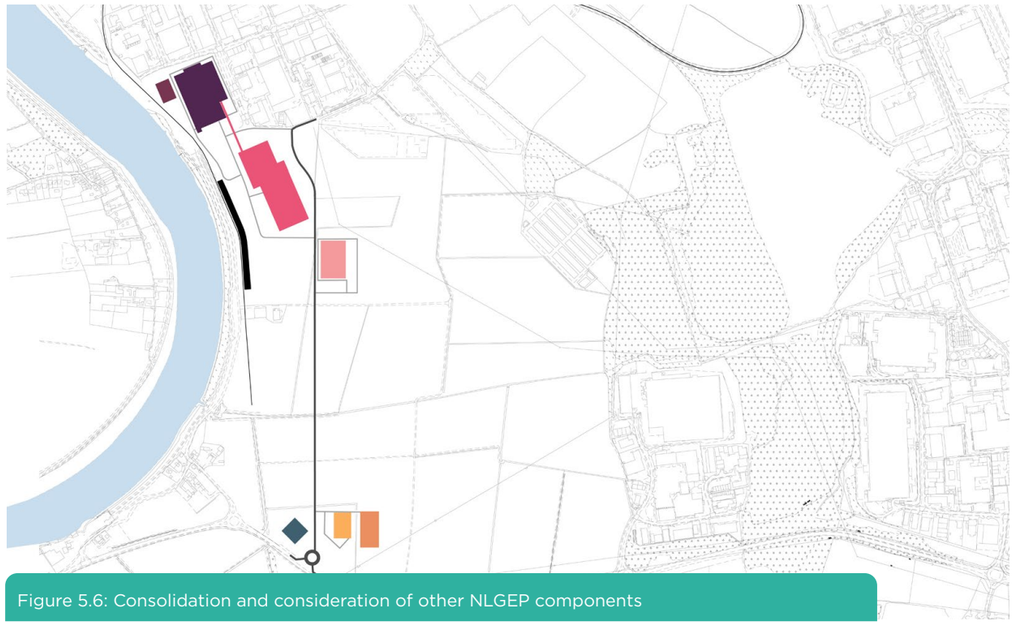


Figure 5.6: Consolidation and consideration of other NLGEP components

5.5.10 The initial location of the PRF resulted in an increase in flood levels within the solar farm located to the east. Through further flood modelling the location of the PRF was shifted further south, removing the increase in flood levels within the solar farm. The orientation of the PRF was optimised to reduce the amount of agricultural land required and the access junction relocated to its southern side in order to stagger the junctions onto the new access road. The revised location avoided the relocation of existing over ground utility infrastructure and avoiding the need to culvert or divert the existing drainage infrastructure, thereby avoiding unnecessary costs and distribution to these existing assets.

5.5.11 The RHTF and CBMF were combined into a single building to avoid unnecessary movement of material across the internal access road, increasing the efficiency of layout as well as reducing associated noise, dust and odour nuisance. The consolidation into one building required less land take and reduced the amount of land that required to be lifted out of the flood plain. The orientation of the building was rotated so that it reflected the pattern of the existing built form and integrated the buildings into the Flixborough Industrial Estate. The adjustment in the orientation of the building also allowed for a greater flood flow path along the eastern bank of the River Trent. The alignment of the new access road was adjusted to accommodate the altered building alignment and the revised location of the PRF allowed space between the new access road and the building footprint for structural planting. The structural planting allows the building to be anchored within its wider landscape and provide for a high-quality designed entrance to Flixborough Industrial Estate.

5.5.12 To further enhance the approach to Flixborough Industrial Estate and minimise interaction between users of Flixborough Industrial Estate and the Energy Park, the access points to the RHTF and CBMF were relocated to the west of the buildings, instead having their own access points directly from the new access road. This reduced the need for multiple security gate entrances and junctions along the new access road, creating a safer active travel route and additional space for structural landscape planting.

5.6 Refinement of Detail

5.6.1 With the location and layout of the associated development having settled through extensive flood modelling, the design was progressed to test the illustrative design. The testing of the illustrative design was an important aspect of the design process to inform the development of the Project's Design Principles and Codes (**Document Reference 5.12**), which will be used to control and guide the later stages of detailed design. This section provides a summary of the further detailed design testing and changes of the layout of Energy Park.

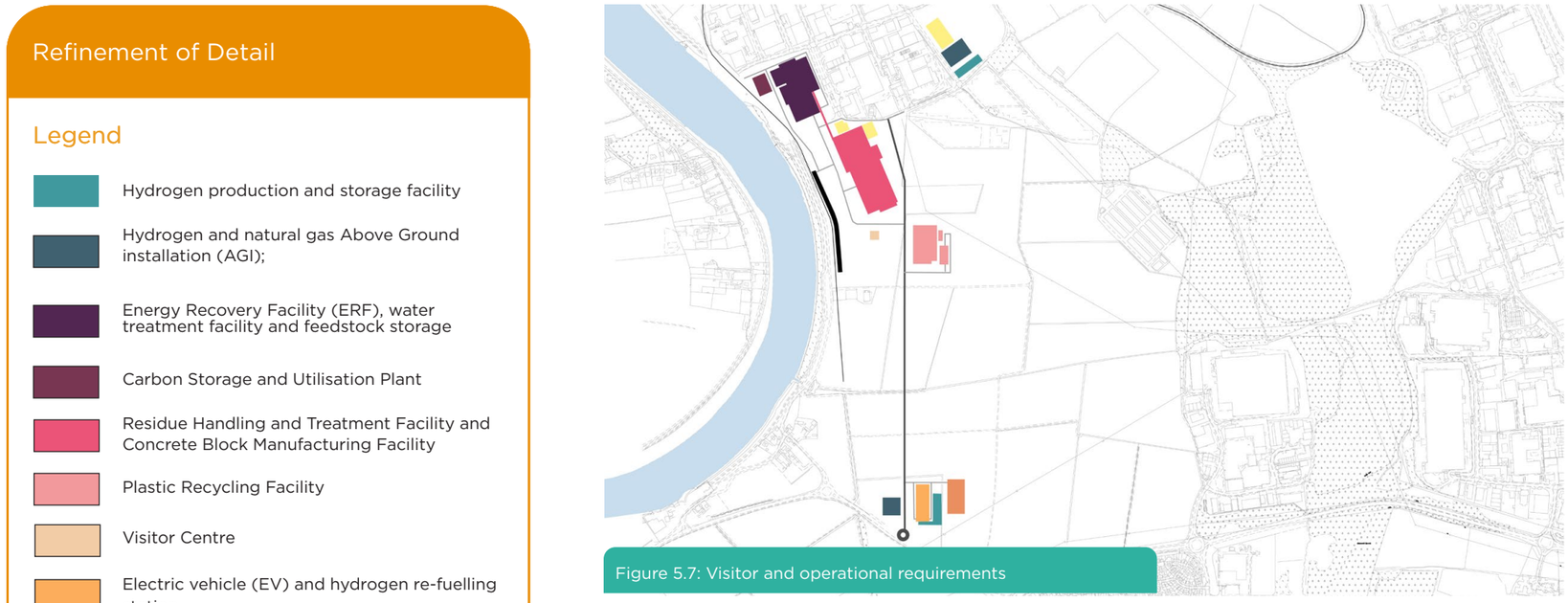


Figure 5.7: Visitor and operational requirements

5.6.2 An important aspect of the vision and design principles was to provide a positive legacy beyond the supply of low carbon electricity and contribute to educational and vocational training. Generally for these types of projects, a visitor centre would be typically integrated into the ERF building, however given the high interdependency of the different elements of the Energy Park including the proposed wetland area, it was considered that a standalone visitor centre, which had a relationship with all the different elements, was better suited and would act as gateway for staff and visitors accessing the facilities. Initially the visitor centre was co-located with the security gatehouse, however it was relocated at the southern end of the CBMF to help with legibility and orientation for those visiting the Energy Park. In this location it would act as 'bridge' between the ERF and associated facilities and the new wetland landscape, allowing staff and visitors access to a high quality and attractive place to work. An elevated walkway connecting the visitor centre with the ERF, CBMF and PRF was included to provide a safe, high-quality access and circulation between the buildings for staff and visitors. The inclusion of the elevated walkway allows for a 'living wall' to be established consisting of climbing plants to soften and screen low level movements and infrastructure from Amcotts.

5.6.3 The orientation of the southern Gas AGI was amended to reflect layout / orientation of refuelling and battery storage compounds so that the cluster of buildings would relate to one another and be seen as group of buildings straddling the new access road. Further optimisation of the PRF resulted in removal of the circular access road, allowing for a positive landscape frontage on to the new access road, reflecting the design intent for the RHTF and CBMF.

Figure 5.8: Fuel tanks and addition of elevated walkway

5.6.4 A secondary gas AGI was required to enable the ERF to be fired up using natural gas from the grid rather using fuel oil. The secondary gas AGI and co-located hydrogen production facility were located to the east of Flixborough Industrial Estate, where the existing gas main is located. Alternative options would have required the facility to be located within the open expanse of agricultural farmland to the south of Flixborough Industrial Estate. Such a location would have been seen as being isolated within an open landscape context and would have required the construction of unnecessary additional roads infrastructure and land take within the flood plain.

5.6.5 The ERF and District Network Operator switchyards were relocated away from the gateway into Flixborough Industrial Estate (Bellwin Drive/Stather Road Junction), to the east of the industrial estate adjacent to the gas AGI and hydrogen production facility. Given the nature of this type of infrastructure and the importance of a high-quality arrival sequence for users of the new access road, it was considered that the east of the industrial estate was the most appropriate location, as it places the infrastructure in close proximity to either of the utility corridors being considered along Stather Road or First Avenue. The rectilinear nature of the switchyard and gas AGI allow for the optimisation of the layout to closely reflect the existing building and field pattern whilst also avoiding further land take within the flood plain. The relocation of the switchyards was required to accommodate the change in levels, between Stather Road and the development platform, for the continuation of the high-quality landscape arrival sequence for staff, existing businesses and users of Flixborough Industrial Estate. The relocation of the switchyard also increased the distance between the raised development platform and the existing buildings which could have potentially acted as a pinch point during a flood event.

5.6.6 Similar to the switchyard, the water and fuel tanks which were relocated away from the gateway into the industrial estate on the corner of Bellwin Drive and Stather Road, to east of ERF so to reduce the amount of visual clutter and create a simple and clean public facing entrance to the ERF from Stather Road.

5.6.7 The location of the southern gas AGI was relocated further north to allow sufficient space for structural landscape planting to help filter views of the infrastructure and set it within its landscape. The approach to the curtilage planting around the cluster of buildings at the southern end of the access road has been designed to reflect the landscape planting pattern around farmsteads within the wider context, whereby clusters of buildings are surrounded by structural planting.

5.7 District Heat and Private Wire Network

5.7.1 The routing of the DHPWN follow the main trunk roads from the Energy Park to the Lincolnshire Lakes housing development (the Southern DHPWN) and the proposed hospital (the Northern DHPWN) as possible commercial off-takers.

5.7.2 Initially, designs for the Southern DHPWN considered the option for the pipework and cables to be laid on either side of the A1077 and M181. The route on the eastern side of the A1077 and M181 was discounted, as it would have required crossing the M181 to access the developments. Consultation with National Highways suggested that works to the highway should be minimised. Additionally, there is a ditch east of the road along the length of the A1077, making construction more difficult.

5.7.3 The north route runs along the A1077 into Scunthorpe to the A1077/Normanby Road Junction. At this point, there are two route options being considered. The DHPWN will either will head south along Normanby Road and Warren Road (Option A) or continue east along Mannaberg Road and Bessemer Way (Option B). Prior to selecting the northern route along the A1077, an alternative route following the B1216 was considered but rejected due to noise and traffic impacts on residents during construction. Additionally, the routing initially included a further section, following Normanby Road south of the intersection with the B1216 and along the B1431 to deliver heat and power directly to the offices of North Lincolnshire Council as well as the hospital. This section of the route was discounted due to noise and traffic impacts on residents.

5.8 Water Abstraction

5.8.1 The Project considered three possible sources of water for process use:

- abstraction from the River Trent;
- abstraction from boreholes; and
- supply from town's water.

5.8.2 Water quality samples were obtained from each source, to determine the likely pre-treatment and treatment requirements. Water quality sampling for the River Trent identified high levels of metals in the water, and highly changeable tidal conditions. This would require large levels of pre-treatment, with high civil costs and land take for settlement ponds. The abstraction of water from the River Trent would also require infrastructure to be built within the river and its associated ecological designations. The construction and operation of such infrastructure would have a direct impact on the River Trent.

5.8.3 The Flixborough Wharf is sited on an old ferry boat crossing, so consideration was given to the potential impact of archaeology artifacts by limiting invasive construction on the the banks of the River Trent.

5.8.4 Estimates were made for process water usage. The estimates suggested that the Project would be consumptive. The Environment Agency is unlikely to support abstraction for schemes which are consumptive, which would make pursuing abstractive options more difficult.

5.8.5 Only historical water quality data was available for the groundwater and noted high saline content in the water. The quality of the town's water was of sufficient quality to supply the facilities with water, with treatment for the ERF and hydrogen facilities.

5.8.6 Town's water was therefore selected due to lower capital costs, and lower environmental impacts.

5.9 Building Heights

5.9.1 The building heights that were submitted as part of the PEIR assessment were worst case estimates, were refined upon receipt of the results of the Landscape and Visual Impact Assessment (LVIA) and stakeholder feedback. The heights were refined through discussions with technology providers, and refinements of the flood modelling which allowed for fixing of platform heights. In particular, this allowed for a reduction of 10m in the height of the PRF, and 5m in the height of the RHTF and CBMF.

5.10 Construction Compounds

5.10.1 Ten construction compounds had been proposed to serve the construction of the Project, which included 5 along the length of the DHPWN. The number of construction compounds has been reduced to minimise temporary land take and the compounds. Where possible, these have been located on areas of previously developed land and/or in areas where development is proposed, again to minimise the temporary land take of the Project. The temporary construction located near Dragonby Sidings has been relocated to avoid impacts to the Conesby Quarry LNR.

View along Bellwin Drive, Flixborough Industrial Estate

5.11 Illustrative Detail

5.11.1 The level of detail provided in the sections below is purely illustrative and does not form part of the application for development consent. However, the information provides an important level of detail and indicates the intention to create a high quality environment, inspired by sustainability principles and led by the project vision. This detailed information also shows how the Project could be developed in accordance with the works plan (**Document Reference 4.4**).

5.12 Illustrative Masterplan

5.12.1 The illustrative masterplan shown on the next page has been developed through an iterative design process with multi-disciplinary input from a number of consultants with an aim to achieve the project vision set out in section 5.1 of this report, The refinement and development of the masterplan is further explained in sections 5.5 - 5.7.

5.12.2 Whilst the plan provides a potential option of how the vision can be achieved through the parameters summarised in Section 7, it also serves an important purpose in proving the deliverability of what is proposed and the spatial relationships between the Project elements and the landscape.

5.12.3 The built elements of the Project have been tested spatially to ensure they can be delivered in respect of any constraints and technical requirements.

5.12.4 The landscape elements proposed are adaptable to the potential deviation within the Works Plans (**Document Reference 4.4**) and are in line with the vision. Any improvements to the existing landscape features will not be compromised by the potential deviations.

5.12.5 A new roundabout along Ferry Road West will act as the gateway into the Project. A new access road in a north-south direction will provide direct access to the Energy Park and Flixborough Industrial Estate avoiding Neap House. Glimpsed views of the open agriculture landscape with the ERF sat alongside the River Trent and Flixborough Industrial Estate as a backdrop will be possible from Ferry Road West and the new access road. Enhancement along both Ferry Road West and the new access road will provide new hedge/tree planting and wildflower planting, along with a combined foot and cycle path that is separated from the carriageway by a 5m verge to provide an increased sense of safety and security.

5.12.6 Immediately to the north of the new roundabout on Ferry Road West will be a new green vehicle hub - a charging station for hydrogen and electric vehicles. This will be located alongside the hydrogen production facility and battery storage - providing sustainable energy to vehicles and the grid when demand is high. The hub will also include facilities for drivers whilst a nearby footpath loop will provide an alternative active way to spend their time whilst waiting for their vehicle to charge. An above ground gas installation will provide hydrogen back into the gas pipeline and will be located opposite the charging station.

5.12.7 The margins of Lysaght's Drain that runs east to west through the Energy Park Land will be enhanced to increase it's biodiversity value and provide greater habitat connectivity from the newly proposed wetland habitat, to the west of the new access road, to the common land and escarpment east of the Energy Park Land. This corridor will also contain a new footpath, providing amenity and recreational routes.

5.12.8 Travelling north along the new access road, the PRF will sit within a landscape buffer, linking into the new linear tree belt proposed to the east of the new access road. The PRF will be linked to the other facilities within the Project by an elevated walkway that will cross the main access road.

5.12.9 Immediately to the west of the PRF, on the other side of the access road is the visitor centre. The visitor centre is to be located close to the entrance to the ERF, and will provide a first point of contact for visitors and local people. This facility will provide training, security screening and waiting facilities for tour groups and other visitors. The building itself will be located within the wetland habitat, connected to the network of informal footpaths within the wetlands. The visitor centre will provide controlled access to the elevated walkway so that visitors and staff can gain access to the ERF, concrete and PRF safely and securely away from the movement of HGVs.

5.12.10 Further north of the visitor centre there will be a number of weighbridges for RDF arriving via roads, leading to the ramp up to the tipping hall within the ERF. A circular route at the platform level will also be made available for servicing vehicles and other needs for the maintenance of the facility.

5.12.11 Ash from the combustion process will be transported to the RHTF over an elevated conveyor belt. This facility will be linked to the concrete production plant, that will use the ash for manufacturing concrete products.

5.12.12 Internal access routes will provide direct access between the ERF and railhead, where RDF will be unloaded and transported to the tipping hall.

5.12.13 The wharf will provide an opportunity for RDF to be delivered by river and transported to the ERF via an internal circular road system around the ERF building.

5.12.14 At its northern end, the new access road will link to Stather Road and will provide a direct route into the Flixborough Industrial Estate for HGVs and other vehicles, allowing the stopping up of the Stather Road to the north of the existing pumping station.

5.12.15 The stopped up road will provide emergency vehicle access to the wharf as well as permissive access for walking and cycling along the edge of the River Trent.

Figure 5.9: Illustrative Masterplan

Framework Plan

Legend

DCO limits

Trees

- Native woodland blocks and hedgerows
- Formal tree planting of native species
- Feature/focal tree planting
- Wet woodland tree planting
- Low scrub planting under pylons

Understory/ Ground Cover

- Grass/wildflower verges
- Wildflower underplanting
- Improved grassland habitat
- Wetland habitat planting

SuDS Features

- SuDS basins
- Swales/drains

Existing Landscape Enhancement

- Common land for biodiversity improvement
- Ditch enhancement

Movement

- Pedestrian and cycle paths

5.13 Processes and Interconnectivity

5.13.1 The individual elements of the Project are all heavily interdependent with the heat, power, and feedstocks all dependant on the ERF. The relationship between all the elements of the Project is illustrated on Figure 5.11

5.13.2 The ERF recovers energy from incoming RDF, using three boilers, producing a high temperature flue gas. This flue gas is maintained at a temperature exceeding 850°C in accordance with the Industrial Emissions Directive (IED). The flue gas will be cooled as it passes through the boiler, as superheated steam is raised. The superheated steam will be expanded across a steam turbine generator, generating electrical power. A portion of the steam will not be fully expanded, and will be used to supply heat to a district heating scheme.

5.13.3 On exit from the boiler, the flue gas will be cleaned by dosing hydrated lime, activated carbon and ammonia. Particulate matter will be removed by use of a bag filter. Concentrations of pollutants will be measured at inlet and outlet of the flue gas treatment plant, and dosing rates will be controlled to ensure emissions standards are met.

5.13.4 A portion of the clean flue gas will be diverted to the Carbon Capture, Utilisation and Storage Plant, following further cleaning and treatment. In this facility, the diverted flue gas is cooled before being exposed to amines, which will absorb the carbon dioxide within the flue gas stream. The diverted flue gas will pass through a further water wash before being reintroduced to the main flue gas stream and emitted from the stacks. The captured CO_2 will be stored on site before being utilised on site or exported to industrial users off site.

5.13.5 The ERF will produce bottom ash, which is the residue of the combusted RDF, including recyclable elements such as metals. Additionally, the ERF will produce FGTr, which is formed of unreacted reagent, reaction products and particulates. Both materials will be reprocessed in the residue handling and reprocessing facility. Bottom ash is left to dry and mature before being crushed after any ferrous and nonferrous metals are removed. The material is then graded by size using trommels, forming an aggregate. FGTr undergoes accelerated carbonation using the CO_2 captured from the ERF. The residue is mixed with cement in a humid environment. The material is cementitious and expands to form an inert usable aggregate.

5.13.6 The aggregates formed in the residue handling and reprocessing facility are then used in the manufacture of concrete blocks. In this process, the aggregates are mixed with cement, sand and water and moulded to form blocks. The blocks are then left to cure before being transported offsite.

5.13.7 Electrical power from the ERF will be used for hydrogen production. Hydrogen is produced using electrolysis, in which an electrical current is applied between two electrodes across a liquid electrolyte. As the current is applied, water in the electrolyte is split into hydrogen and oxygen. The hydrogen is then collected and used for vehicle refuelling or injected into the gas grid.

5.13.8 Electricity will also be stored in the batteries. This system allows the Project to increase self consumption of electricity, perform energy arbitrage or provide grid balancing services such as frequency and voltage response for both the national grid and the local PWN.

5.13.9 The hydrogen production, battery storage and electricity from the ERF will be used to supply an EV and hydrogen re-fuelling station.

5.13.10 Electrical power and heat from the ERF will be used to supply a PRF. This facility will accept segregated plastic material, which will be cleaned and reprocessed using a hot wash process, before being mechanically and thermally treated to form plastic pellets, plastic flakes of various polymers that can be re-used to displace the use of fossil fuels.

5.13.11 The Project will also export heat and power to off-site developments, through a district heat and private wire network which may export energy to to the proposed business park and potentially the new hospital.

A FIRST IN THE UK

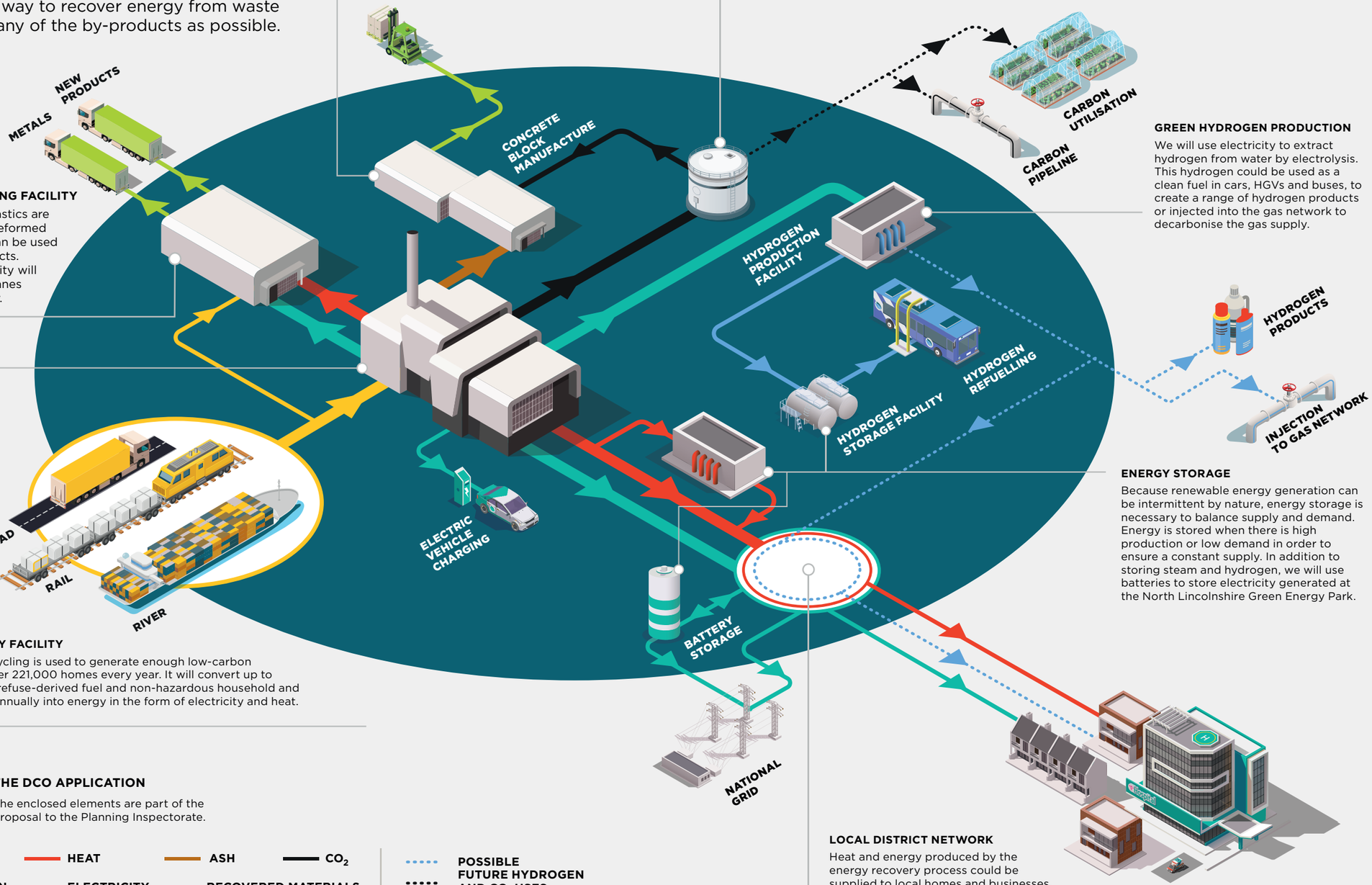
Our plans bring together proven technologies in an innovative way to recover energy from waste and use as many of the by-products as possible.

FLY ASH AND BOTTOM ASH PROCESSING

Ash produced by the energy recovery process will be used on site to make concrete blocks which can be used in the construction industry.

CARBON CAPTURE STORAGE AND UTILISATION

Carbon dioxide will be released during the energy recovery process. Some of this will be captured, stored and utilised on site in the manufacture of concrete blocks using fly ash from the energy recovery process. We are exploring the possibility of linking to the Drax carbon pipeline planned for the Humber once that project is consented and built.



GREEN HYDROGEN PRODUCTION

We will use electricity to extract hydrogen from water by electrolysis. This hydrogen could be used as a clean fuel in cars, HGVs and buses, to create a range of hydrogen products or injected into the gas network to decarbonise the gas supply.

PLASTIC RECYCLING FACILITY

The polymers in plastics are broken down and reformed into plastics that can be used again in new products. We expect the facility will process 20,000 tonnes of plastic each year.

ENERGY STORAGE

Because renewable energy generation can be intermittent by nature, energy storage is necessary to balance supply and demand. Energy is stored when there is high production or low demand in order to ensure a constant supply. In addition to storing steam and hydrogen, we will use batteries to store electricity generated at the North Lincolnshire Green Energy Park.

ENERGY RECOVERY FACILITY

Waste left after recycling is used to generate enough low-carbon energy to power over 221,000 homes every year. It will convert up to 760,000 tonnes of refuse-derived fuel and non-hazardous household and commercial waste annually into energy in the form of electricity and heat.

LOCAL DISTRICT NETWORK

Heat and energy produced by the energy recovery process could be supplied to local homes and businesses.

THE DCO APPLICATION

The enclosed elements are part of the proposal to the Planning Inspectorate.

WASTE
HEAT
ASH
CO_2
HYDROGEN
ELECTRICITY
RECOVERED MATERIALS

POSSIBLE FUTURE HYDROGEN AND CO_2 USES

Figure 5.10: Diagram showing connections between different site facilities

5.14 Access and Movement

5.14.1 This section provides a summary of the movement of people material and vehicles within the Energy Park .

Vehicular Access

5.14.2 In order to access to the ERF and CBMF, the majority of staff and visitors would use the new access road.

5.14.3 The visitor centre would act as the primary access point for visitors, with direct access to the elevated walkway. Visitors will also be able to use the staff entrance and park immediately south of the ERF so to allow flexibility to accommodate different groups.

5.14.4 Access to the CBMF will be provided from within the secure compound.

5.14.5 The service needs of the ERF will be accommodated through the circular road around the ERF building.

5.14.6 Service vehicles would access the ERF via the new access road. See Figure 5.12 for more information on the new access road corridor.

5.14.7 The illustrative section shows how the new access road between Ferry Road West and Stather Road could look. Raised above the existing ground levels to ensure a dry access and egress to and from Flixborough Industrial Estate and the Energy Park in case of a flood event. The road will provide both a carriageway, wide enough to accommodate HGV traffic coming in to the Energy Park and Flixborough Industrial Estate, as well as a segregated shared pedestrian and cycle route. The path will be separated from the carriageway by a verge with new hedgerow/herbaceous planting.

5.14.8 Both sides of the route will have swales and ponds, providing attenuation for surface water run-off from the access road.

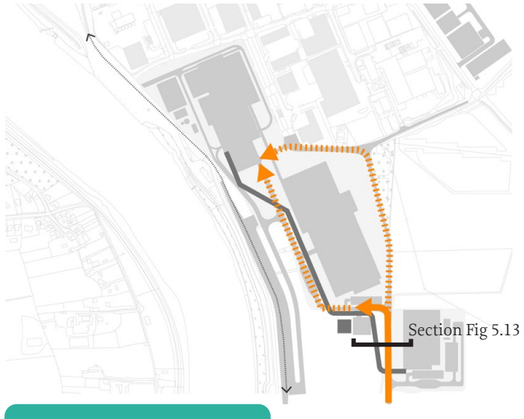


Figure 5.11: Staff and visitors

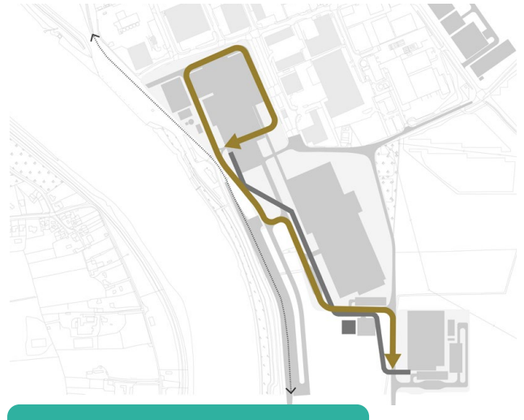


Figure 5.12: Service vehicles

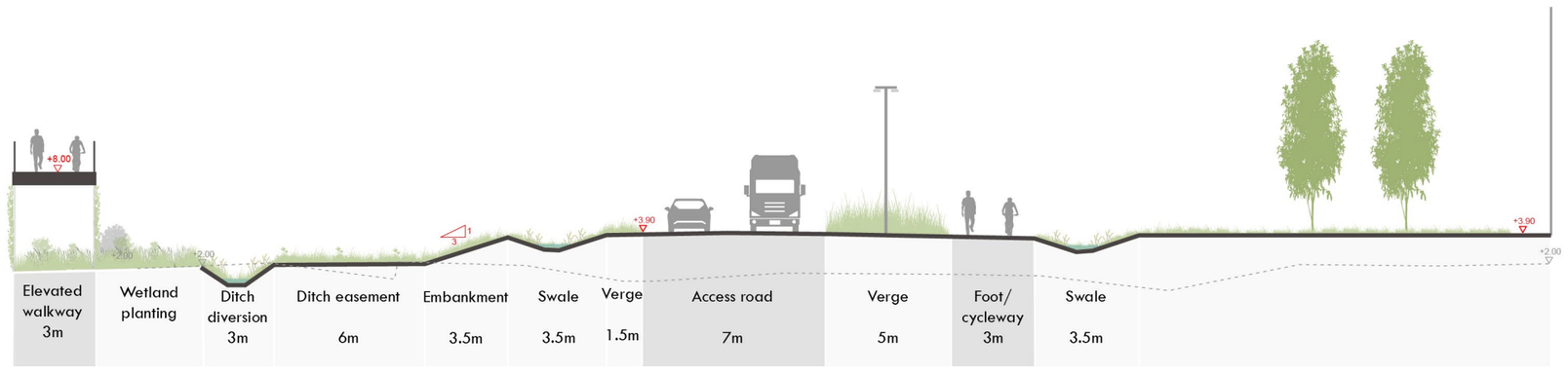


Figure 5.13: Illustrative section through main access road

Active Travel

5.14.13 A new foot and cycle route will be provided along the new access road, providing a link to Flixborough Industrial estate and further afield to Flixborough village and beyond.

5.14.14 A new pelican crossing wil be be provided at Ferry Road West/A1077 junction to northern edge of Scunthorpe, allowing for safe crossings for pedestrians and cyclists.

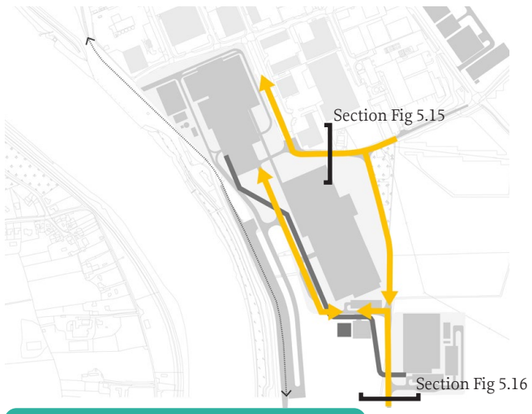


Figure 5.14: Active Travel

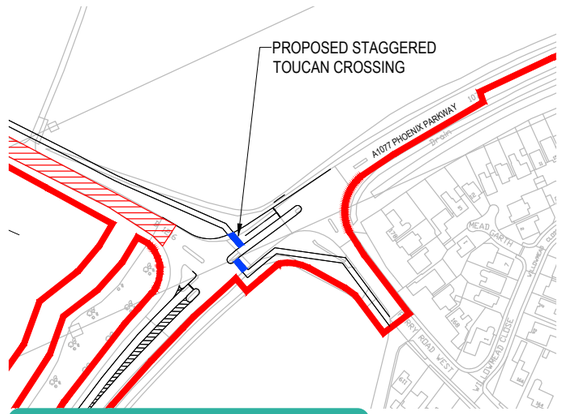


Figure 5.17: Proposed Pelican crossing

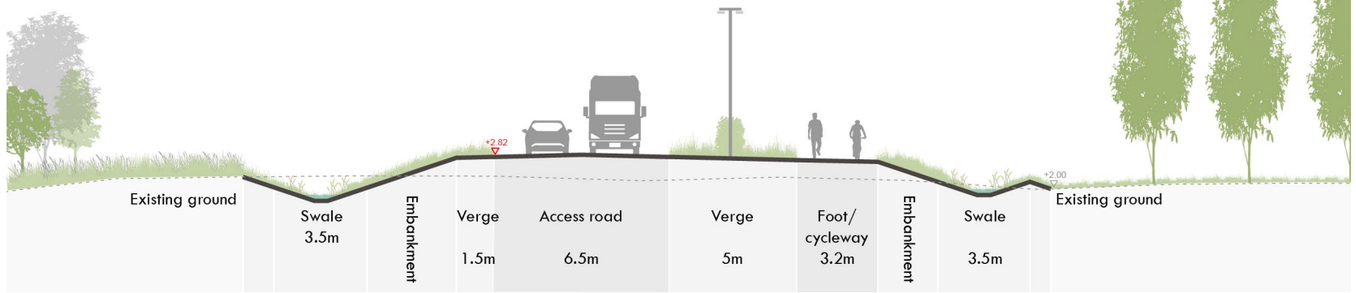


Figure 5.16: Illustrative Road Corridor Sections

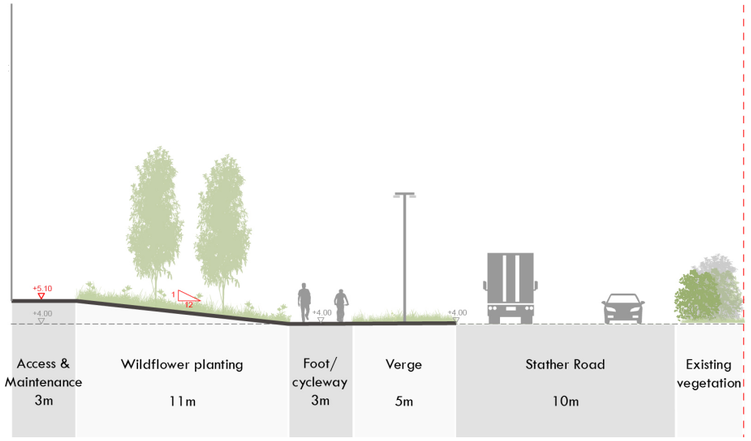


Figure 5.15: Illustrative section through Stather Road north of concrete block manufacturing facility

Residue Derived Fuel Movement

5.14.9 RDF delivered by road would approach from the south along the new access road and gain access to the Energy Park via the southern access points.

5.14.10 After making its way over the weighbridges, the RDF will be delivered to the tipping hall of the ERF using the internal private road network.

5.14.11 RDF delivered via railway will be off-loaded at the railhead, from which it will be taken to the tipping hall by transfer vehicles using the internal private road network. See Figure 5.20 for more information on the proposed railway corridor.

5.14.12 RDF delivered via the River Trent will be off-loaded at the wharf, from which it will be taken to the tipping hall by transfer vehicles using the internal access road network.

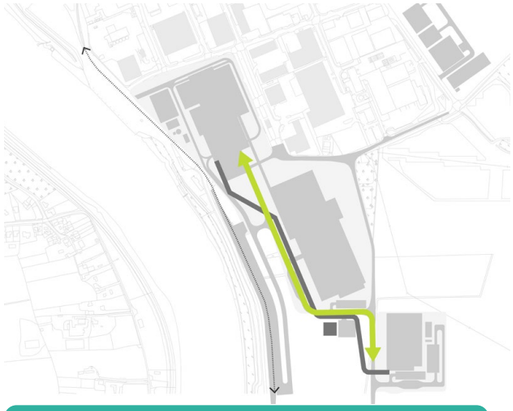


Figure 5.18: Waste delivery by road

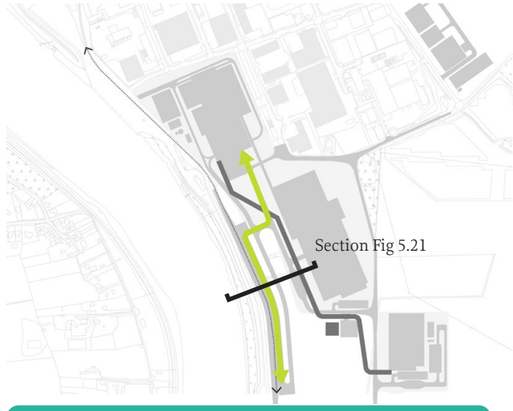


Figure 5.19: Waste delivery by rail

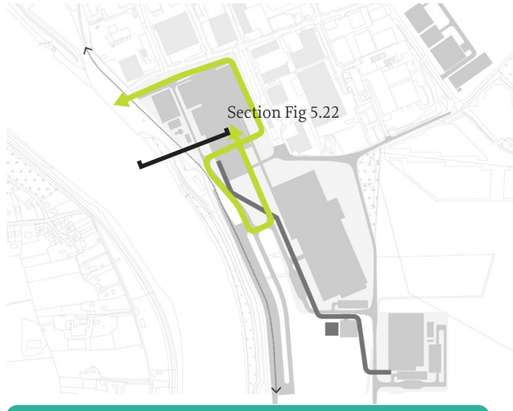


Figure 5.20: Waste delivery by wharf

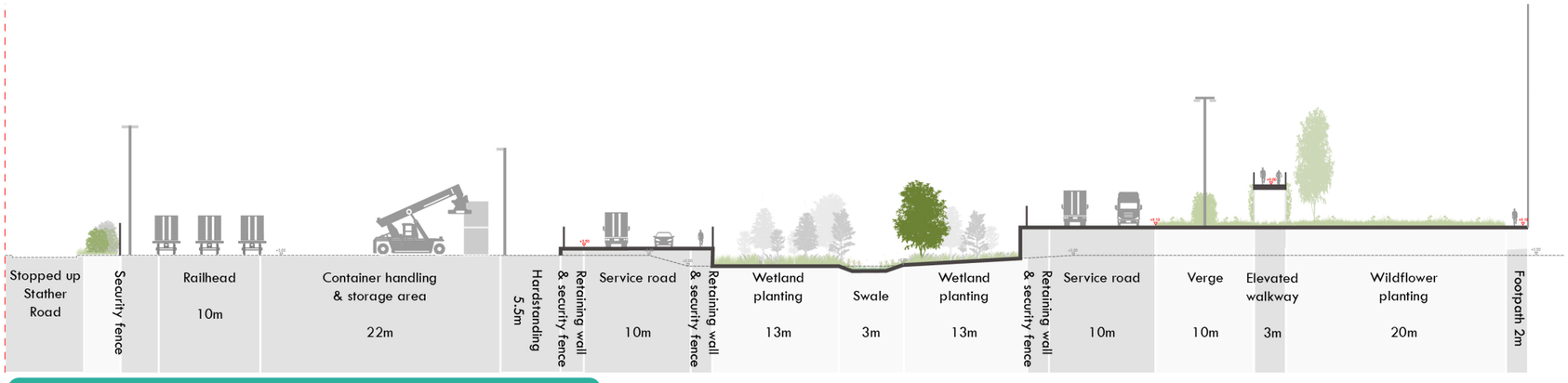


Figure 5.21: Illustrative Railhead and Rail Corridor Sections

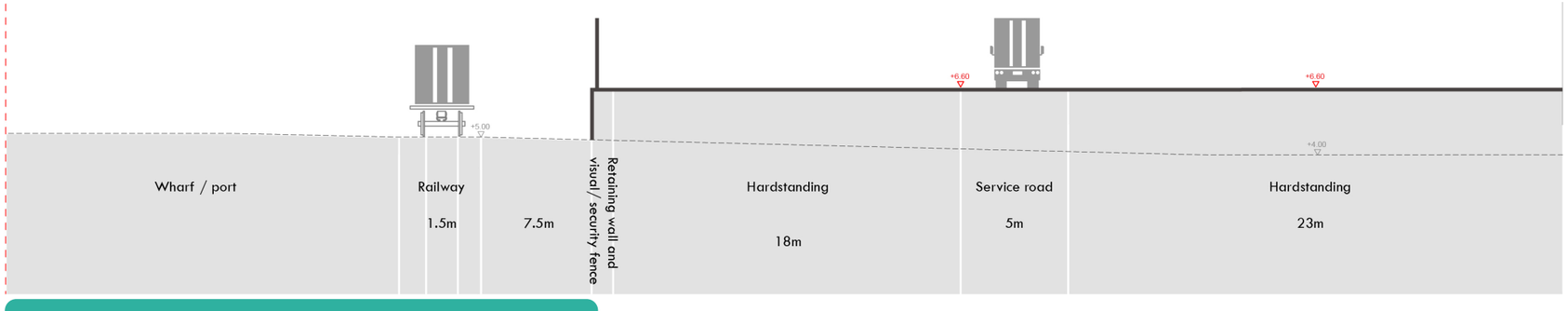


Figure 5.22: Illustrative Railhead and Rail Corridor Section

Access to Flixborough Industrial Estate and the Port

5.14.15 Access to the Flixborough Industrial Estate will be retained through the provision of new access road. The junction priority will be reconfigured for the Bellwin Drive and Stather Road junction. See Figure 5.14 and 5.24 for more information on the new access road corridor.

5.14.16 Stather Road will be upgraded to include a new priority junction and a right turn onto the new access road.

5.14.17 Access to the wharf will be gained via First Avenue to allow the continuous usage of wharf by RMS Ports.

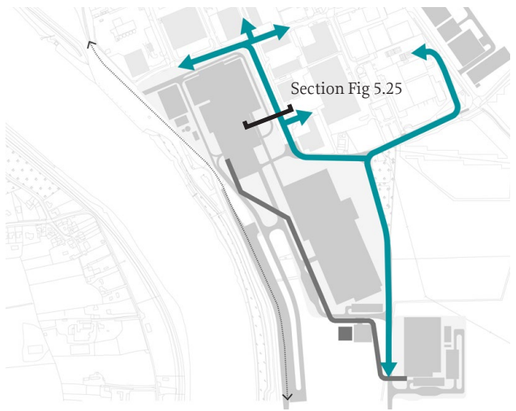


Figure 5.23: Access to Industrial estate and wharf

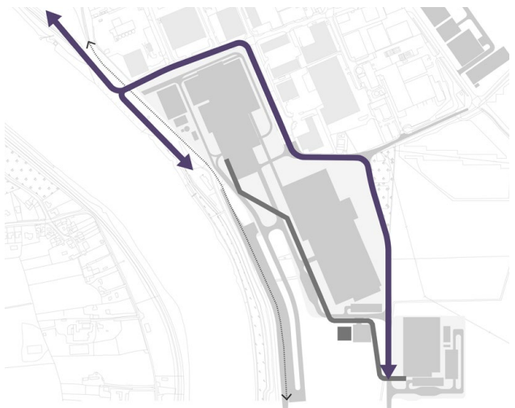


Figure 5.24: Access to Industrial estate and wharf

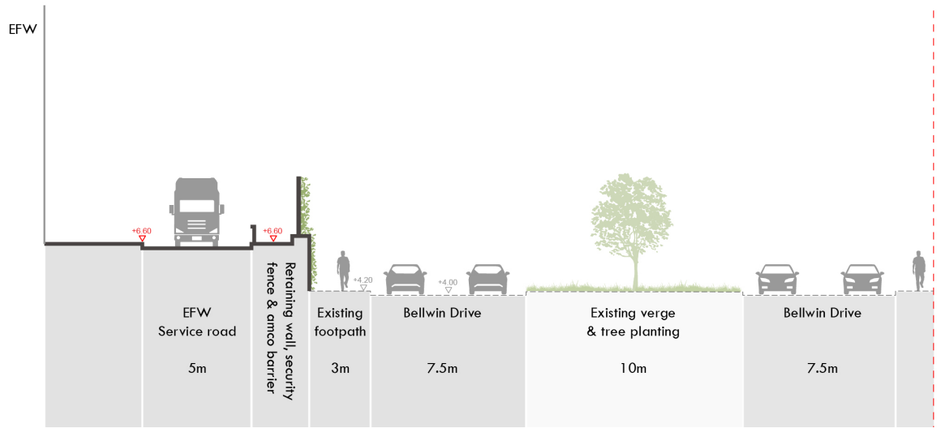


Figure 5.25: Illustrative Bellwin Drive Section

5.15 Public Connectivity Strategy

5.15.1 The Project aims to make a significant contribution to improving pedestrian and cycle connections within the Application Land. The improvements will not be limited to providing new active travel options for those coming to the Energy Park and Flixborough Industrial Estate, but will also improve connections around the northern edge of Scunthorpe and southern edge of Flixborough, connecting into the existing PRoW. A new combined foot and cycle path will be provided on the north side of Ferry Road West and will run between Neap House to a new proposed pelican crossing over Phoenix Parkway. This will create a new safe connection between Neap House and the northern edge of Scunthorpe.

5.15.2 A new shared pedestrian and cycle connection will be provided along the new access road between Ferry Road West and Flixborough Industrial Estate. The route will be located to the east of the carriageway and be separated by a verge for added safety and comfort. This will provide a new connection for those travelling to the Energy Park, Flixborough Industrial Estate as well as Flixborough and the countryside beyond.

5.15.3 The new pedestrian routes will create circular routes by connecting to existing PRoWs. One such loop will be formed via the new access road and the east-west route running along Lysagth's Drain, connecting to the adjacent PRoW FP175 and then running along the northern edge of Scunthorpe and across the new proposed crossing on Phoenix Parkway. Another such route will be available south of Flixborough, connecting a number of PRoW FP174B, FP174A, FP175, FP176 and FP178 with new connections within the Application Land.

5.15.4 A stretch of Stather Road will be stopped up between the junction with Bellwin Drive and the pumping station located on Lysagth's Drain, north of Neap House. The stopped up section of Stather Road will be retained to provide emergency access to the wharf and will be retained as a permissive route for pedestrian and cyclists, opening up access to the River Trent.

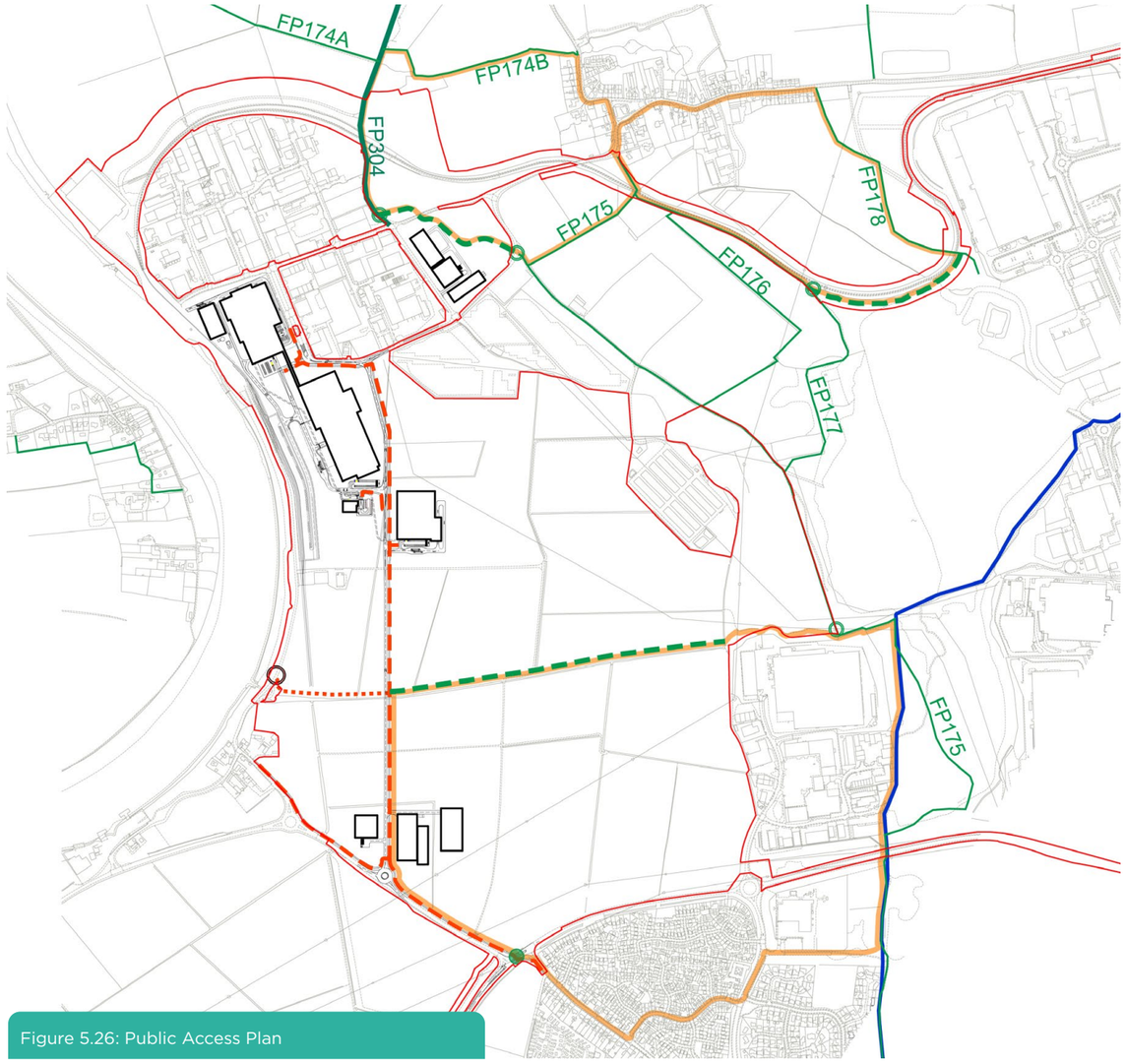
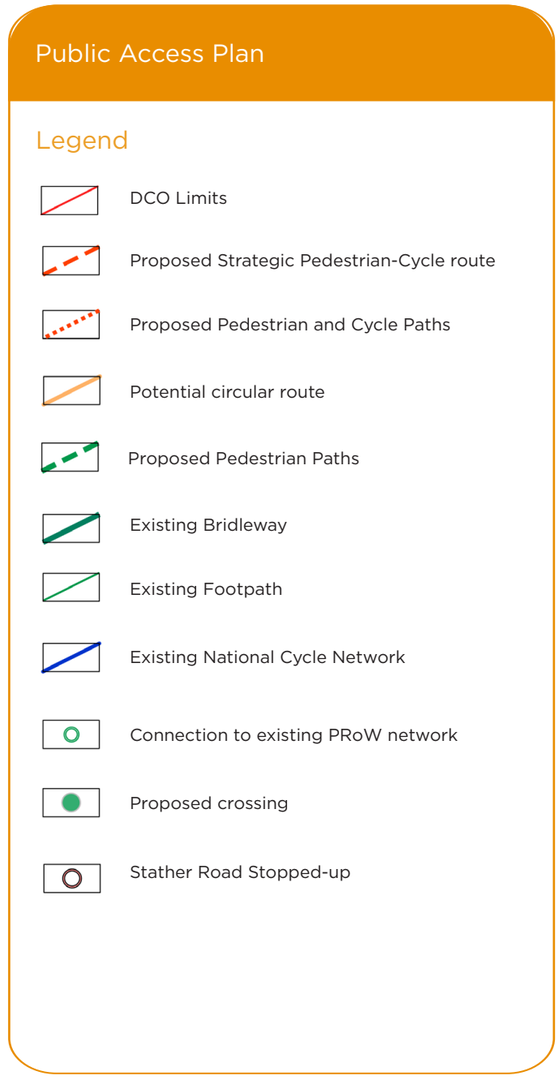


Figure 5.26: Public Access Plan



5.15.5 A new circular walk for pedestrians will be provided along Lysaght's Drain, which will connect to the new access road and the footpath (FP177) further east and the network of routes.

5.15.6 Another recreational route provided will be a connection between PRoW FP175 and FP304, north east of the Flixborough Industrial Estate.

5.15.7 New permissive routes will also be provided through the wetland landscape, located to the west of the new access road.

5.15.8 The wetland landscape will be accessible from the visitor centre and the proposed pedestrian/cycle path located along the new access road.

5.15.9 Two existing PRoW cross the reinstated railway - FP176 and FP178. These crossing points will be made safe with appropriate infrastructure and signage to ensure users can continue using these safely.

5.16 Staff and Public Accessibility

5.16.1 The main point of access to the Energy Park will be from the new access road. The ERF, RHTF and CBMF will be secured by a perimeter fence served via three access points. A new access from the Bellwin Drive/ Stather Road junction access will form the primary staff access and would be an automatic system operated by use of staff access cards and will lead directly into the staff car park, with space for 89 vehicles.

5.16.2 Visitors such as school groups and students will be able to visit the Energy Park to gain an insight into how the facility is run and the energy life-cycle. The visitor centre will provide the gateway for such visitors, with facilities for inductions, presentations and waiting areas. Visitor parking will be located at the visitor centre. This will be able to accommodate 27 vehicles.

5.16.3 An elevated walkway will provide a safe and secure way for visitors and staff to travel between the ERF, RHTF, CBMF and PRF, following the flow of materials as it passes between the buildings and all the associated processes in recovering materials.

5.16.4 Separate car parks are proposed for the CBMF, PRF and the EV and hydrogen charging facility, with the latter being fully open to the public.

5.16.5 It is intended that all the footpaths and elevated walkways as well as public facing facilities, including the visitor centre, will be fully compliant with The Equality Act 2010 requirements. Accessible gradients will be provided in all instances where this is practical, otherwise alternative arrangements will be provided.

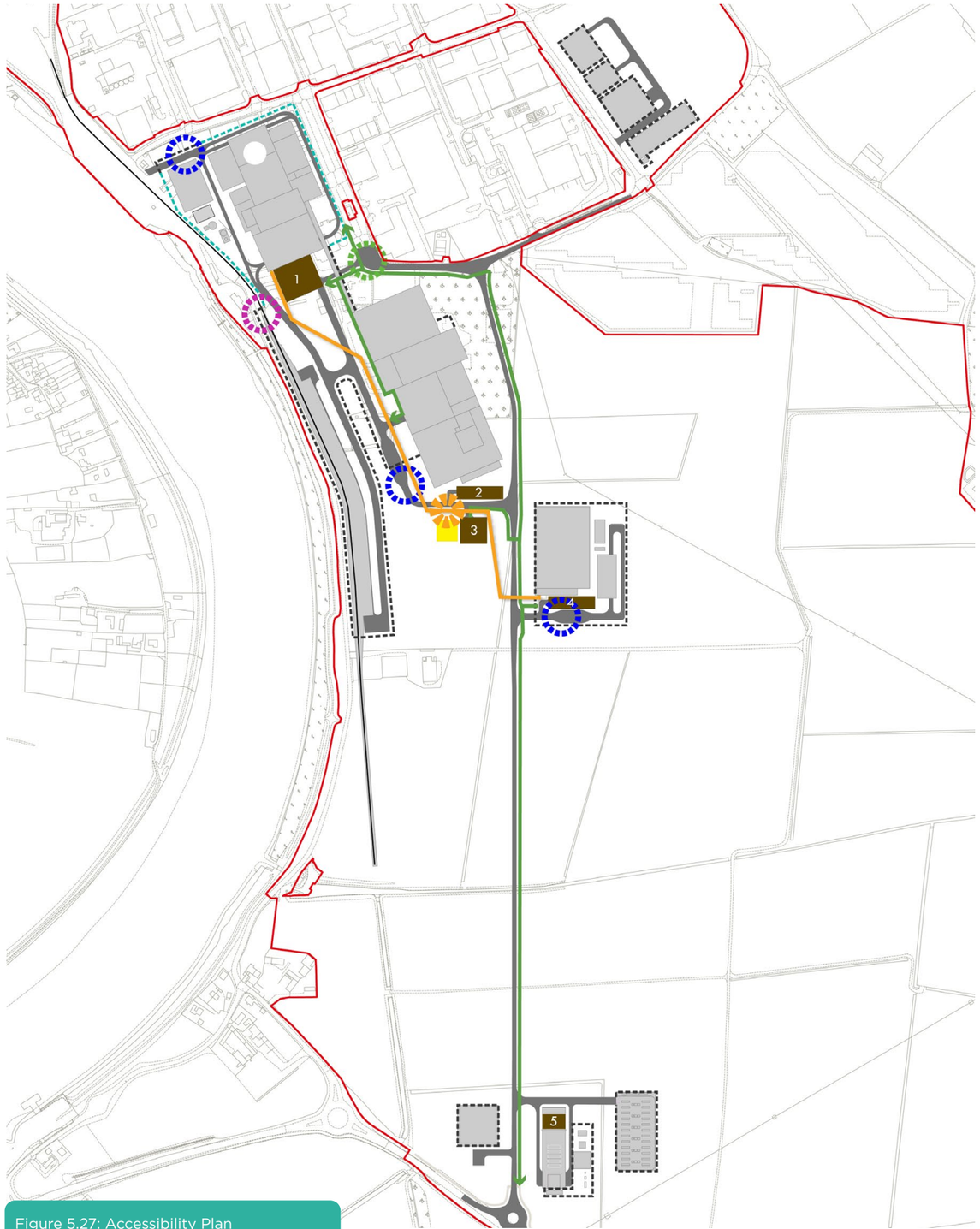


Figure 5.27: Accessibility Plan

Accessibility Plan

Legend

- Visitor centre
- Parking
- Controlled Access to the Elevated Walkway
- Secure access
- Secure access and weighbridge
- Secure rail access
- Pedestrian-cycle route
- Elevated walkway
- Security fence
- Security fence and visual barrier

1	Staff parking
2	Staff parking
3	Visitor parking
4	Staff parking
5	Customer parking

5.17 Landscape Strategy: A Place to Enjoy

5.17.1 As part of the Design Principles and Codes **(Document Reference 5.12),** how the Project interacts with people, landscape, water and biodiversity has been a key consideration in how we have approached the design for the Project. The combination of the Project's location, adjacent to the River Trent, and the existing drainage network provides a unique opportunity to integrate the existing features, along with infrastructure required to support the Project, and deliver a new wetland landscape as part of mitigation.

5.17.2 The introduction of large new buildings into open landscape, and new linear infrastructure (new access road) requires consideration and introduction of associated landscape features for integration of the Project into its context. Understanding of existing built clusters (farms) within the landscape, albeit the Project consists of larger scale development, has influenced the design response although it is recognised that the new landscape cannot completely echo the past approach. The new landscape features are a coherent arrangement of appropriately scaled landscape design measures that aim to provide an appropriate setting in the vicinity of the new development at human and building scale. In the wider landscape the new landscape features provide a framework of landscape structure in an otherwise quite open setting to help integrate the new infrastructure and buildings whilst ensuring long open views that are typical of the area are conserved and retained.

5.17.3 Existing structural landscape should be retained wherever possible and extensive new areas of planting are proposed, underpinned by a detailed understanding of local landscape character and views/ visual amenity, so that mitigation is embedded into the Project wherever possible to avoid and reduce adverse landscape and visual impacts where they may arise. A collaborative approach has been taken to ensure landscape proposals are capable of delivering wider green infrastructure benefits, for example screening in the form of woodland form part of connective habitats and provide an appropriate setting to new and existing rights of way. The vision for the wetland landscape is to promote health, wellbeing, education for local communities and staff (via the elevated walkway) by incorporating a number of features that facilitate physical activity, play, learning and relaxation through improved access to quality open space and increased contact with nature, as an intrinsic part of the Project.

5.17.4 The wetland landscape is intended to provide new ecologically diverse habitats, including reeds, rushes, lowland meadows and wet woodland. It should be designed to create opportunities for protected and notable species including amphibians, birds, bats, water vole otter, other small animals and invertebrates. Alongside providing an environment that benefits health, well being and biodiversity, it is intended to also manage surface water drainage from the Site through a series of sustainable measures such as swales and attenuation ponds. This sustainable drainage system should be the backbone of the wetland landscape, providing a variety of features including ponds, swales and ditches, planted and managed to improve the quality of surface water run off, and a mosaic of habitat types capable of supporting a wide range of ecological species. The existing ditches should be retained where possible and the Lysaght's Drain enhanced, improving ecological connectivity between the Phoenix Parkway LNR and the River Trent.

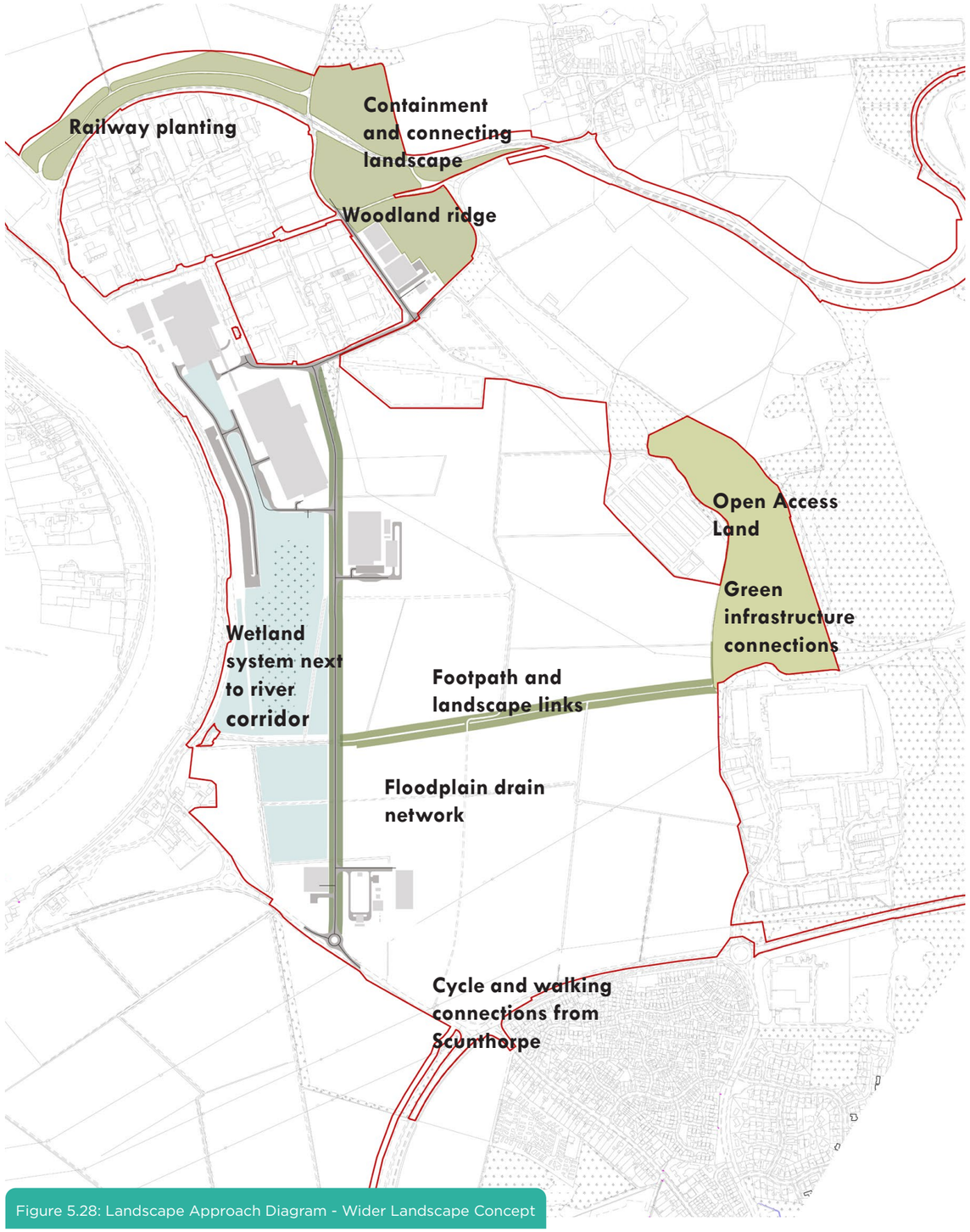


Figure 5.28: Landscape Approach Diagram - Wider Landscape Concept

5.17.5 There are two areas of potential woodland planting proposed to the north and east of Flixborough Industrial Estate. The proposed woodland planting would be a continuation of Burton Wood, along the Lincoln Edge, connecting through to an existing pocket of woodland to the north of the solar farm south of Stather Road. The proposed woodland would strengthen habitat connectivity between Burton Wood and Atkinson Warren and help mark the transition between the Lincolnshire Edge situated on the higher ground and the Trent Levels. Woodland planting is also proposed along the railway corridor to the north of Flixborough Industrial Estate, which would create a natural edge to the industrial estate and provide improved ecological connectivity between the River Trent, railway corridor and Burton Wood. The selection of species and approach to landscape design should reflect local landscape character to help assimilate the development into the local context using species that offer opportunities to support and provide a food source for a wide range of ecological species.

5.17.6 Consideration of the community impacts, from the perspective of local residents' access to public rights of way, has played a central role in the development of the proposals. The Project is intended to maximise accessibility and permeability through the use of new and well-placed routes. The existing PRoW that pass through the Application Land will be retained (save, where there may be a temporary diversion or closure of the PRoW) and complemented by a series of new paths that provide additional walking and cycling routes for the local communities. A new segregated foot and cycle way will connect Scunthorpe with Neap House and the Flixborough Industrial Estate providing a new and safer route for those currently using Ferry Road West and Stather Road for either recreational or commuting journeys. A new path connecting the area of Open Access Land, north of the Skippingdale Industrial Park, with the River Trent will pass through the wetland landscape, creating a new 6.5km circular walking route on the northern edge of Scunthorpe, allowing people to experience the wetland landscape and reconnect with the River Trent. A further path will be provided to the south of the minerals railway, connecting the two existing footpaths (FP/FLIX/177 and FP/FLIX/178), creating a new 1.6km circular route on the southern edge of Flixborough village. A third short section of path will connect the footpath(FP175) that runs adjacent to Willow Holt with the Bridleway (FP304) that passes under the minerals railway and connects up to Burton upon Stather, so that users can avoid having to walk along the Stather Road.

5.17.7 These new connections will be set within proposed woodland planting, wetland landscape, or other landscape providing a variety of different experiences, with places to stop and relax as well as educational/ interpretation opportunities along the routes.

5.17.8 The combination of proposed community, landscape, ecology, and drainage mitigation and enhancements is intended to deliver biodiversity net gain as an intrinsic part of the Project. The proposed habitats should be designed to provide additional benefits beyond delivering net gain and may for example provide habitat for protected or rare species or extend the habitat available for locally significant species.

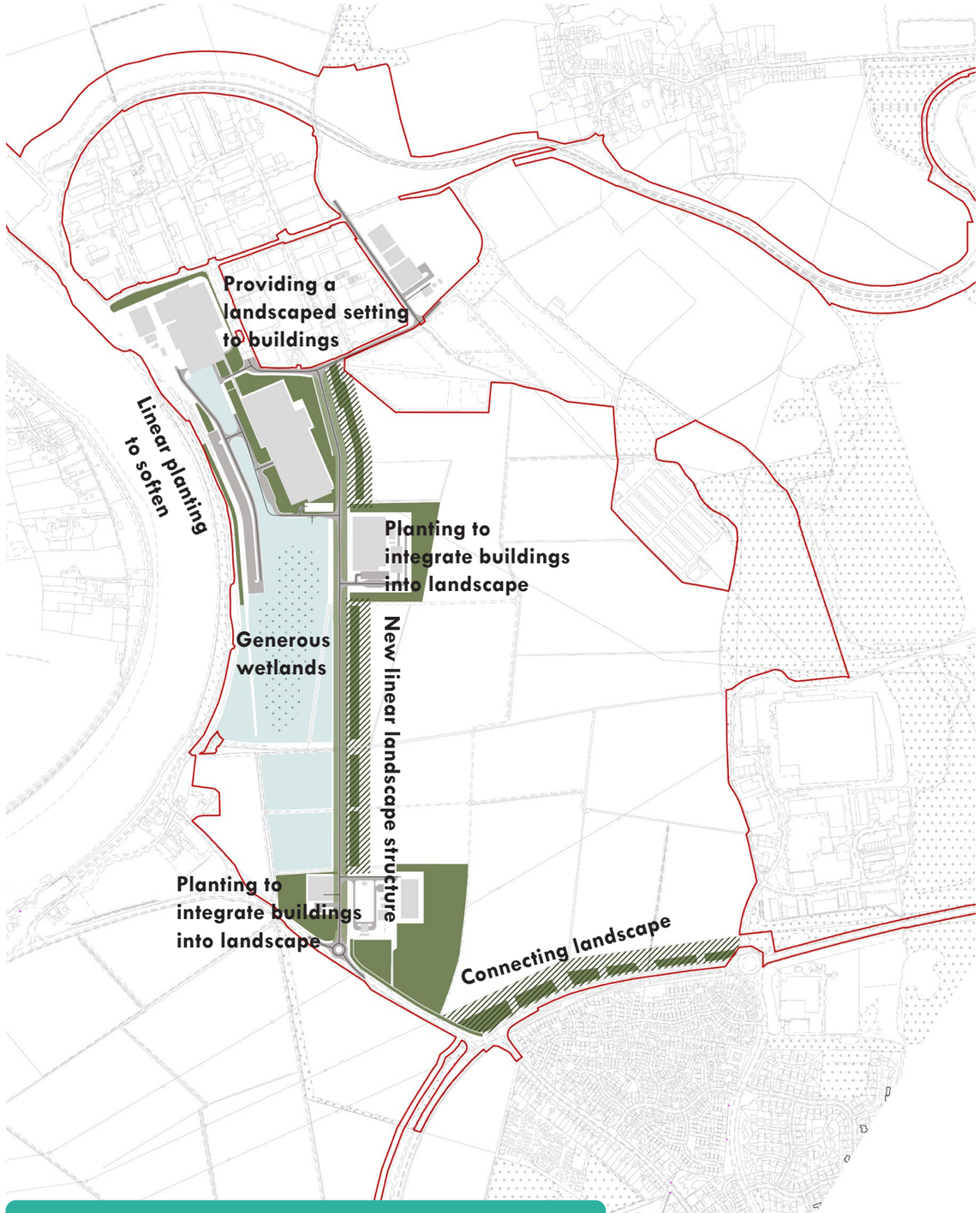


Figure 5.29: Landscape Approach Diagram - Curtilage Landscape Concept

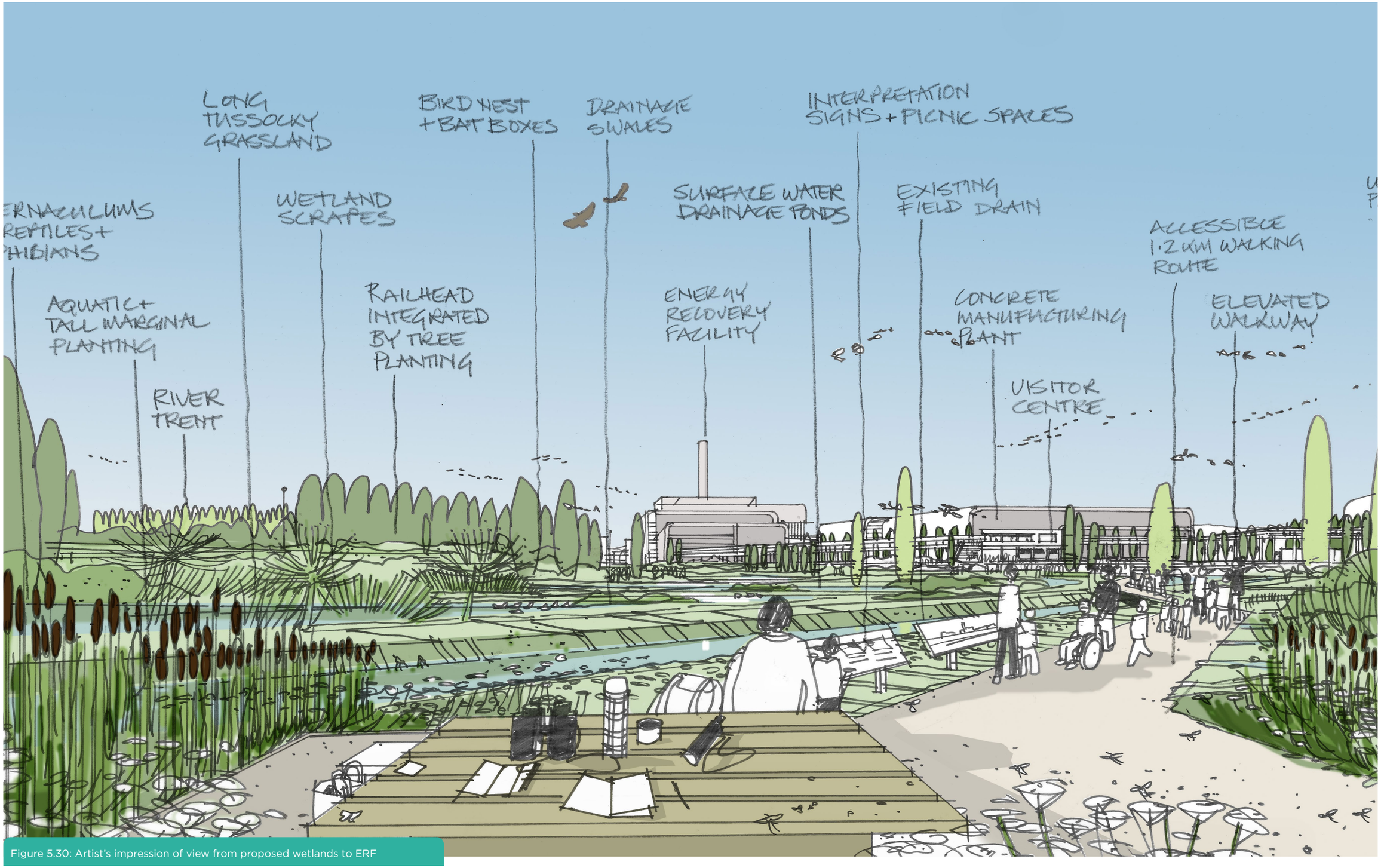


Figure 5.30: Artist's impression of view from proposed wetlands to ERF

Landscape Typologies

5.17.9 The following section visually describes the pallet of interventions/approaches for landscape treatment within the Project.

5.17.10 The axonometric views are intended to provide an indication of the character presented in the landscape design, noting that the detail will vary across locations throughout the Application Land and be refined based on their specific needs/spatial requirements.

Replanted Ancient Woodland at Burton upon Stather

Wider Landscape Context

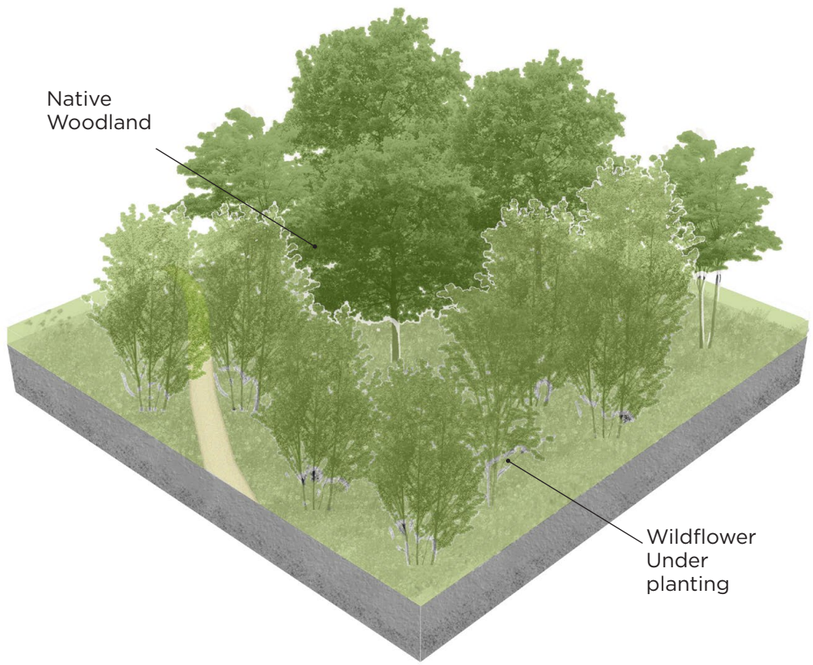
5.17.11 The wider landscape context concerns the setting of the Project surrounding the proposed built development. It is important to the success of the Project to provide visual mitigation and biodiversity improvements to benefit the wider area.

5.17.12 The aim of these varied landscape approaches is to deliver meaningful landscape and biodiversity benefits, delivering rich interventions that are appropriate to local landscape character.

5.17.13 Through reinforcing the existing landscape character of the 'steep wooded scarp', the approach will extend the semi natural woodland through the escarpment to provide additional tree planting where this is most appropriate.

5.17.14 Increasing tree planting would positively contribute to the North Lincolnshire Tree Planting Pledge.

5.17.15 In the lower lands of the wider landscape, the approach is centred on protecting and enhancing the existing open access land for existing and future users. This is achieved through the outline Landscape and Biodiversity Management and Maintenance Plan (oLBMMP) (**Document Reference 5.7**)



Illustrative excerpt and axonometric of wider landscape typology

Curtilage Landscape

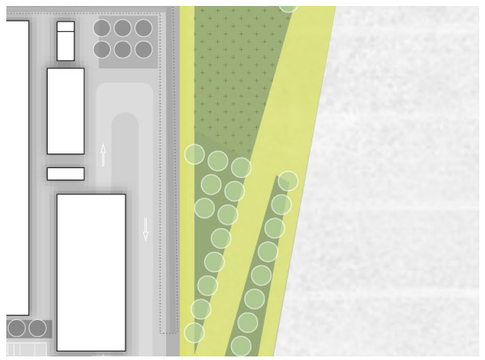
5.17.16 The curtilage landscape typology describes the landscape treatment to the proposed buildings within the Project.

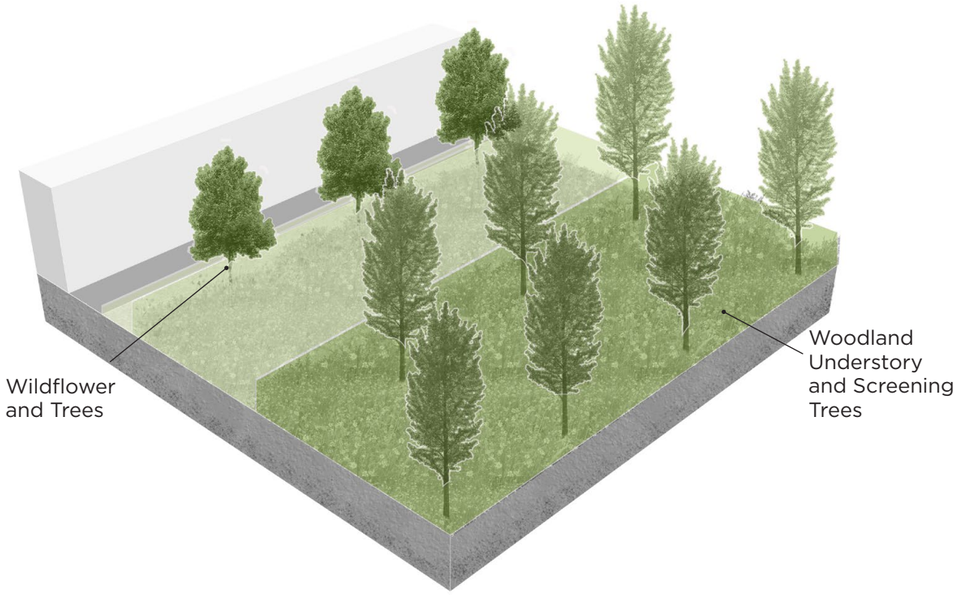
5.17.17 The typology aims to provide a landscape setting to new development and anchor the buildings within the landscape. The landscape seeks to soften edges and impact whilst maintaining an openness and outward looking spirit to new development.

5.17.18 Blocks of native tree planting set in organised grids is intended to offer mitigation of visual effects of built development.

5.17.19 Tree species should be selected to provide seasonal interest to users and increased habitats for a range of species and alongside areas of native hedges (single species and mixed species) would add a formalised edge where needed and support species corridors identified through the ecology study and strategy.

5.17.20 A diverse understory of appropriate species reinforces ingrained biodiversity improvements and marries with the intention to create beautiful landscape settings which are of benefit to all.





Illustrative excerpt and axonometric of curtilage landscape typology

Road Corridor Landscape

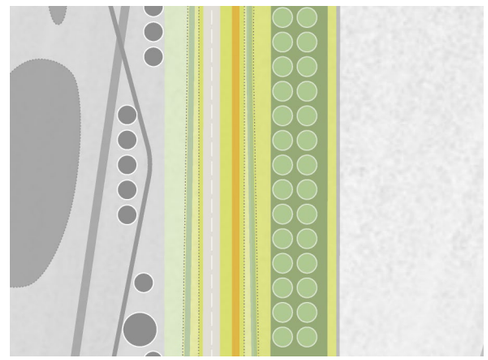
5.17.21 The Road Corridor Landscape approach concerns the landscape treatment to the proposed access road.

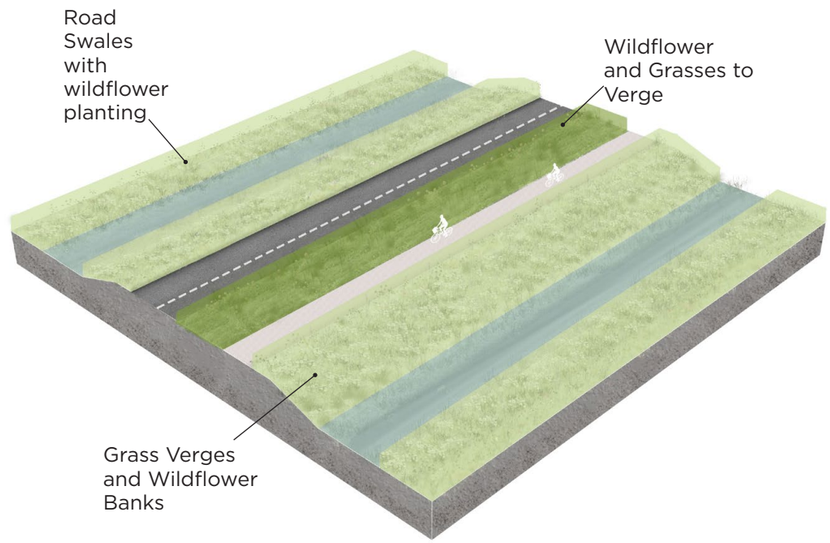
5.17.22 The landscape approach seeks to provide a pleasant and safe environment for people using the new access road by motor vehicle, bicycle or on foot.

5.17.23 The planting is intended to introduce a positive landscape structure to the corridor. This is provided through the creation of a landscaped edge to the development containing intermittent blocks of native tree plantings in organised grid forms to help filter views from Scunthorpe and Flixborough Village.

5.17.24 Diverse underplanting of grasses and wildflowers would provide a range of valuable habitats and seasonal interest.

5.17.25 A generous, richly planted verge to the edge of the pedestrian cycle path provides many benefits including the strengthening of the biodiversity corridor, positive placemaking and protection to cyclists and pedestrians to enjoy their journey.





Illustrative excerpt and axonometric of access road typology

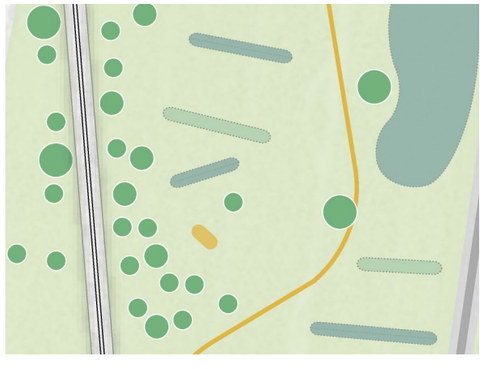
Wetland Landscape

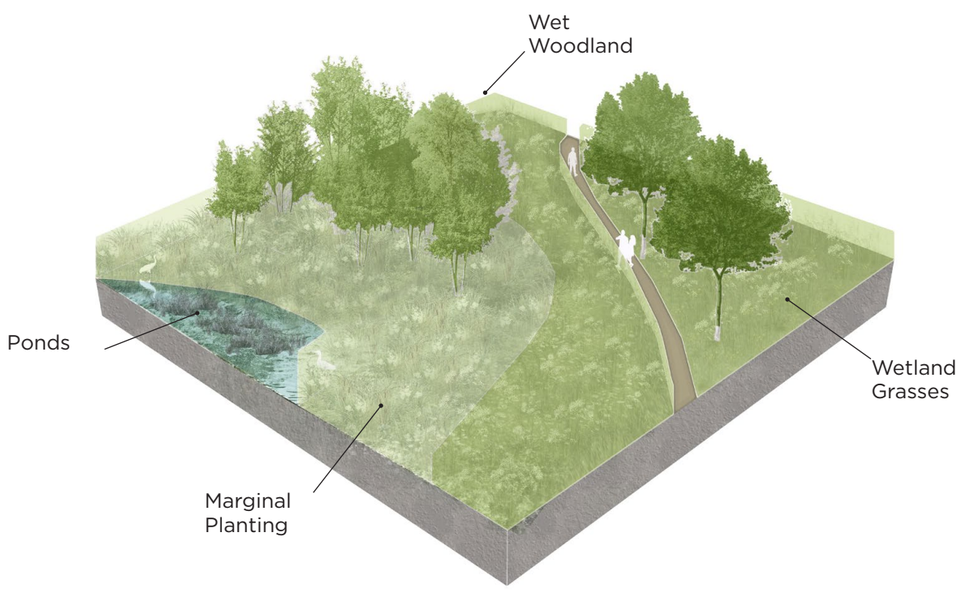
5.17.26 The Wetland Landscape typology responds to the river edge location and the low-lying character of the Energy Park Land.

5.17.27 It seeks to provide a wetland landscape that combines surface water attenuation, habitat creation and amenity landscape.

5.17.28 The landscape is formed through larger wetland ponds of permeant and ephemeral water, and land scrapes with native wetland species including rushes, sedges and marginal grasses.

5.17.29 Interpretation signage, picnics spots and benches further improve the placemaking value of the Wetland Landscape.





Illustrative excerpt and axonometric of wetland landscape typology

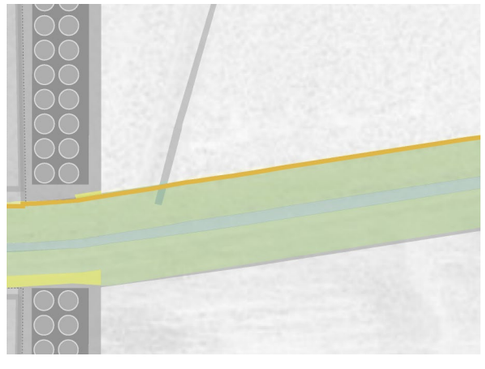
Connecting Landscape

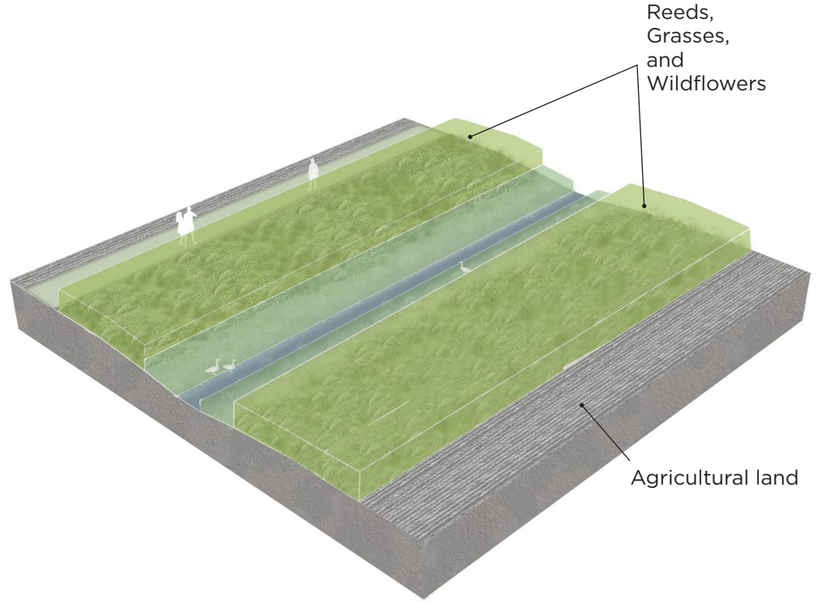
5.17.30 The Connecting Landscape typology centres on the environmental connectivity of the Project.

5.17.31 The approach should provide new and enhanced connections within the development through to the wider landscape, unlocking and connecting footpath networks.

5.17.32 An ecological regimen to reinforce and repair ecological corridors (existing railway line, drainage ditches) is intended to provide improved habitats for wildlife and naturalise the engineered elements of the Energy Park Land and development. With wildflower and grassland planting mixes chosen to create/enhance habitats to benefit species movement through green corridors.

5.17.33 Pedestrian and cycle connections will be constructed in materials appropriate to their setting, including adoptable cycle/ pedestrian path finishes to the main access road, bound gravel, timber boardwalks (to certain areas of wetland) and mown grass paths.





Illustrative excerpt and axonometric of connecting landscape typology

5.18 Ecology Strategy

5.18.1 The Ecological approach to the Project is to respect, restore and promote the rich biodiversity and ecology of local terrestrial ecosystems which is set out in the Design Principles and Codes (**Document Reference 5.12**).

5.18.2 The Project area and surrounding landscape support a range of ecological receptors, comprising designated sites, habitats, and protected species. Arable land characterises the Application Land, with frequent ditches and field margins, alongside occasional pockets of scrub, hedgerows, and grassland. Surveys have confirmed the presence of water vole, badger, reptiles, and great crested newts. An array of breeding and overwintering birds includes species associated with the Humber Estuary Ramsar, Special Area of Conservation (SAC) and Special Protection Area (SPA) statutory sites.

5.18.3 The Project is sympathetic in its approach to sustaining ecological interests and aims to preserve, enhance and create well-connected habitats that achieve a 10% net-gain for biodiversity.

Habitat Creation

5.18.4 Proposed habitat creation falls within three main categories: the provision of a large area of wetland immediately west of the new access road; extensive woodland planting to the north of Flixborough Industrial Estate; and abundant soft landscaping within the Project.

5.18.5 The proposed wetlands could provide 17 ha of new habitat, comprising attenuation and wildlife ponds, wet woodland, reedbeds and lowland floodplain meadows. The area will aim to achieving a diverse mosaic of habitats capable of supporting water vole, great crested newts and an array of wetland birds.

5.18.6 To the north of the Energy Park, woodland planting covering 16.5 ha would comprise native broadleaved tree communities. Both species and structural diversity would be prioritised in the future management of these areas, ensuring they establish into natural woodlands with glades, well developed edge habitats and a varied shrub layer.

5.18.7 In addition to these strategic landscape interventions, the buildings and the new access road have been set within extensive areas of landscape, totalling 20ha, which would provide multi-functional benefits for the visitors, staff, local communities, biodiversity and the environment. Woodland and scrub planting is paired with the creation of species-rich grassland and the establishment of new linear features in the form of hedgerows and ditches. The creation and management of these habitats will ensure they promote native biodiversity. Further details are set out within the oLBMMP (**Document Reference 5.7**).

Enhancement and Connectivity

5.18.8 A key enhancement area comprises the mosaic of habitats within the east extents of the Energy Park Land. Control measures to reduce the abundance of bracken would open up this area and promote the establishment of lowland acidic grassland. Other habitats subject to enhancement include ponds, reedbeds, scrub and perimeter ditches.

5.18.9 Biodiversity enhancements would also connect areas of natural habitat through the creation of corridors along ditches extending east from the Energy Park. Improving the condition of ditches through limiting agricultural run-off, improving water quality and implementing marginal and aquatic planting will increase their suitability for water vole.

5.18.10 Enhancement is also proposed along the Railway reinstatement land. Certain areas support calcareous grassland including orchid species. Enhancement and creation of further calcareous grassland would be achieved through scrub control, seeding and translocation of notable plant species.

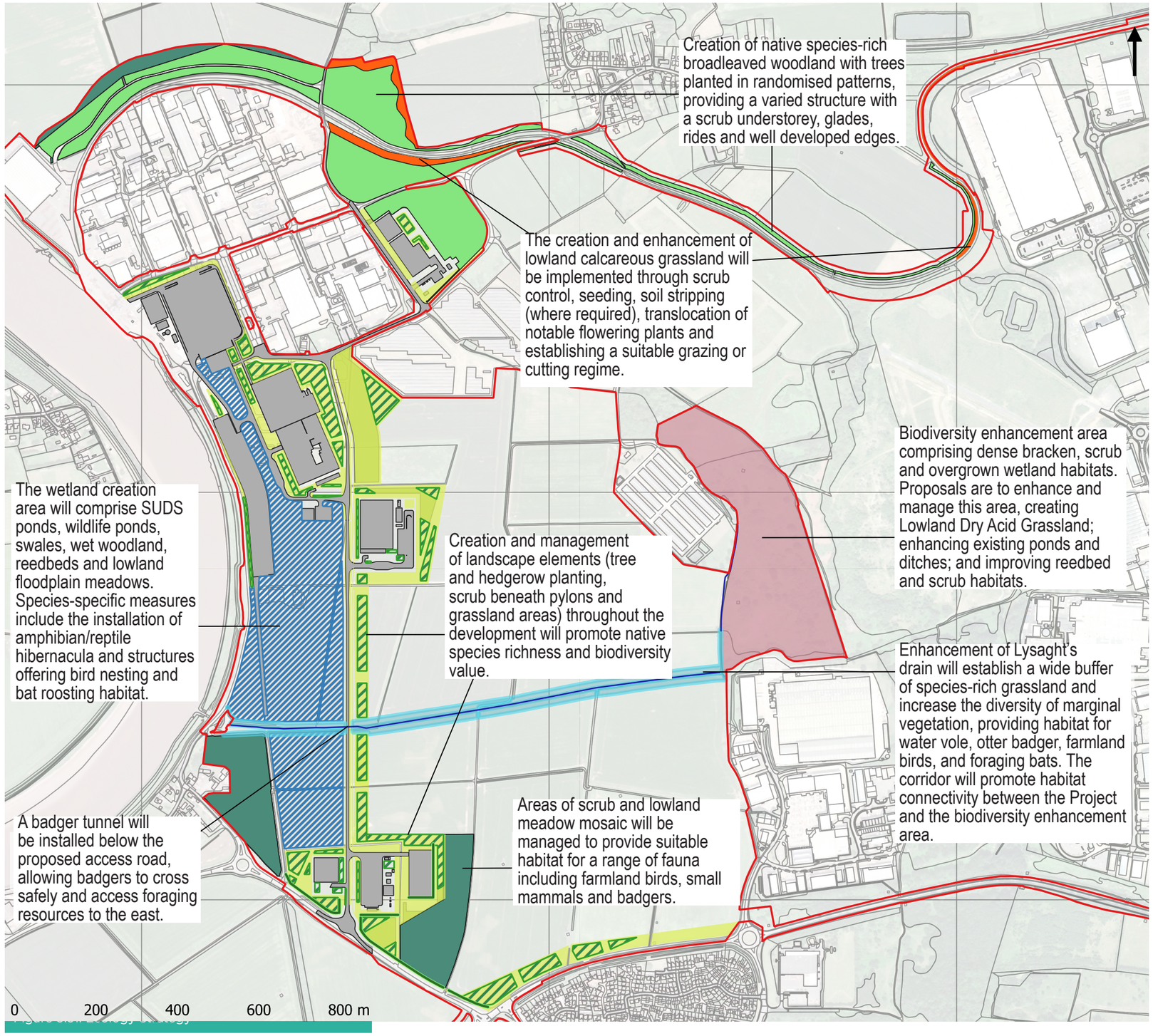
5.18.11 Overall, the Project seeks to minimise ecological impacts and achieve a 10% net gain in biodiversity, as demonstrated by the DEFRA Metric 3.0 calculations. The creation of large areas of new and enhanced habitats, together with improving habitat connectivity, is anticipated to significantly benefit biodiversity.

Mitigation Hierarchy

5.18.12 A key element of the ecology strategy is adhering to the mitigation hierarchy, aiming first to avoid ecological impacts through masterplanning, the design process and proposed construction methods. Where impacts are unavoidable, mitigation measures will be implemented to reduce the scale and severity of impacts, in line with a Code of Construction Practice (**Document Reference. 6.3.7**).

5.18.13 Updated ecological monitoring of key receptors, notably mobile protected species, will continue to inform the development in advance of construction and during each phase of works. A Construction Environmental Management Plan will dictate appropriate timing of activities, pre-works ecological surveys and careful working methods adhering to best practice guidelines. Where necessary, Natural England licences will be sought for direct impacts to protected species.

5.18.14 The provision of compensatory habitats and their ongoing management is intended to offset impacts arising from habitat loss and ensure that protected species are successfully accommodated within the Application Land and surrounding area.



Ecology Strategy Plan

Legend

- DCO Limits
- Proposed wetland creation
- Proposed green infrastructure and landscaping
- Proposed ecological enhancement area
- Proposed woodland creation
- Proposed Lowland calcareous grassland enhancement
- Proposed formal tree planting
- Proposed mixed scrub/lowland meadow mosaic
- Poposed Wildlife corridor
- Proposed hedgerows
- Enhanced ditches

5.19 Flood and Drainage Strategy

5.19.1 The Energy Park Land is divided into 10 drainage catchments as there are several existing ditches crossing the Energy Park Land. 10 detention basins and 1 storage tank are shown on Figure 5.31. The surface water drainage strategy has been designed to promote biodiversity, treat water quality and attenuate stormwater before being discharged into the existing ditches.

5.19.2 The surface water drainage system will consist of a series attenuation ponds, swales and ditches, all of which will be designed to support a mosaic of wetland landscape habitats that support ecological enhancements. Where possible, swales will be used to convey runoff instead of pipes and attenuation basins will be used for storage instead of tanks where possible. The attenuation basins will feature a control mechanism to regulate the surface water discharge rates into the existing watercourses so that discharge rates are no greater than the existing run off rates.

5.19.3 The surface water drainage system has been designed to store the 1 in 100-year storm event plus a 40% allowance for climate change.

5.19.4 The reinstatement of the railway will require the repairing and replacement of the existing surface water drainage system, where required.

5.19.5 More information on the drainage strategy, including the discharge for each catchment and attenuation volumes required are available in the Indicative Drainage Strategy (**Document Reference. 6.3.5**).

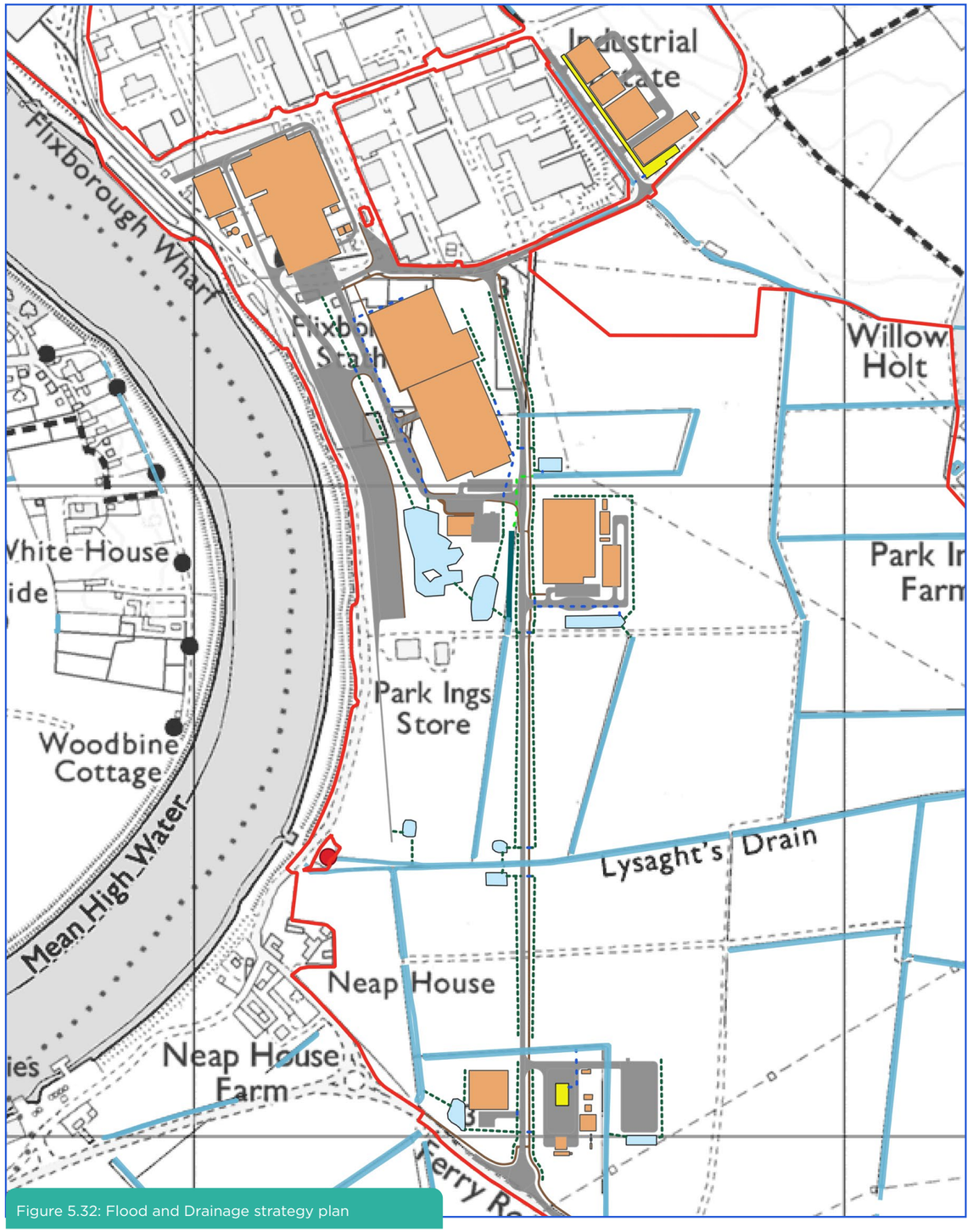


Figure 5.32: Flood and Drainage strategy plan

Flood and Drainage strategy plan

Legend

- Proposed road and hardstanding
- Proposed buildings
- Proposed footpath/cyclepath
- Proposed detention basin
- Proposed storage tank
- Proposed swale route
- Proposed drainage pipe
- Existing ditch
- Proposed pipe diverted ditch
- Proposed diverted ditch
- Existing pumping station

Existing drainage ditch network

5.20 Architectural Design Approach

5.20.1 From the outset it has been recognised that due to the scale and the setting of the Project it would be important for it to be designed in such a way as to best minimise its visual, lighting and noise impacts. Nevertheless, it was also clear that the ERF component would appear as a large building in the landscape, and while giving due consideration to its surroundings and context, it was considered that in its design it should also make a positive and confident architectural statement, one which could be repeated across the Project to establish a visually related 'family of buildings'.

5.20.2 The Project principles have been applied to the development of the proposed indicative design as follows:

- Optimising and minimising the building footprints;
- Minimising where possible the individual building sizes (heights and volumes);
- Minimising the scale of the largest buildings by in principle adopting a 'form follows function' design approach that avoided more 'sculptural' designs which would otherwise stray from being volumetrically efficient;
- Establishing a visually related 'family of buildings' for the Project by adopting the same architectural design approach across all of its principle buildings;
- Repeating a limited palette of materials and colours across the Project to further reinforce it as a 'family of buildings';
- Minimising the extent of external plant and equipment and where required minimising their visual impact by careful consideration of proposed perimeter boundary treatments; and
- Minimising lighting impacts on nearby sensitive receptors.

5.20.3 The indicative design of the buildings has been developed to best respond to the constraints and opportunities offered by their context and to meet the project principles and objectives. It suggests how the future detailed design of the Project might be developed within the defined design parameters and this has informed the Design Codes, which will ensure these design principles are integrated within the detailed design.

5.20.4 The indicative Plans and Elevations (**Document Reference. 4.12 and 4.13**) will provide an indication of how a detailed design developed in line with the Design Principles and Codes (**Document Reference 5.12**) might appear.

5.21 Design Evolution

5.21.1 The development of the indicative design of the buildings has been informed by a number of factors. This has included:

- Working with the constraints and opportunities offered by the site and its surroundings;
- Working within the defined worse case design parameters;
- Meeting the project principles and objectives;
- Ensuring an operationally efficient state of the art Energy Park;
- Optimising connectivity across the Energy Park; and
- Considering how to minimise the development's visual, lighting and noise impacts within its setting.

5.21.2 As part of the evolution of the indicative design a range of alternative architectural design approaches were considered and reviewed in LVIA photomontages from key views in order to test alternative architectural design approaches and colour studies.

5.21.3 Due to its scale and location the initial design studies focussed on the ERF building as minimising its visual impact on nearby Amcotts and Flixborough villages was identified as a key consideration.

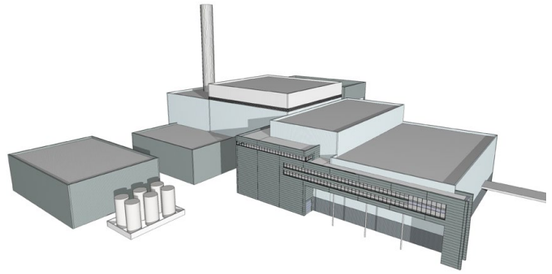
Stage 1

5.21.4 The first stage of the architectural design focussed upon the scale and massing of the ERF building. Having established the likely building heights and footprints required for the main process areas a basic 3D CAD massing model was generated and upon which a range of initial architectural design concepts were developed. These studies tested how strictly the design should adopt a 'form follows function' design approach by clearly expressing the differing heights of its main process volumes such that the building would read as a series of interrelated stepped cubic forms. Other design studies considered if there was any benefit in combining these volumes in whole or in part within larger curved roof forms. In all studies the ERF administration wing fronted the building's western facade facing the River Trent.

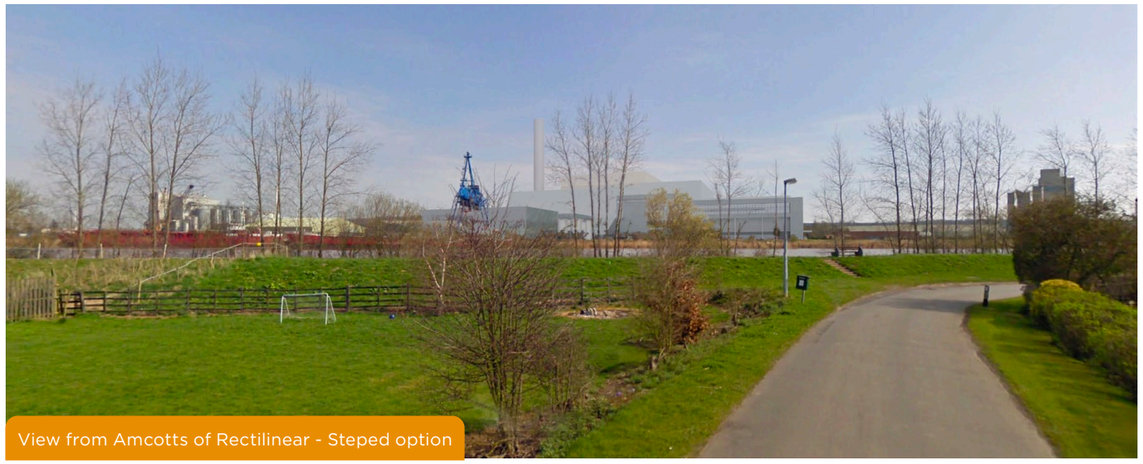
5.21.5 From the wide range of design studies three were shortlisted for further development and tested in a number of draft photomontages from key views. The colour strategy adopted for all of the design concepts was to lighten the upper parts of the building to better blend with a background of sky and darken the lower parts to better blend with the groundscape. The horizontal layering created by the colour differentiation was considered successful in breaking up the overall scale of the building.

1. Rectilinear - Stepped

5.22.6 This concept adopted a strict 'form follows function' design approach and sought to minimise the overall scale of the ERF building by treating its main volumes as a series of volumetrically efficient interlocking / stepped 'rectilinear' forms with flat roofs with perimeter parapets.



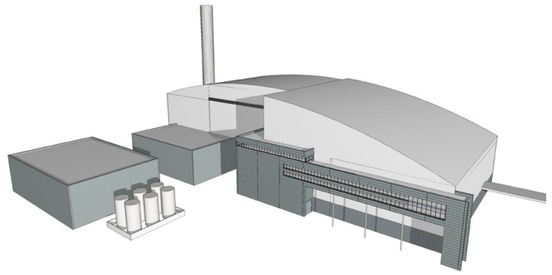
Axonometric view of Rectilinear -Steped option



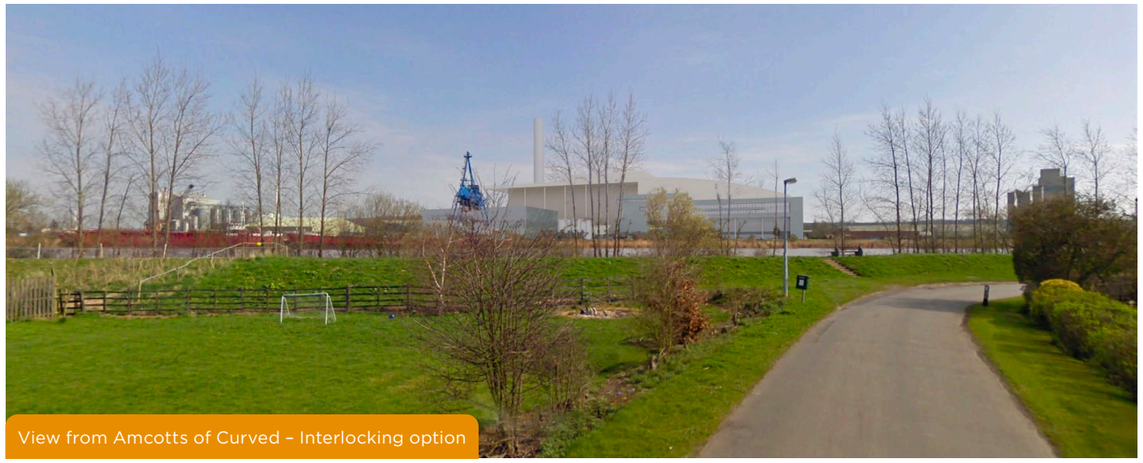
View from Amcotts of Rectilinear - Steped option

2. Curved – Interlocking

5.21.6 This design approach offered a contrast to the rectilinear design approach and grouped the largest process volumes under two curved roof forms which interlocked at their highest parts. The curved roofs design approach sought to soften the appearance of the building, particularly its upper levels.



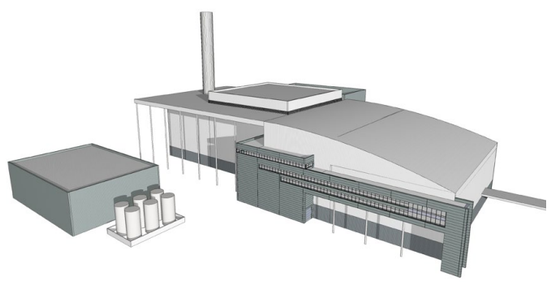
Axonometric view of Curved – Interlocking option



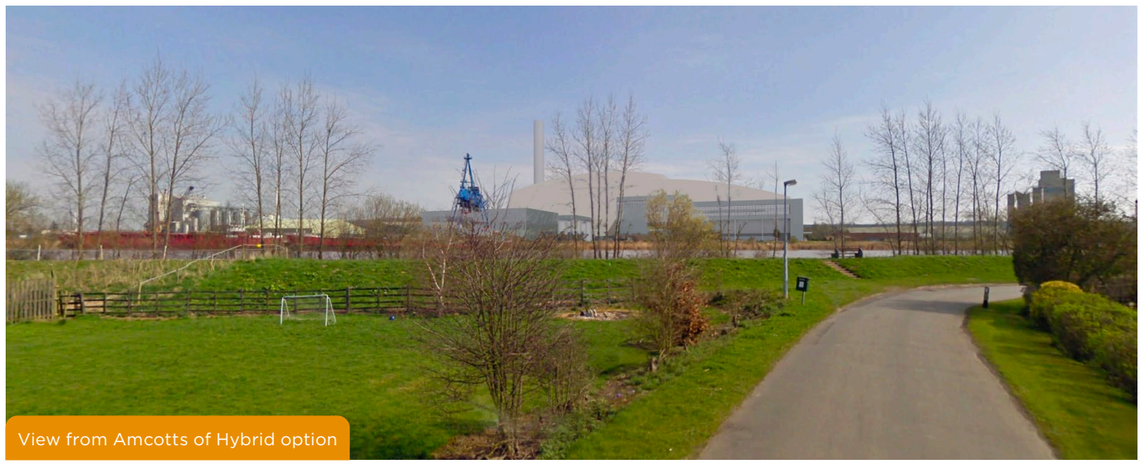
View from Amcotts of Curved – Interlocking option

3. Hybrid – Rectilinear & Curved

5.21.7 This design blended both previous concepts by adopting a rectilinear and volumetrically efficient design for the higher northern half of the building and a curved roof form over the southern half and extending it to overlap the rectilinear volumes with a colonnaded canopy



Axonometric view of Hybrid option



View from Amcotts of Hybrid option

5.21.8 These early studies established that:

- the adopted colour approach helped to minimise the visual impact of the higher parts of the ERF with lighter colour best sky blending the upper parts and darker colours for the base better integrating with the ground colouring;
- the curved roof forms were less successful in minimising the visual massing of the building and in breaking up its overall scale when compared with the stepped design approach;
- consideration should be given to curving the upper parts of the western and eastern facades to visually soften the transition between the building and the sky; and
- the extent of glazing created by locating the administration accommodation on the western side of the ERF would likely generate unwanted night-time illumination when viewed from Amcotts.

View from Flixborough of Rectilinear - Steped option

View from Flixborough of Curved – Interlocking option

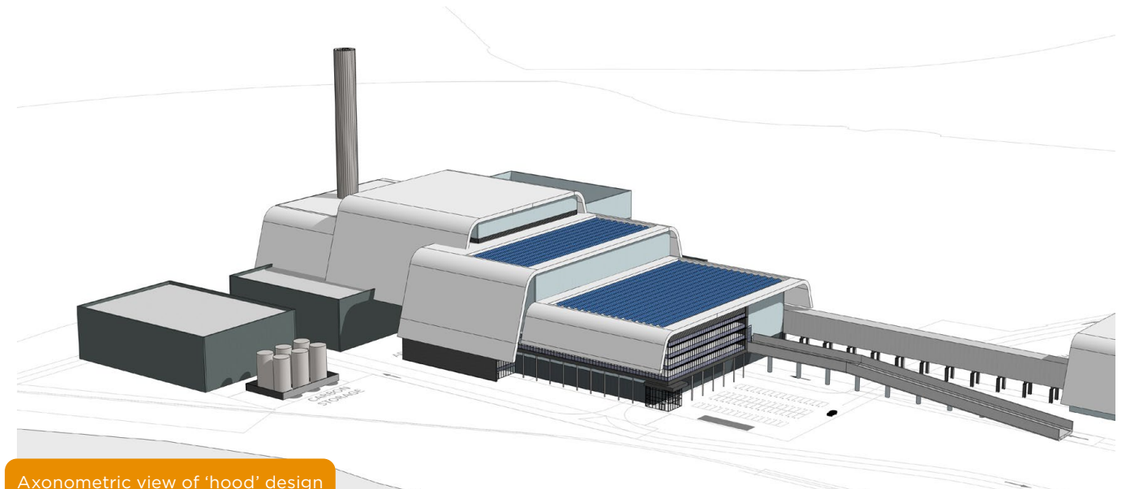
View from Flixborough of Hybrid option

Stage 2

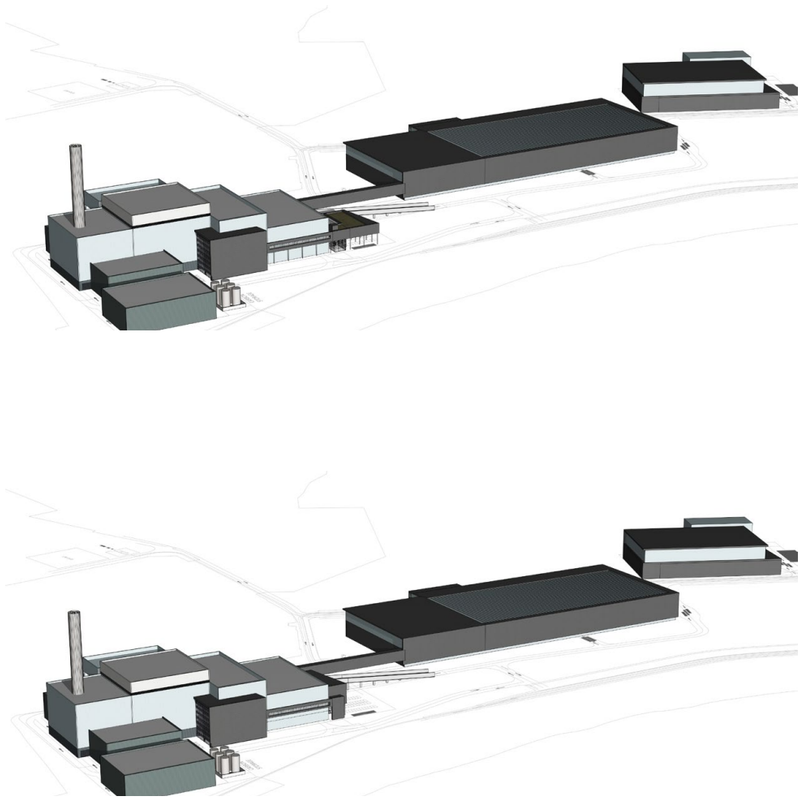
5.21.9 The second stage of design development revisited the floor layout of the ERF to seek to relocate areas of glazing from the western to the southern facades of the building. Further development of the stepped design approach was undertaken and alternative approaches to relocating the administration accommodation were considered. It also explored a further design approach which looked to curve the upper edges of the western and eastern facades to link them with the flats roofs to create 'hoods' over the largest parts of the building, with only the air cooled condensers or air blast chillers remaining rectilinear. The developed design approaches were also repeated across the other main buildings to test if they would be similarly successful on the other building shapes and footprints.

5.21.10 The developed 'hood' design offered several advantages over the 'stepped' design:

- The curving of the upper parts of the facades allowed the building to visually recede at higher level and better blend with the sky colouring;
- The use of lighter roofing material on the upper parts of the building also visually lightened it against the sky and reinforced the break between the upper part and the lower and darker plinth;
- Allowing the steps to vary in width to suit the process volumes of the ERF assisted in fracturing the linear length of the ERF and in so doing break up its scale;
- Oversailing the 'hoods' over the southern and northern facades created recess within which the glazed accommodation could be located and shielded by the 'hoods' from Amcotts;
- Repeating the design approach across the other main buildings proved to be successful and offered the same benefits in minimising the visual impact of those buildings and established a 'family of buildings'; and
- It offered a confident and positive architectural design approach which would also best minimise the visual impact of the Energy Park.



Axonometric view of 'hood' design



Axonometric view of three options considered

Stage 3

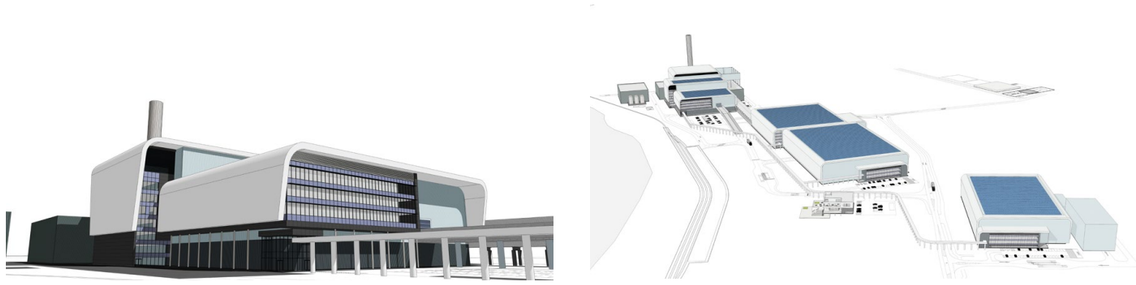
5.21.11 The third stage of design development made further refinements to the 'hood' design on both the ERF and across the other buildings. The major change was reverting to vertical rather than the previously sloped sides in order to reduce the footprints of the buildings and in so doing reduce their overall scale and appearance.

5.21.12 This stage also included developing the architectural design of the visitor centre. Its location south of the CBMF was chosen to ensure that it would relate to the main cluster of Energy Park buildings in the northern half of the Energy Park Land, and to the proposed wetland. It would therefore provide support for visitor experiences of both. It would also be located close to the main access road giving easy access to those travelling by cycle or car. To minimise its footprint upon the proposed wetland area, and to accommodate a wide range of visitor functions, it would be spread across three floors which would include a range of outdoor terraces and connections to ground level.

5.21.13 Another key component of the visitor centre was the elevated pedestrian walkway. Being raised above the roadways this would provide safe access for both visitors and staff to the ERF, CBMF and PRF, and include a canopy to shelter users in inclement weather conditions. Controlled access to the elevated walkway would be via the top floor of the visitor centre.

5.21.14 The elevated walkway also allowed for the inclusion of a vertical climbing structure/ living wall to be established beneath the walkway. The inclusion of this feature helps to further soften and screen the concrete block manufacturing and plastic recycling facility from Amcotts.

5.21.15 Being smaller in scale than the other Energy Park buildings the design of the visitor centre does not incorporate the 'hood' design approach but adopts a more rectilinear design which would express the stacking of the differing levels of internal accommodation and outdoor terraces to cascade it into the surrounding landscape. This rectilinear approach being more 'wall' than 'roof' would also allow the facades to be punctured with the windows and openings required by the internal accommodation which would otherwise be less successful if the 'hood' design was repeated. However, the repeated use of materials would ensure that the visitor centre would still be read as one of a 'family of buildings' and the inclusion of a 'brown' roof would offer biodiversity benefits.



Illustrative views of refined design for NLGEP components

Further view from Amcotts of refined design

Illustrative view of visitor centre

Stage 4

5.21.16 The fourth and final stage of design development included a number of revisions.

5.21.17 The potential arrangement of the ERF's carbon capture equipment had been developed in further detail. This concluded that the western extent of the 'hood' over the northern part of the ERF could be reduced to allow the main vertical process cylinders to be left outside the ERF building. This reduced the overall massing of the ERF particularly when viewed from the north and north west. The LVIA that had been running in parallel with the evolution of the architectural design had identified areas that would benefit from further consideration in order to minimise the visual impact of the development. In response the following design changes were made:

- To further minimise the visual impact of the ERF the upper part of the previous rectilinear form of the ERF's air cooled condensers or air blast chillers and the carbon capture building were changed to include upper curved profiles in the same materials/finishes as that adopted across the remainder of the ERF;
- Further colour studies were explored for the main facades not covered by the 'hoods' to establish if using banded and pixelated colour patterns offered any benefit in further minimising the visual impact of the development. This exercise concluded that the use of muted colours in larger areas would best minimise the visual impact of the buildings.

View from Stather road of of the proposed development

View of Project from North of Flixborough Industrial Estate

View of Project from footpath to the east of the Site

5.22 Architectural Design Concept

5.22.1 Careful consideration has been given in developing the indicative design of Energy Park buildings. By employing a limited palette of high quality materials, and by articulating the architectural elements in both form and colour, a cohesive and striking design has been achieved.

5.22.2 The main buildings are comprised of a series of volumetrically efficient interlocking forms, which are defined by their related but different internal process functions. This minimises the overall volume of each and assists in breaking down the overall scale of the buildings and adds visual interest by fracturing the upper profile of the buildings against the skyline. To further visually soften the appearance of the buildings from key views from Amcotts and Flixborough the tops of the western and eastern facades of the buildings are curved over onto their roofs. This helps to visually blend the upper parts of the buildings with the sky background and also allows the combined profile of the walls and the roof to be projected to form 'hoods' over the south and north elevations which creates a distinctive architectural appearance which being repeated across a number of buildings establishes a 'family of buildings' throughout the Energy Park.

5.22.3 All high level roofs are enclosed behind parapet walls to help visually shield rooftop mounted equipment from view and to ensure safe service access to roof areas for personnel.

5.22.4 In summary the indicative architectural design contains a number of key design features including:

- Recognising that the main buildings would be read on two distinct levels (i.e. the lower level of the building being read against the scale of the adjoining developments within the area, while the upper level would rise above this and be more visually prominent from nearby and distant views) led to the lower levels of the buildings being treated as an operational 'plinth' upon which the contrasting upper architectural 'hood' forms would sit;
- Architecturally, the 'cubic' forms of the ERF are expressed as 'hoods'. Each of the 'hoods' are expressed as projecting perimeter frames on the southern and northern facades of the underlying cubic forms and are dressed down their east and west facades. In colour and texture, they contrast with the dark coloured flat cladding of the plinth, adding visual interest and dynamism to the overall appearance. The lighter colour of the 'hoods' would assist in minimising its visual impact by blending the upper parts of the building's main facades with the sky. Furthermore, the spacing between the 'hoods' would assist in breaking down the overall linear scale of the main buildings;
- The 'hood' forms and the material and colour palette would be repeated across the larger scale Energy Park buildings to establish a 'family of buildings'; and
- It was established that from key views that including large areas of glazing on western and eastern facing facades would 'darken' the upper parts of the buildings and undermine the ability to colour blend the highest parts of the buildings against the sky. It would also allow internal lighting to create areas of visual brightness on these facades drawing attention to the buildings during the hours of darkness. For these reasons areas of glazing have been focussed on the south and north facing facades of the main buildings, and would be inset within the projecting 'hoods' to further shield the glazing from key views;
- The location of louvres has been carefully controlled and at low level are predominantly located at interfaces between cladding types to minimise their appearance on the facades and match the colour of surrounding cladding. In contrast high level louvres would be focussed on the south and north facing facades of the largest buildings to minimise their occurrence on the lighter coloured west and east facades of the 'hoods' and avoid visually interrupting and darkening the upper areas of cladding; Being smaller in scale the visitor centre would not adopt the 'hood' forms of the main buildings and would be treated as a standalone architectural feature within the Project. In its design the majority of its external terraces and internal accommodation would be raised above the ground level and sit upon a cluster of slender columns which would instil a sense of civic presence for those approaching the visitor centre while at the same incorporating materials and colours similar to that being proposed on the other buildings.
- Elaborate designs for the ERF stack have been rejected as it has a slightly different set of visual and operational issues which influence how its design is approached. It will be the major component read against the sky and will be the only feature seen from many areas. For that reason, the ERF stack would be played down in its form and colour and left as single visually refined 'column' to best minimise its appearance and against a backdrop of sky.
- The scale of the other buildings and external equipment forming the Project are all essentially lower than the main buildings and of varying heights. However where appropriate they will match the architectural design approach and the material and colours employed on the main buildings. By establishing a unified appearance, the Project will read as a 'family of buildings' across the site;
- The upper part of the air cooled condensers or air blast chillers would be clad in the same cladding as the upper parts of the ERF building. This ensures they are visually refined and in keeping with its overall design approach.

5.22.5 The overall indicative design approached is well considered and visually refined and has taken the principle of a 'form follows function' design approach and uplifted it to offer a dynamic architectural design.

Computer Generated view along Stather Road towards ERF

Computer Generated view towards Visitor Centre

5.23 Materials

5.23.1 A range of materials, textures and colours have been fully considered in the development of the indicative design and would be based upon a limited palette of high quality materials across the Project to ensure that a family of buildings is established through out the Energy Park.

5.23.2 Not surprisingly for a development of this nature, metal cladding is suggested as the predominant cladding material to be used across the Energy Park. The suggested cladding systems are robust and of low maintenance and their durability (i.e. colour retention and corrosion resistance) will ensure that the high quality appearance of the Energy Park will be retained over time.

5.23.3 The metal cladding systems being proposed would include horizontally orientated insulated composite steel cladding, and vertically orientated aluminium standing seam cladding. All will be in contrasting but complementary colours and create a visually striking, durable and low maintenance building.

5.23.4 The location of glazing and louvres on the buildings has been carefully considered to be in keeping with overall design approach, and louvres within areas of cladding will be coloured to match that surrounding.

5.23.5 The majority of roofs will be 'flat' and finished in single ply roofing membrane or low pitched metal roofing particularly where Photovoltaic (PV) solar panels could be installed. The exception to this would be the visitor centre which would include a series of paved or timber outdoor terraces and a planted 'brown' roof. All roofs, with the exception of the gatehouse and the re-fuelling buildings will include wall parapets around their perimeter. As well as providing safe and permanent perimeter guarding for service personnel accessing the building's roof plates, the parapets will assist in visually screening less prominent roof mounted equipment and access hatches etc.

5.24 Colour

5.24.1 Using the final indicative architectural design, a series of colour studies were undertaken to fine tune the potential colour selection for the main areas of building cladding. These studies took the colour principles concluded during the design development stage i.e. lighter upper areas and darker lower areas for the main buildings, and tested alternatives in the selected views.

5.24.2 The first consideration was whether large areas of single colours would be more successful than adopting more visually pixelated colour patterns. It was concluded that breaking the areas of wall cladding into smaller more fractured patterns would draw more attention to these areas of cladding, and to achieve this patterning darker colours would have to be used which at high level would be more visually prominent against the background and the sky when compared with using a single consistent lighter cladding colour. It was also recognised that at lower levels the buildings facades would be seen as a backdrop to the foreground landscape and the proposed planting. As such the use of a single colour for the cladding would provide a more visually recessive year round backdrop for the planting which might otherwise be dominated by a pixelated backdrop of varied colours.

5.24.3 Having established the benefits of using large areas of single coloured cladding a series of studies then explored which colour might best blend the upper areas of wall cladding with the sky while at the same time offering contrast with the light coloured finish of the roof 'hoods'. The studies also explored alternatives colours for the plinth and how dark these might be to best blend it with the surrounding landscape. A range of blues, green and grey cladding studies were completed and these established a clear preference for a light blue/grey colour for upper parts and a contrasting darker blue/grey colour for the plinths.

5.24.4 A light grey colour for the ERF stack windshield proved to be the optimum colour for best blending it with the sky and minimising its visual impact.

5.25 Lighting

5.25.1 The River Trent, the potential location of badger setts and the residential area Amcotts, are identified as the three main sensitive environmental and human receptors, which could be impacted by the Project. The lighting strategy with suitable applications and mitigation measures would ensure these areas are not adversely affected.

5.25.2 The strategy includes for consideration of intensity of light sources, mounting, height and shielding as well as provision of integrated and external shielding.

5.25.3 The illumination of the wharf, railway and railhead has been designed with specific lighting treatments to avoid undue light spill onto the River Trent. The lighting requirements for the wharf loading crane is designed to avoid direct visibility of high intensity light sources from the Amcotts residential properties.

5.25.4 Considerations for the preservation of the existing ecology are also addressed and identified with the Indicative Lighting Strategy (**Document Reference 6.3.4**). Suitable measures are provided to ensure that ecologically sensitive areas as well as proposed new habitats within the Site are to be preserved and enhanced to promote wildlife connectivity.

5.25.5 The Project would have an impact on existing rural areas that are currently unilluminated during the hours of darkness, due to the introduction of lighting within these areas for operational purposes and those of health and safety. The Indicative Lighting Strategy (**Document Reference 6.3.4**) sets out the requirements for compliance with the relevant regulations, recommendations and adaptation of best practice, ensure that the artificial lighting for the Project would not constitute or be a cause of nuisance or detrimental effect on health and safety of residents within areas affected by the changes.

Standing seam cladding ©Thomas Graham_Arup

Gabion wall

Plinth metal cladding

Computer generated view towards ERF

6.0 Indicative Phasing Strategy

6.1 Phasing

6.1.1 This section sets out an indicative phasing strategy for the delivery of the Project. It is intended that the Project will be delivered in six phases and will take approximately six years to construct. It is anticipated that construction will commence in year one following the grant of DCO and the ERF will commence operation in year four, with all of the other elements of the Project fully operational by year six. Each phase (which overlap) is described in more detail below.

Phase 1

6.1.2 Phase 1 will include the ground preparation contract in parallel with the clearance and preparation of the main construction compound. It will establish key facilities and infrastructure for construction of the ERF and associated development. The works will include:

- Relocation of RMS ports to the northern part of their site ownership and establish their main access from First Avenue
- Undertake any outstanding archeological investigations.
- Establish main and secondary contractors compounds, including car park, earthworks and construction welfare facility.
- Commence site clearance and demolition work for ERF.
- Establish Dragonby Sidings construction compound and commence railhead construction upgrade.
- Commence junction construction on B1216 and new access road from B1216 to Stather Road (south to north).
- Commence new sub-station and export cable corridor as well as service diversions.
- Construction of internal access road around RHTF and CBMF.
- Construction of visitor centre.
- Construction of attenuation ponds, swales and realignment of ditches and advance planting and ecology works.
- Clearance of existing vegetation and construction of flooding bund around chicken farm south of Stather Road and across First Avenue.

Phase 2

6.1.3 Phase 2 will focus on the earthworks and build out of the ERF. The works will include:

- New access road adopted.
- Import fill material.
- Pile foundations.
- Construct ground slab/turbine and boiler blocks.
- Construct access ramp.
- Construct superstructure.
- Fit out and commission.
- Construct electrical switchyard
- Construction of CCUS.

Phase 3

6.1.4 Phase 3 will involve the groundworks and construction of the RHTF. The works will include:

- Clear site for bottom ash and flue gas residue handling and treatment facility.
- Import fill material.
- Pile foundations.
- Construct ground slab.
- Construct superstructure.
- Fit out and commission.

Phase 4

6.1.5 Phase 4 will focus on the earthworks and build out of an EV and hydrogen re-fuelling station and battery storage. The works will include:

- Clear site for an EV and hydrogen re-fuelling station , a gas AGI, a hydrogen production and storage facility and battery storage.
- Import fill material.
- Pile foundations.
- Construct ground slab.
- Construct superstructure.
- Fit out and commission
- Construct hydrogen and gas AGI.

Phase 5

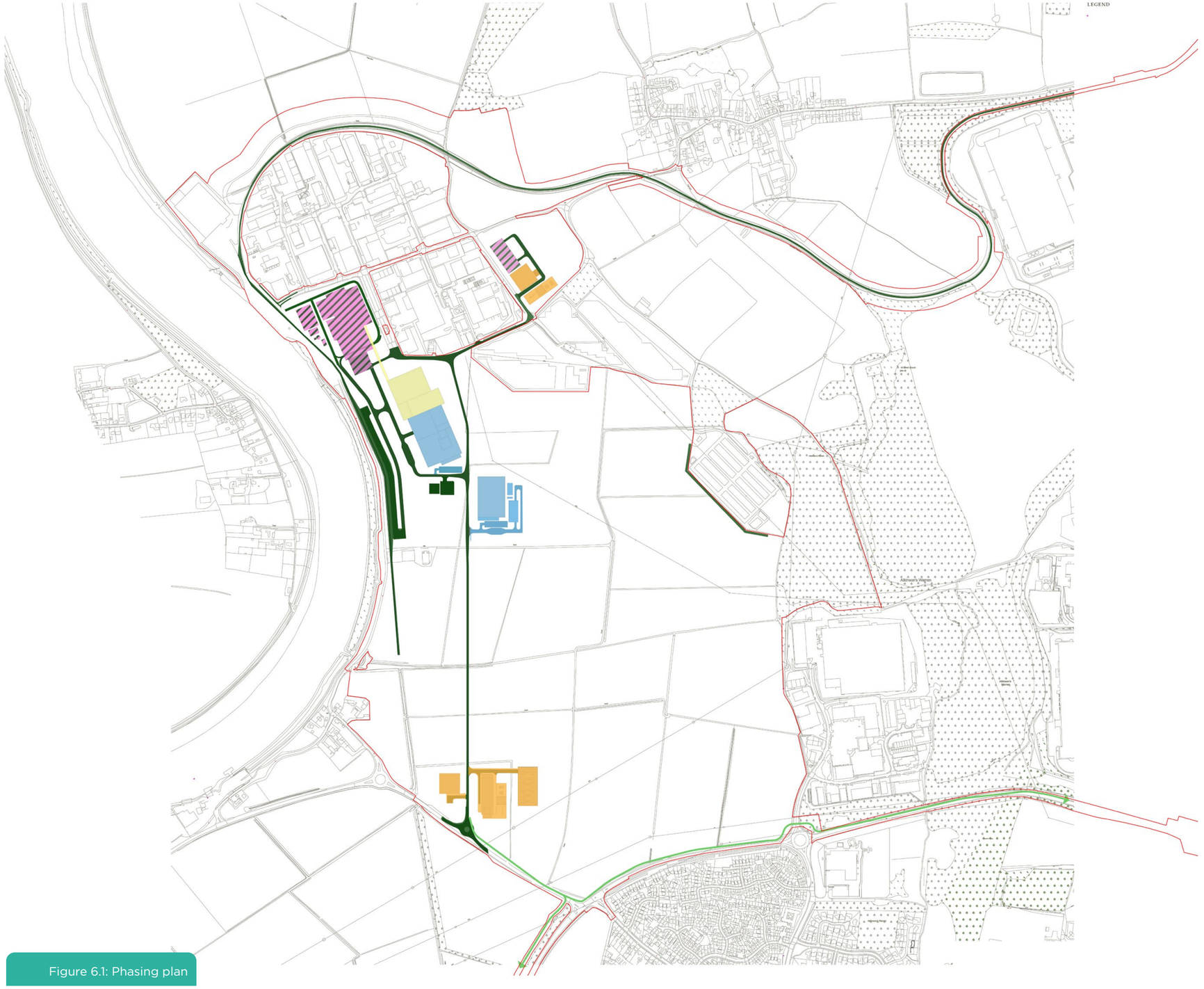
6.1.6 Phase 5 will focus on the earthworks and build out of the CBMF and PRF. The works will include:

- Establish temporary construction compound for the PRF.
- Clear sites for the CBMF and PRF.
- Import fill material.
- Pile foundations.
- Construct ground slab.
- Construct superstructure.
- Fit out and commission.
- Construct elevated walkway.

Phase 6

6.1.7 Phase 6 will focus on the creation of temporary construction compounds, clearance and installation of DHPWN and associated infrastructure. The works will include:

- Establish temporary construction compounds.
- Commence site clearance on agreed route (easement).
- Install district heating and private wire
- Commission.

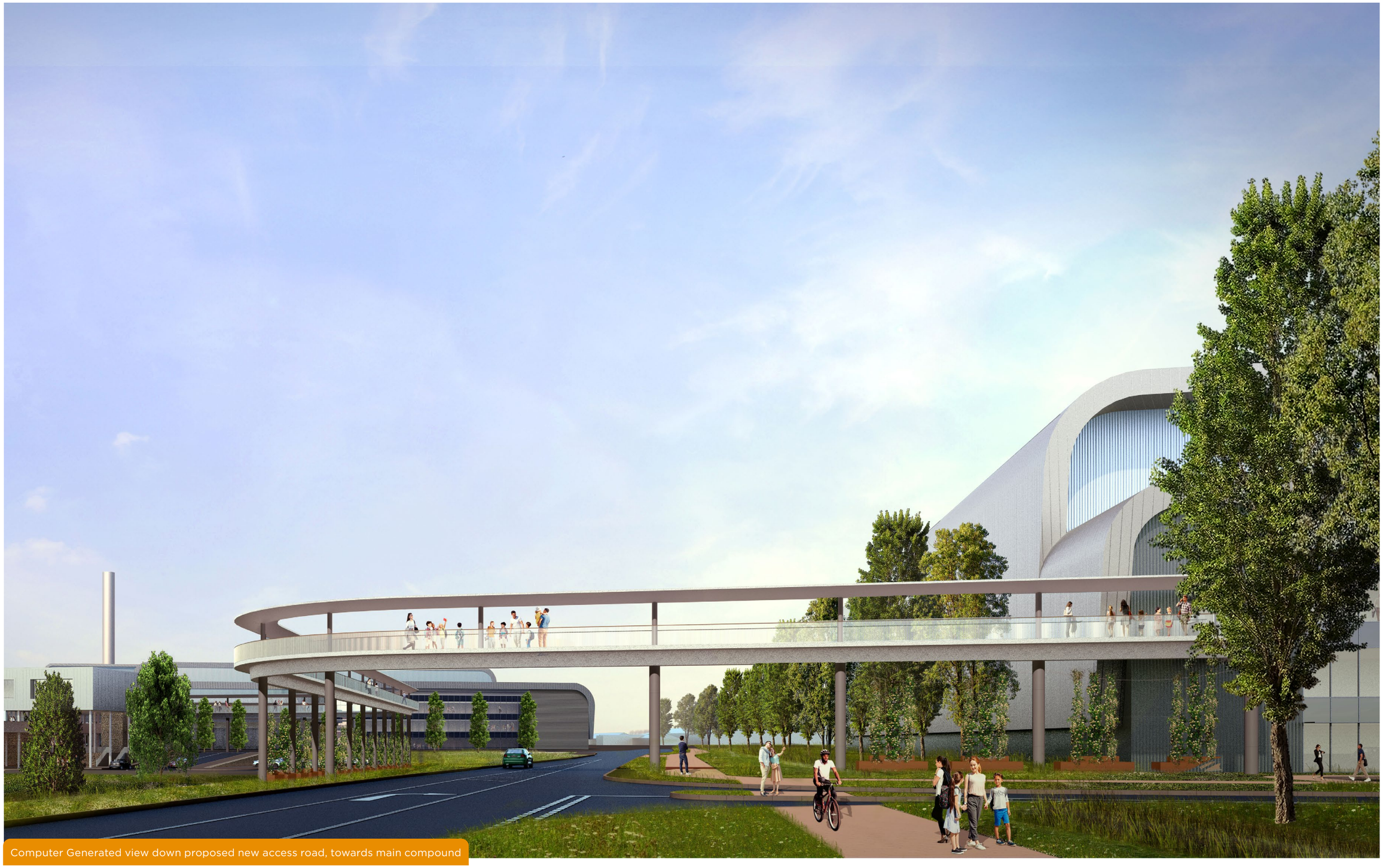


Phasing Plan

Legend

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6 (DHN)

Figure 6.1: Phasing plan



Computer Generated view down proposed new access road, towards main compound

7.0 Design Parameters

7.1 Works Plans

7.1.1 The proposals for the Project are set out in accordance with the 'Rochdale Envelope' approach, with the limits of deviation set out in theWorks Plans (**Document Reference 4.4**) along with vertical parameters for each of the individual components set out in Table 7.1.

7.1.2 The Project has been separated into individual works as follows;

7.1.3 ERF infrastructure

- Work No. 1 — an electricity generating station located on land at Flixborough Port, Lincolnshire, fuelled by refuse derived fuels with a gross generation capacity of up to 95 megawatts at ISO conditions.
- Work No. 1A — three stacks, consisting of ERF stack windshield, back up boilers stack windshield and back up generator stack, and associated emissions monitoring system.
- Work No. 1B — carbon capture utilisation and storage facility capable of capturing at least 54,387 tonnes of CO_2 per annum including carbon dioxide storage tanks.
- Work No. 1C — associated development being a visitors centre containing offices, exhibition space and visitor accommodation with elevated walkway connected to Work Nos. 1 and 2.
- Work No. 1D - a cooling system consisting of air-cooled condensers or air blast chillers.
- Work No. 2 comprising associated development —

  a) a bottom ash and flue gas residue handling and treatment facility;

  b) a concrete block manufacturing facility; and

  c) offices.

7.1.4 Rail infrastructure

- Work No. 3 — associated development being reinstatement of the railway line between Flixborough Wharf and the Dragonby sidings including new sidings.
- Work No. 4 — associated development being a railhead, sidings and associated equipment to allow loading and unloading

7.1.5 Supporting infrastructure

- Work No. 5 — associated development being a new access road linking the B1216 and Stather Road, stopping up of the section of Stather Road between Neap House and Bellwin Drive and improvements to footpaths and the junction between the B1216 and A1077.
- Work No. 6 — associated development being a plastic recycling facility and associated infrastructure including gatehouses, weighbridges, electrical equipment, heat exchange equipment, office and welfare facilities, pre-processed material storage and post processed material storage.
- Work No. 7 — associated development being a hydrogen electrolyser, associated infrastructure and equipment required to inject hydrogen into the national gas grid.
- Work No. 8 — associated development being an electric and hydrogen vehicle refuelling station, with hydrogen production and a gas grid injection above ground installation and offices.
- Work No. 9 — associated development being a battery storage facility capable of peak discharge of 30MWe, with associated infrastructure including site roads, offices, control equipment, transformers and rectifiers.

7.1.6 DHPWN

- Work No. 10 — associated development being private wire networks linking Work No 1 with Work No 2, Work No 6, Work No 7, Work No 8, Work No 9 to end users outside of the order limits.
- Work No. 11 — associated development being a district heating network providing heating and cooling and pipes carrying hydrogen gas, linking Work No. 1 with Work No. 6, and to end users outside of the order limits.

7.1.7 Landscaping, mitigation and utility works

- Work No. 12 — associated development being hard and soft landscaping and the construction of landscape features including a wetland area and ecological mitigation works.
- Work No. 12A - associated development being habitat creation measures.
- Work No. 13 — associated development being flood defences and sustainable drainage systems, including swales, attenuation ponds and below ground tanks and the diversion of ditches.
- Work No. 14 — associated development being diversions of existing utilities which conflict with the construction of Work No 1, Work No 2, Work No 5, Work No 6, Work No 10 and Work No 11.
- Work No. 15 — associated development being laydown areas to allow for storage of materials and prefabrication activities in connection with Works 1-14.

7.1.8 Vertical extents for the Project elements are defined by height parameters set out in Table 7.1 and provide a maximum permissible height above ground level.

7.1.9 In connection with and in addition to Work Nos. 1, 1A to 1D and 2 to 15, to the extent that they do not otherwise form part of any such work, authorised development is allowed in connection with the construction, operation and maintenance of the authorised development within the Order limits.

PROJECT ELEMENT		MAXIMUM FOOTPRINT	MAXIMUM HEIGHT (ABOVE FINISHED FLOOR LEVEL (FFL))	MAXIMUM HEIGHT (ABOVE ORDINANCE DATUM LEVEL (AOD))
ERF plant	Tipping hall (with workshops underneath)	87.5x 60m	31m	37.6m
	Bunker hall	92x 40m	43m	49.6m
	Boiler hall	105x 60m	55m	61.6m
	Flue Gas Treatement (FGT) hall	41x 60m	45m	51.6m
	Turbine hall (including district heating and water treatment plant)	80x37m	25m	31.6m
	Bottom Ash hall	37x37m	25m	31.6m
	Transformer compound	52x22m	10m	16.6m
	Switchyard	93x44m	10m	14.6m
	ERF stack windshield [1]	10m diameter	120m	126.6m
	Back up boilers stack windshield [2]	3m diameter	53m	59.6m
	Back up generator stack	0.85m diameter	55m	61.6m
	Administration and control room and offices	30x100m	43m [3]	49.6m
	Air cooled condensers/ air blast chillers	75m x 35m	50m [4]	56.6m
	Carbon capture utilisation and storage facility	79m x 66m	50m	56.6m
	Carbon dioxide storage tanks	28x20m	20m	26.6m
	Fire water tank	11.3m diameter	19.3m	25.9m
	Fire water pumphouse	6x6m	6.5m	13.1m
	Gatehouse	32x12m	5m	11.6m
	Visual Barriers		4.5m	11.1m

[1] Will contain 3 individual flues
[2] May contain up to 3 individual flues
[3] Roof height of 43m to allow ability to situate above ERF
[4] Situated above 25m tall turbine hall, not 50m from ground level

PROJECT ELEMENT		MAXIMUM FOOTPRINT	MAXIMUM HEIGHT (ABOVE FINISHED FLOOR LEVEL (FFL))	MAXIMUM HEIGHT (ABOVE ORDINANCE DATUM LEVEL (AOD))
RHTF + CBMF	Process building and storage areas	280x130m	25m	30.1m
	Admin building	62x10m	21m	26.1m
Plastic Recycling Facility	Pre-processed material storage	65x35m	10m	13.9m
	Heat exchange building	35x17m	15m	18.9m
	Post processed storage	5x16.4m	15m	18.9m
	Electrical rooms	15x7m	10m	13.9m
	Process building	130x80m	25m	28.9m
	Admin building	62x10m	21m	24.9m
Battery storage facility		115x58m	8.5m	11.5m
Electric vehicle and hydrogen re-fuelling station		95x80m	12.5m	15.5m
Northern hydrogen production and storage facility		100x25m	8m	12.6m
Northern Gas AGI		60x60m	5m	9.6m
Southern hydrogen production and storage facility		100x25m	8m	11.6m
Southern Gas AGI		60x60m	5m	10.1m
DHPWN		Up to 30m working width	Up to 3m below ground	-
Visitor centre		41x36m	16m	19.05m
Elevated walkway		700m in length x 4m width	12m	Maximum of 17.05m
Access Road				5.2m (allows for 1m deviation from current design)

8.0 Sustainability

8.1 Sustainability as Part of the Decision Making

8.1.1 In order to ensure that the Project encourages more sustainable behaviour as well as reducing its impact on the environment, sustainability was always a key consideration in decision making from the outset.

8.1.2 The Project has been designed to reduce waste wherever possible. Waste products from the ERF, such as bottom ash and FGTr are to be processed on site and used as inputs to produce concrete blocks. This reduces the material to be disposed of to landfill even further, and contributes to producing a circular economy within the Energy Park.

8.1.3 The inclusion of the PRF supports the government strategy to recycle above recovery. The Project will recycle where possible from work streams associated with the operation of the Project.

8.1.4 The Project has also been designed to ensure that sustainable transport is used wherever possible. The location of the Project provides an opportunity to convey material to and from the Energy Park by road, river and rail.

8.1.5 The ERF will be equipped with a Carbon Capture, Utilisation and Storage Plant from the outset. This will further reduce the carbon footprint of the Project, and provide opportunities for industrial and agricultural processes to utilise captured CO_2.

8.1.6 Beyond the ERF, the Project will also be a leader in sustainable transport and low carbon energy. The inclusion of the infrastructure to deliver sustainable fuel for electric and low carbon hydrogen powered vehicles will support the uptake of low carbon transport. It will contain hydrogen production, both to support a vehicle re-fuelling station and have the potential to provide low carbon hydrogen to decarbonise the gas grid. An EV charging area is also included, supplied with electricity by the ERF.

8.1.7 The proximity of the proposed East Coast Cluster pipeline that has been selected by the Department for Business, Energy and Industrial Strategy (BEIS) to form the first phase of carbon capture and hydrogen production schemes to meet the Net Zero by 2050, could provide significant carbon capture capacity for the region and the Project.

8.2 Sustainability Strategy Process

8.2.1 In order to set out a sustainability strategy, key sustainability themes were chosen, which bring together the main goals of the project as well as align with the United Nations Sustainable Development Goals and the project design codes. (Shown in Figure 8.1)

8.2.2 Six sustainability themes have been proposed as the drivers for the responsible and sustainable development of the Project.

8.2.3 Commitments and aspirations have been set out under each of the sustainability themes, developed from relevant planning policy context and existing project documentation.

8.2.4 The commitments and aspirations were further consolidated through interactive workshopping with the Applicant.

8.2.5 The commitments and aspirations under each sustainability theme are detailed in the text bubbles on the following page, which contain references to the Design Principles and Codes shown in Figure 8.1.

Sustainability Theme	Alignment with UN SDGs	Alignment with Project Design Principles and Codes
NET ZERO OPERATIONAL CARBON		DP_CLIMATE 1.09,1.10 DC_ARC 2.01,2.02,2.03
CIRCULAR ECONOMY		DP_CLIMATE 1.09,1.10 DC_ARC 2.03 DC_LAN 5.04
CLIMATE RESILIENCE		DP_CLIMATE 1.09, 1.10 DP_PLACES 1.08 DC_ARC 2.03, 2.04 DC_LAN 3.02, 3.03,3.05, 3.08 DC_ENV 1.01, 1.05
SUSTAINABLE CONNECTIVITY		DC_ACC 7.01, 7.03, 7.08, 8.02
SUSTAINABLE LAND USE AND BIODIVERSITY		DP_PLACES 1.08 DC_LAN3.0,3.01,3.05,3.06,3.07,6.02, 6.03 DC_ENV 1.0, 1.03,1.04 DC_ACC 7.01,7.02
SOCIAL VALUE		DP_PEOPLE 1.02, 1.01 DP_VALUE 1.05 DC_ACC 7.01, 7.02, 8.02

Figure 8.1: Key sustainability themes and alignment with UN SDGs

NET ZERO OPERATIONAL CARBON

Responding to the climate emergency with a commitment to net zero carbon for all operational energy use

- The Project is committed to providing the infrastructure and generation capacity to decarbonise the gas grid, power network and remove the use of fossil fuel for heating and cooling. This commitment includes the construction of a hydrogen refuelling facility as well as a comprehensive EV charging station, and the capacity to store CO_2 long-term, with the adaptability to transport for other uses in the future, if it can be profitably used as an additive in manufacturing processes. DP_CLIMATE 1.10

- Materials will be sourced responsibly, with the use of local materials maximised to reduce embodied carbon. DC_ARC 2.01

- Carbon capture technology will be used on the Project to capture CO_2 from the ERF flue gases, which equates to the lesser of 54,387 tonnes per annum and 8.37% of the ERF waste throughput per annum. This will subsequently be mineralised as carbonates within aggregates or sent for utilisation offsite. This captured CO_2 represents a reduction in the total net GHG emissions from the Project. DP_CLIMATE 1.09

- Aggregates recovered from the bottom ash and FGTr will be used to produce concrete blocks, avoiding the GHG emissions from the extraction of virgin aggregates and embedding captured CO_2 for long term storage. DC_ARC 2.03

- The use of rail, ship and road transportation to bring RDF, captured CO_2 and other materials to and from the Energy Park offers the potential for reductions in GHG

CLIMATE RESILIENCE

Building in a capacity to adapt to a changing climate and future weather extremes, protecting the long-term health of community users and the functionality of the facility

- There are10 detention basins which promote biodiversity and 1 storage tank which are used to treat water quality and attenuate storm water before it is discharged into the existing ditches. Wherever possible swales and basins will be used instead of pipes and tanks to encourage biodiversity, such as the swales to be constructed on either side of the new access road, forming an integrated part of the landscape. DC_ENV 1.05, DC_LAN 3.02, 3.05, 3.08, DP-CLIMATE 1.10

- The flood prevention measures, including wetlands, have been sized based on a hydraulic model so that they have the capacity to store the 1 in 100-year (plus 40% climate change) storm event. DC_LAN 3.08 DP-CLIMATE 1.10

- Recovery of ferrous and non-ferrous metals from the bottom ash and FGTr will avoid GHG emissions from the extraction and production of virgin metals. DC_ARC 2.03

- Building design will take into consideration future weather patterns and build in adaptive measures to the heating and cooling systems, to maintain acceptable thermal comfort levels while remaining highly energy efficient. DC_ARC 2.04 DP_CLIMATE 1.10

SUSTAINABLE LAND USE AND BIODIVERSITY

Protecting and restoring the land for the benefit of the people and wildlife.

- The ERF and PRF will prevent up to 760,000 tonnes of waste from ending up in a landfill or being exported annually.

- Despite this project not falling within the remit for the 10% BNG now required by government policy, the Applicant is committed to deliver a project that closely aligns with these requirements by a series of interventions to create new habitats: DP_PLACES 1.08

- Replanting of native trees, hedgerows, and grasslands as well as creation of large area of wetland comprising of ponds, wet woodland, reedbeds, and lowland meadows, as part of an integrated flood drainage system, providing new habitat. DC_LAN 3.0, 3.01, DC_LAN 3.05, 6.01, 6.02 ,6.03, DC_ENV 1.0, 1.03,1.04

- Platform embankment gradients will allow for plating of trees to maximise biodiversity while minimising land use and importation of materials. DC_LAN 3.06, 3.07.

- Increased access to green space through the construction of new footpaths and cycleways around the development which will contribute towards promoting active travel. DC_ACC 7.01, 7.02

RESOURCE EFFICIENCY

Design for resource efficiency over the whole life of the development through responsible consumption and facilitating ease of re-use and recycling.

- The ERF will use RDF to produce energy for various uses. The carbon dioxide produced in the ERF will be captured using USS, reducing the overall carbon emissions of the development. DC_ARC 2.03 DP_CLIMATE 1.09
- Assessments will be undertaken to establish the amount of non-hazardous and inert waste, which will arise from demolitions and can be recovered and reused to further reduce the volumes of waste removed from site. DC_LAN 5.04 DC_ARC 2.03 DP_CLIMATE 1.09
- The heat and energy produced in the energy recover process can be supplied to local homes and businesses via a DHPWN, as well as being fed into the national grid, stored in batteries and used to supply local EV charging.
- Rechargeable batteries will be used to store electricity when demand is low and release this charge rapidly when demand peaks.
- The bottom ash produced as a by-product of the energy recovery process will be used to produce various aggregates and concrete blocks for use in construction. DC_ARC 2.03 DP_CLIMATE 1.09

SUSTAINABLE CONNECTIVITY

A strategy that works for both the local community and visitors, underpinned by sustainable travel choices.

The development aims to promote active travel by:

  - including a new 3m wide walkway/cycleway which will run along the eastern side of the carriageway of the link road. This accessway will connect to existing footways on Bellwin Drive, as well as along the northern side of the B1216 Ferry Road West. DC_ACC 7.01, 7.03
  - A new toucan crossing will be facility will be put in place at the A1077/B1216 junction, enabling cyclists and pedestrians to cross safely.

- Creation of new wetland landscape will incorporate various features, including a 6.5km circular route, which aim to help facilitate physical activity, play, learning and relaxation by providing better access to quality open green spaces, with the overall aim of improving health and wellbeing of visitors. DC_ACC 7.01, 7.02, 8.02

During construction, vehicle emissions will be reduced by:

  - A shuttle bus or park and ride facility will be provided during busy periods of construction to reduce the number of trips made by site workers.
  - A Construction Workers Travel Plan will be put in place to encourage travel to and from the construction site by clean modes of travel or active transport. DC_ACC 7.01, 7.03

SOCIAL VALUE

A catalyst for job creation and regeneration, generating economic and community benefits for the local area.

- Commitment to strong community engagement throughout the project. DP_PEOPLE 1.02
- The Project will allow opportunity for students and school groups to gain educational experience by visiting the ERF to gain an insight to the inner workings of the facility. A range of educational facilities will be provided to accommodate for visits like these, as well as safe pedestrian links around the development. DP_VALUE 1.05
- The Project will create hundreds of jobs, approximately 600 during construction and 250 during operation, of varying skillset requirements, including opportunity for local apprenticeships. DP_VALUE 1.05, DP_PEOPLE 1.01
- The Project will boost the local economy, bringing in approximately £5.7m, with up to £30m spent in the local area during construction.
- New footway and cycleway connections will provide a number of different landscape experiences, with seating areas to stop and relax as well as educational signage along the routes. DC_ACC 7.01, 8.02
- The Project will generate clean power which can be fed into the national grid and to local district networks, helping to provide affordable energy for the surrounding community.

LOWERING CARBON EMISSIONS

Generate enough low-carbon energy for

221,000

homes

Capture up to

650,000

tonnes of CO_2 per annum

Prevent up to

150,000

tonnes of CO_2 being released from landfill

Providing

Hydrogen

as a clean fuel for buses and HGVs

LOCAL ECONOMY

250+ new jobs

600 jobs

during construction

£5.7m to local economy

up to

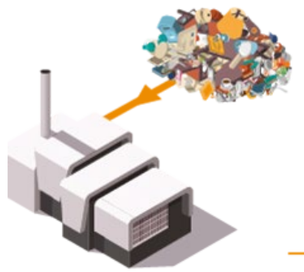
£30m

spend in the local area during construction

Heat+ power

Providing heat and power to local homes and businesses

IMPROVING THE ENVIRONMENT



Prevent up to

760,000

tonnes of waste going to landfill or being exported

Improving

local biodiversity

QUALITY OF LIFE

New routes

New cycle and walking routes

Better access

to the river and countryside

Visitor centre

A visitor centre for the community to use

9.0 Conclusion

9.1.1 This DAS describes the proposals for the Project and our approach to securing delivery of good design. The Project has clearly stated a commitment to design quality by establishing design principles at the outset of the design process. These principles have been used to guide the resultant design.

9.1.2 The Project design is by necessity, based on defined parameters as set out within the written parameters and Works Plans (**Document Reference 4.4**).

9.1.3 The DAS includes illustrative design detail where it is considered these matters are of sufficient importance that further information is required to demonstrate an understanding and commitment to high quality design both for the buildings, publicly accessible spaces and landscape. The Design Principles and Codes (**Document Reference 5.12**) will secure the principles and detail of the illustrative design material.

9.1.4 The proposed design is based on an in-depth understanding of the environmental and landscape context which was the basis of a landscape-led scheme.

9.1.5 Our design process has included extensive statutory and informal consultation with stakeholders to ensure amongst other things, that our appreciation of the site context is agreed and that we have explored design flexibility and our design rationale in an open and transparent manner.

9.1.6 The UK has a growing body of energy and climate change law, policy and guidance which, collectively, outlines the urgent need for new energy generation infrastructure, including energy recovery facilities and carbon capture equipped power stations.

9.1.7 Alongside the drive for new energy generation, the UK Government has a legally binding commitment to achieve net zero in terms of greenhouse gas emissions by 2050.

9.1.8 Throughout the design development process, impact on the environment was minimised in accordance with the project principles, such as maximising development on brownfield land. Where this was not possible, enhancement, mitigation and compensation was at the heart of the proposals, embedding environmental principles as part of good design. We have identified how negative impacts can be avoided or reduced, and how positive impacts can be further enhanced.

9.1.9 The illustrative masterplan and associated landscape, ecology, drainage and public access strategies provide a comprehensive vision of the Project and surrounding area. As part of this vision is a landscape and access enhancement strategy, that aims to increase green corridors, improve and re-connect existing habitats, and provide new and improved access to these habitats for the public to enjoy in perpetuity. The centrepiece to this strategy is a new wetland habitat area of 17ha, situated adjacent the new visitor centre with proposed public walking loops and amenity areas.

9.1.10 The benefits of the Project would include:

- Lowering carbon emissions - generating enough low-carbon energy for 221,000 homes.
- Preventing up to 150,000 tonnes of CO_2 being released to landfill and, subject to the successful Zero Carbon Humber Pipeline, capturing up to 650,000 tonnes of CO_2 per annum.
- Providing low carbon hydrogen as a clean fuel for buses and HGVs.
- 250+new jobs in the local economy in addition to 600 jobs during construction.
- Contributing £5.7m to the local economy and up to £30m spend in the local area during construction.
- Crucially, the ERF will be providing heat and power to local homes and businesses.
- Preventing up to 760,00 tonnes of waste going to landfill or being exported.
- Improving local biodiversity, including voluntarily achieving 10% biodiversity net gain ahead of regulatory requirement.
- Providing new cycle and walking routes, with better access to the river and surrounding countryside.
- A new visitor centre for the community to use.

Appendix A

Schedule of post submission amendments

Amendments from Rev 0

PAGE [DENOTES ORIGINAL SUBMISSION PAGE WHERE PAGES HAVE BEEN ADDED]	PARAGRAPH REF/ FIGURE REF IF APPLICABLE [DENOTES ORIGINAL PARAGRAPH REF WHERE ADDITIONAL PARAS ARE ADDED]	DESCRIPTION
P.36 [new page]	n/a	Added visual from Belwin Drive
p.37 [p.37]	Para 5.2	'5.2 Project Principles' changed to '5.2 Project Principles and Delivering Good Design'
p.37 [p.37]	New paras	Three new paragraphs added after [5.2.1]: 5.2.2, 5.2.3 and 5.2.4 [paras 5.2.2 cont. moved to 5.2.5 cont.]
p.38 [p.36]	Fig 5.1 [fig.5.1]	Added column of 'Adheres to/References'
p.39 [new page]	Fig 5.2 [new figure]	New Project Timeline Diagram
p.39 [new page]	New paras	Paras 5.3.3 to 5.3.8 Added after [5.3.2] [Section 5.3 moved from p.37 to new page 39]
p.57 [p.55]	Fig 5.26 [fig.5.26]	Controlled Access to the Elevated Walkway added to the legend and relocacted on Figure plan.
p.58 [p56]	5.17.3	'will' changed to 'should'
p.58[p56]	5.17.4	1st sentence: 'will' changed to 'is intended to' 2nd sentence: 'will' changed to 'should' 3rd sentence: 'will' changed to 'is intended to' 4th sentence: sentence: 'will' changed to 'should' Final sentence: 'The existing ditches will be retained where possible and the Lysaght's Drain will be enhanced, improving ecological connectivity between the Phoenix Parkway LNR and the River Trent.' Changed to The existing ditches should be retained where possible and the Lysaght's Drain enhanced, improv-ing ecological connectivity between the Phoenix Parkway LNR and the River Trent.'
p. 59 [p.57]	5.17.5	2nd sentence: 'will' changed to 'would' 4th sentence: 'will' changed to 'would' Final sentence: 'will' changed to 'should'
p. 59 [p.57]	5.17.6	2nd sentence: 'will' changed to 'is intended to'
p. 59 [p.57]	5.17.7	'These new connections will be set within either the proposed block of woodland planting or the wetland landscape, providing a variety of different landscapes experiences, places to stop and relax as well as educational opportunities along the routes.' changed to 'These new connections will be set within proposed woodland planting, wetland landscape, or other landscape providing a variety of different experiences, with places to stop and relax as well as education-al/interpretation opportunities along the routes.'

p. 59 [p.57]	5.17.8	1st sentence: ‘will’ changed to ‘is intended to’ 2nd sentence: ‘will’ changed to ‘should’
p.61 [p.59]	5.17.14	‘will’ changed to ‘would’
p.62 [p.60]	5.17.18	‘will’ changed to ‘is intended to’
p.62 [p.60]	5.17.19	‘Tree species will be selected to provide seasonal interest to users and increased habitats for a range of species and alongside areas of native hedges (single species and mixed species) will add a formalised edge where needed and support species corridors identified through the ecology study and strategy.’ Changed to ‘Tree species should be selected to provide seasonal interest to users and increased habitats for a range of species and alongside areas of native hedges (single species and mixed species) would add a formalised edge where needed and support species corridors identified through the ecology study and strategy.’
p.62 [p.60]	5.17.24	‘will’ changed to ‘would’
p.63 [p.61]	5.17.31	‘will’ changed to ‘should’
p.63 [p.61]	5.17.32	1st sentence: ‘will’ changed to ‘is intended to’
p.64 [p.62]	5.18.5	‘will’ changed to ‘could’
p.64 [p.62]	5.18.6	1st sentence: ‘will’ changed to ‘would’ 2nd sentence: ‘will’ changed to ‘would’
p.64 [p.62]	5.18.7	1st sentence: ‘will’ changed to ‘would’
p.64 [p.62]	5.18.8	‘will’ changed to ‘would’
p.64 [p.62]	5.18.9	‘will’ changed to ‘would’
p.64 [p.62]	5.18.10	‘will’ changed to ‘would’
p.64 [p.62]	5.18.14	‘will’ changed to ‘is intended to’
p.76 [p.74]	5.25.1	‘will changed to ‘would’

Amendments from Rev 1

p.52 [p.52]	Fig 5.11	Section reference amended from Fig 5.12 to Fig 5.13
p.53 [p.53]	Fig 5.14	Section reference amended from Fig 5.14 to Fig 5.15 Section reference amended from Fig 5.15 to Fig 5.16
p.54 [p.54]	Fig 5.19	Section reference amended from Fig 5.20 to Fig 5.21
p.54 [p.54]	Fig 5.20	Section reference amended from Fig 5.21 to Fig 5.22
P.55 [p.55]	Fig 5.23	Section reference amended from Fig 5.24 to Fig 5.25
P.55 [p.55]	Fig 5.25	Fence height adjusted from 2m to 3m
P57 [p.57]	Legend	Typo correction “Pedestria” to “Pedestrian“ Addition of Security Fence and Visual Barrier
P57 [p.57]	Fig 5.27	Addition of Security Fence and Visual Barrier to differentiate from Security Fence
p.82 [p.82]	Table	New row added at bottom of table “Visual Barriers”

LDĀDESIGN

London
209 - 215 Blackfriars Road
London SE1 8NL
United Kingdom
+44 (0) 20 7467 1470

Bristol
Studio 4B
36 King Street
Bristol BS1 4DZ
United Kingdom
+44 (0) 117 203 3628

Cambridge
The Courtyard
17A Sturton Street
Cambridge CB1 2SN
United Kingdom
+44 (0) 1223 949054

Exeter
Kings Wharf, The Quay
Exeter EX2 4AN
United Kingdom
+44 (0) 1392 260 430

Glasgow
Sovereign House
158 West Regent Street
Glasgow G2 4RL
United Kingdom
+44 (0) 1412 229 780

Manchester
Hilton Square
3 Tariff Street
Manchester M1 2FF
United Kingdom
+44 (0) 161 359 5684

Oxford
Worton Rectory Park
Oxford OX29 4SX
United Kingdom
+44 (0) 1865 887050

Peterborough
17 Minster Precincts
Peterborough PE1 1XX
United Kingdom
+44 (0) 1733 310 471

LDA Design Consulting Ltd
Registered No: 09312403
17 Minster Precincts, Peterborough PE1 1XX

LDA Design is a ISO 9001 / ISO 14001 accredited company

NORTH LINCOLNSHIRE GREEN ENERGY PARK