

Gate Burton Energy Park Preliminary Environmental Information Report

Volume 1 – Main Report

June 2022



Gate Burton Energy Park Preliminary Environmental Information Report Volume I, Glossary and Table of Contents



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Gate Burton Energy Park Limited

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Glossary of Abbreviations

AADT Annual Average Daily Traffic

AC Alternating current

AEP Annual Exceedance Probability

agl Above ground level

AlL Abnormal Indivisible Load

ALC Agricultural Land Classification

AOD Above Ordnance Datum

AONB Areas of Outstanding Natural Beauty

AQMA Air Quality Management Area

AQS Air Quality Strategy

ATC Automatic Traffic Count

AW Ancient Woodland

BAP Biodiversity Action Plan
BCT Bat Conservation Trust
BDC Bassetlaw District Council

BDLDF Bassetlaw District Local Development Framework

BESS Battery Energy Storage System

BGS British Geological Survey
BMV Best and Most Versatile
BNG Biodiversity Net Gain

BOAT Byways Open to All Traffic

BOD Biochemical Oxygen Demand

BPM Best Practicable Means

BRE Building Research Establishment

BRES Business Register and Employment Survey

BS British Standard

CAFE Clean Air for Europe

CAMS Catchment Abstraction Management Strategy

CCC Climate Change Committee
CCGs Clinical Commissioning Groups

CCR Climate change resilience
CCTV Closed circuit television

CCW Countryside Council for Wales
CDM Construction Design Management

CEMP Construction Environmental Management Plan

CIEEM Chartered Institute of Ecology and Environmental Management

CifA Chartered Institute for Archaeologists

CIPD Chartered Institute of Personnel and Development



CJEU Court of Justice of the European Union

CM Conceptual Model

COPA Control of Pollution Act 1974

COSHH Control of Substances Hazardous to Health

CSM Conceptual site model

CTMP Construction Traffic Management Plan

CWS County Wildlife Sites
DBA Desk-Based Assessment

DBEIS Department for Business, Energy & Industrial Strategy

DC Direct Current

DCO Development Consent Order

DECC Department of Energy and Climate Change

DEFRA Department for Environment, Food and Rural Affrairs
DEMP Decommissioning Environmental Management Plan

DfT Department for Transport
DMP Dust Management Plan

DMRB Design Manual for Roads and Bridges

DoS Degree of Saturation

DRA Dust Risk Assessment

EA Environment Agency

EC European Commission

EcIA Ecological Impact Assessment

EIA Environmental Impact Assessment

EMI Electromagnetic Interference

EN Energy

EPA Environmental Protection Act

EPD Environmental Product Declaration
EQS Environmental Quality Standards

ERP Emergency Response Plan
ES Environmental Statement
FRA Flood Risk Assessment
FTE Full Time Employment

FZ Flood Zone

GCR Ground Coverage Ratio

GHG Greenhouse Gas

GLVIA3 Guidelines for Landscape and Visual Impact Assessment, 3rd Edition

GPP Guidance for Pollution Prevention

GRP Glass reinforced plastic

GVA Gross Value Added

GWDTE Groundwater Dependent Terrestrial Ecosystem

Ha Hectare



HaPI Habitats of Principal Importance
HCA Homes and Communities Agency
HDD Horizontal Directional Drilling

HDV Heavy Duty Vehicle
HE Historic England

HER Historic Environment Record

HGV Heavy Goods Vehicle

HIA Heritage Impact Assessment
HIS Habitat Suitability Index

HLC Historic Landscape Character
HRA Habitats Regulation Assessment

HSI Habitat Suitability Index

HVAC Heating, Ventilation and Cooling
IAQM Institute of Air Quality Management
ICCI In-combination climate change impact

IDB Internal Drainage Board

IEF Important Ecological Features

IEMA Institute of Environmental Management and Assessment

IMD Index of Multiple Deprivation
INNS Invasive Non-Native Species

IPCC Intergovernmental Panel on Climate Change

JNCC Joint Nature Conservation Committee

JSNAs Joint Strategic Needs Assessment

kg CO2e/kWh Kilograms carbon dioxide equivalent per kilowatt hour

Km Kilometre

LBAP Local Biodiversity Action Plan

LBMP Landscape and Biodiversity Management Plan

LCA Landscape Character Area
LCC Lincolnshire County Council
LCP Landscape Character Parcel
LCT Landscape character Type
LDU Landscape Description Unit

LERC Lincolnshire Environmental Records Centre

LGV Light Goods Vehicle

LHA Local Highway Authority

LLCA Local Landscape Character Area

LLFA Lead Local Flood Authority
LNR Local Nature Reserves

LOAEL Lowest Observable Adverse Effect Level

LSEs Likely Significant Effects



LSOA Lower Super Output Area

LVIA Landscape and Visual Impact Assessment

LWS Local Wildlife Sites

M³ Meters cubed

MAGIC Multi-Agency Geographic Information Centre

MCC Manually Classified Count

MRN Major Road Network

MSOA Middle Super Output Area

MW Megawatts

MWh Megawatt hours

NBGRC Nottinghamshire Biological and Geological Records Centre

NBN National Biodiversity Network

NCC Nottinghamshire County Council

NE Natural England

NERC Natural Environment Research Council

NGR National Grid Reference
NNR National Nature Reserves

NO₂ Nitrogen Dioxide

NOEL No Observed Effect Level

NPPF National Planning Policy Framework
NPPG National Planning Practice Guidance

NPS National Policy Statement

NPSE National Policy Statement for England

NRMM Non-Road Mobile Machinery
NRTF National Road Traffic Forecast

NSIP Nationally Significant Infrastructure Project

NTEM National Trip Ends Model

NTL National Tidal Limit

NTM National Transport Model

NVQ National Vocational Qualification

NVZ Nitrate Vulnerable Zone

ODEMP Outline Decommissioning Environmental Management Plan

OEMP Operational Environmental Management Plan

ONS Office for National Statistics

OOEMP Outline Operational Environmental Management Plan

OS Ordnance Survey

PEA Preliminary Ecological Appraisal

PEI Preliminary Environmental Information

PIC Personal Injury Collision

PM₁₀ Particulate Matter



PPE Personal protective equipment
PPG Pollution Prevention Guidance
PPG Planning Practice Guidance
PRA Preliminary Risk Assessment

PRoW Public Rights of Way

PSYM Predictive System for Multimetrics

PV Photovoltaic
PV Photovoltaic

PWS Private Water Supply
RBD River Basin District

RBMPs River Basin Management Plans

RCPs Representative Concentration Pathways

RFC Ratio of Flow to Capacity

RLB Red Line Boundary

RVAA Residential Visual Impact Assessment

SAC Special Areas of Conservation

SF6 Sulphur hexafluoride

SFRA Strategic Flood Risk Assessment

SM Scheduled Monument

SOAEL Significant Observed Adverse Effect Level
SOCC Statement of Community Consultation

SoS Secretary of State

SPA Special Protection Areas

SPI Species of Principal Importance

SPZ Source Protection Zone

SSSI Site of Special Scientific Interest
SuDS Sustainable Drainage Systems
SWMP Site Waste Management Plan

TA Transport Assessment
tCO2e tonnes CO2 equivalent
TEMPRO Trip Ends Model Program

TTM Temporary Traffic Management

TVL Trent Valley Landscape

TW Trent Washlands

UKBAP UK Biodiversity Action Plan

W Watts

WCA Wildlife and Countryside Act
WFD Water Framework Directive
WHO World Health Organisation
WLDC West Lindsey District Council



WMP Water Management Plan

WRMP Water Resources Management Plan

WSI Written Scheme of Investigation

WTN Waste Transfer Note

WTT Well-to-tank

Zol Zone of Influence

ZTV Zone of Theoretical Visibility



Definitions of Frequently Used Terms

Abnormal Indivisible Load

An abnormal load that cannot be broken down into smaller loads for

transport.

Abnormal Load

A vehicle that has a weight of more than 44,000kg, an axle load of more than 10,000kg for a single non-driving axle and 11,500kg for a single driving axle, a width of more than 2.9 metres or a rigid length of more than

18.65 metres.

Applicant

Gate Burton Energy Park Limited

Automatic Traffic

Count

A traffic count which is undertaken automatically such as through the installation of a temporary or permanent electronic traffic recording device.

Baseline Conditions

The Conditions against which potential effects rising from the Scheme are

identified and evaluated.

Battery energy storage system Proposed development of a battery storage installation and associated development to allow for the storage, importation and exportation of energy

to the National Grid.

Byways Open to All

Traffic

A highway over which the public have a right of way for vehicular and all other kinds of traffic, but which is primarily used by the public for walking,

cycling or horse riding.

Grid Connection

Route

Corridor which represents the land within which the cable route would be

located.

Cables

The cables, which transmit electricity from the transformers to the project

substation.

CO₂ equivalent (CO₂e) Carbon dioxide (CO₂) equivalent is a measure of how much a gas contributes to global warming, relative to carbon dioxide, by multiplying the mass of the gas (in tonnes), by the gas' global warming potential (GWP).

Conservation Area

An area of special environmental or historic interest or importance, of which the character or appearance is protected (Section 69 of the Planning

(Listed Buildings and Conservation Areas) Act 1990).

Construction Environmental Management Plan (CEMP)

A site-specific plan developed to ensure that appropriate environmental management practices are followed during the construction phase of a

project.

Cumulative Effects

Effects upon the environment that result from the incremental impact of an action when added to other past, present or reasonably foreseeable actions. Each impact by itself may not be significant but can become a significant

effect when combined with other impacts.

DCO Site Comprises the Solar and Energy Storage Park and Grid Connection Route.

Degree of Saturation/ Ratio of Flow to

A ratio of demand to capacity on each approach to the junction, with a value of 100% meaning the demand and capacity are equal and no further traffic is able to progress through the junction

Designated Landscape

Capacity

Areas of landscape identified as being of importance at international, national or local levels, either defined by statute or identified in

development plans or other documents.



Order (DCO)

Development Consent Development consent is required pursuant to the Planning Act 2008 for Nationally Significant Infrastructure Projects. A development consent order is the order which grants development consent when an application is made to the Secretary of State.

Direct employment

Employment generated by direct activity on site.

Drinking Water Protected Area Drinking Water Protected Areas (Surface Water) are, within the WFD, where raw water is abstracted from rivers and reservoirs. Raw water needs to be protected to ensure that it is not polluted which could lead to additional purification treatment. To do this water companies and the Environment Agency identify raw water sources that are 'at risk' of deterioration which would result in the need for additional treatment. These zones are areas where the land use is causing pollution of the raw water. Action is targeted in these zones to address pollution so that extra treatment of raw water can be avoided.

Drinking Water Safeguard Zones Catchment areas that influence the water quality for their respective Drinking Water Protected Area (Surface Water), which are at risk of failing the drinking water protection objectives. These non-statutory Safeguard Zones are where action to address water contamination will be targeted, so that extra treatment by water companies can be avoided.

EN 15804

European Standard for the generation of EPD for construction products

Environmental effect

The consequence of an action (impact) upon the environment such as the decline of a breeding bird population as a result of the removal of hedgerows and trees.

Environmental impact

The change in the environment from a development such as the removal of a hedgerow.

Environmental Impact Assessment (EIA)

A process by which information about environmental effects of a proposed development is collected, assessed and used to inform decision making. For certain projects, EIA is a statutory requirement.

Environmental Product Declaration (EPD)

An EPD is a document that quantifiably demonstrates the environmental impacts of a product.

Environmental Statement

A document produced in accordance with the EIA Directive as transposed into UK law by the EIA Regulations to report the results of an EIA.

Flood Zone 1

Land assessed as having a less than 1 in 1,000 annual probability of river flooding (<0.1% Annual Exceedance Probability (AEP)

Flood Zone 2

Land assessed as having between 1 in 100 and 1 in 1,000 annual probability of river flooding (>0.1% AEP to <1% AEP)

Flood Zone 3

Land assessed as having 1 in 100 or greater annual probability of river flooding (>1% AEP))

Grid Connection

Route

The cable route between the Solar and Energy Storage Park and the substation at Cottam Power Station.

Gross impact

Overall impact before taking into account the impact of deadweight, displacement, leakage and substitution.

Heavy Goods Vehicle

(HGV)

Vehicles with 3 axles (articulated) or 4 or more axles (rigid and articulated).

Indirect employment

Employment growth arising through spending in the supply chain by activity on site (i.e. contracted out manufacturing and services).

Prepared for: Gate Burton Energy Park Limited



Induced employment Employment generated through spending by workforce (direct employment)

in the economy.

Interface cables Buried high-voltage cables linking the on-site electrical infrastructure to the

National Grid.

Inverter Inverters convert the direct current (DC) electricity collected by the PV

modules into alternating current (AC), which allows the electricity generated to be exported to the National Grid. BESS also use inverters to convert between DC and AC. The batteries function in DC and electricity must be

converted to AC to pass into or from the grid.

ISO 14025:2006 establishes the principles and specifies the procedures for

developing Type III environmental declaration programmes and Type III

environmental declarations.

Jointing pit Underground structures constructed at regular intervals along the cable

route to join sections of cable and facilitate installation of the cables into the

buried ducts.

Landscape An area, as perceived by people, the character of which is the result of

the action and interaction of natural and/or human factors.

Landscape and Visual Impact Assessment

A tool used to identify and assess the likely significance of the effects of change resulting from development both on the landscape as an

environmental resource in its own right and on people's views and

visual amenity.

Landscape Character A distinct, recognisable and consistent pattern of elements in the

landscape that makes one landscape different from another, rather than

better or worse.

Landscape Character

Area

These are single unique areas which are the discrete geographical

areas of a particular landscape type.

Landscape Character

Assessment

The process of identifying and describing variation in the character of the landscape and using this information to assist in managing change

in the landscape. It seeks to identify and explain the unique

combination of elements and features that make landscapes distinctive.

The process results in the production of a Landscape Character

Assessment.

Landscape Character

Types

These are distinct types of landscape that are relatively homogeneous in character. They are generic in nature in that they may occur in

different areas in different parts of the country, but wherever they occur they share broadly similar combinations of geology, topography,

drainage patterns, vegetation and historical land use and settlement

pattern, and perceptual and aesthetic attributes.

Landscape Effects Effects on the landscape as a resource in its own right.

Landscape Receptors

Defined aspects of the landscape resource that have the potential to be

affected by a proposal.

Landscape Sensitivity A term applied to specific receptors, combining judgements of the

susceptibility of the receptor to the specific type of change or development proposed and the value related to that receptor.



Landscape Value The relative value that is attached to different landscapes by society. A

landscape may be valued by different stakeholders for a whole variety

of reasons.

Light Goods Vehicle A commercial motor vehicle with a total gross weight of 3,500kg or less.

Magnitude (of effect) A term that combines judgements about the size and scale of the effect, the

extent of the area over which it occurs, whether it is reversible or

irreversible and whether it is short or long term in duration.

Major Road Network The middle tier of England's busiest and most economically important local

authority 'A' roads.

Manually Classified

Count

A traffic count which is undertaken manually such as by an observer visually counting and recording the volume of vehicles on a tally sheet.

Middle Super Output A geog

Area

A geographic hierarchy designed to improve the reporting of small area statistics in England and Wales, built from groups of contiguous Lower

Layer Super Output Areas.

Mitigation Measures including any process, activity, or design to avoid, prevent,

reduce, or, if possible, offset any identified significant adverse effects on the

environment.

National Road Traffic

Forecast

A forecast for traffic demand, congestion and emissions in England and

Wales.

National Transport

Model

A multi-modal model of land-based transport in Great Britain, used to inform transport policy and roads strategy and produce road traffic

forecasts.

National Trip Ends

Model

A model which forecasts the growth in trip origin-destinations (or

production-attractions) for use in transport.

Nationally Significant Infrastructure Projects

(NSIP)

NSIPs are large scale developments such as certain new harbours, power generating stations (including wind farms), highways developments and electricity transmission lines, which require a type of consent known as 'development consent' under procedures governed by the Planning Act

2008 (and amended by the Localism Act 2011).

Net impact Impact discounting deadweight (impact that would have happened without

the intervention), displacement (proportion of intervention outputs/outcomes accounted for by reduced outputs/outcomes elsewhere in the target area), leakage (proportion of outputs that benefit those outside of the intervention's target area or group) and substitution (effect arises where a firm substitutes

one activity for a similar one)

Nitrate Vulnerable

Zone

NVZs are statutory designated areas as being at risk from agricultural nitrate pollution and includes about 55% of land in England. The

designations are made in accordance with the Nitrate Pollution Prevention

Regulations 2015.

NPS National Policy Statement. National Policy Statements are produced by

government. They comprise the government's central policy documents for

the development of nationally significant infrastructure.

On-site substation A compound containing electrical equipment to enable connection to the

national grid. .



Personal Injury

Collision

A collision involving a mechanically-propelled vehicle on a road or other

public area which causes injury or damage to a person.

Photomontage A visualisation which superimposes an image of a proposed development

upon a photograph or series of photographs.

Preliminary Environmental Information (PEI) PEI is defined in the EIA Regulations as: "information referred to in

Regulation 14(2) which -

(a) has been compiled by the applicant; and

(b) is reasonably required for the consultation bodies to develop an informed view of the likely significant environmental effects of the

development (and of any associated development)."

Preliminary Risk Assessment

Report that presents a summary of readily-available information on the geotechnical and/or geo-environmental characteristics of the site and provides a qualitative assessment of geo-environmental and/or geotechnical

risks in relation to the proposed development.

These are layers of rock or drift deposits that have high intergranular and/or Principal Aquifer

> fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously

designated as major aquifer.

Public Rights of Way Rights across land exercisable by the public at all times.

Q95 Flow River flow rate that is exceeded 95% of the time.

A component of the natural or man-made environment that is affected by an Receptor

impact, including people.

Representative Concentration Pathways (RCPs) Representative Concentration Pathways (RCPs) capture, within a set of scenarios, assumptions about the economic, social and physical changes to our environment that will influence climate change. The conditions of each scenario are used in the process of modelling possible future climate

evolution.

RCPs specify concentrations of greenhouse gases that will result in total radiative forcing increasing by a target amount by 2100, relative to preindustrial levels. Total radiative forcing is the difference between the incoming and outgoing radiation at the top of the atmosphere. Radiative forcing targets for 2100 have been set at 2.6, 4.5, 6.0 and 8.5 watts per square metre (W m-2) to span a wide range of plausible future emissions scenarios and these targets are incorporated into the names of the RCPs; RCP2.6, RCP4.5, RCP6.0 and RCP8.5. Each pathway results in a different range of global mean temperature increases over the 21st century.

Scheduled Monument A 'nationally important' archaeological site or historic building, given protection against unauthorised change and included in the Schedule of Monuments kept by the Secretary of State for Culture, Media and Sport. The protection given to scheduled monuments is given under the Ancient

Monuments and Archaeological Areas Act 1979.

Scheme The Gate Burton Solar Farm comprising solar PV and battery storage and

associated development for connection to the national transmission system

via Grid Connection.

Scoping The process of identifying the issues to be addressed by an EIA. It is a

method of ensuring that an EIA focuses on the important issues and avoids

those that are considered to be less significant.



Secondary (undifferentiated) aquifer Assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

Secondary A Aquifer

Secondary A aquifers comprise permeable layers that can support local water supplies and may form an important source of base flow to rivers.

Secondary B Aquifer

Predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.

Setting

The surroundings within which a heritage asset is experienced and any element, which contributes to the understanding of its significance.

Significance

A measure of the importance or gravity of the environmental effect, defined by significance criteria specific to the environmental topic.

Site Boundary

The maximum extent of land potentially required temporarily and/or permanently for the construction, operation and maintenance of the Scheme.

Solar and Energy Storage Park Comprises solar PV and battery storage infrastructure.

Solar Farm

Proposed generating station comprised of solar PV modules mounted on racks and connected via associated infrastructure to the national grid.

Source Protection

Zone

Zones which show the level of risk to a groundwater source from contamination. This could be from any activity that might cause pollution in the area. For example, storing pollutants like petrol underground, soakaways from septic tanks to the ground. The closer the activity, the greater the risk.

Study Area

The area in which a particular assessment or survey targets. The study area will vary depending on the nature of the technical assessment. Where relevant, these are defined within the relevant technical chapter of the PEIR.

Susceptibility

The ability of a defined landscape or visual receptor to accommodate the specific proposed development without undue negative consequences.

Temporary Traffic Management

A system of controlling traffic movement (such as through or past a works site) to maximise safety for and minimise inconvenience to road workers and road users.

Tranquillity

A state of calm and quietude associated with peace, considered to be a significant asset of landscape.

Transformers

Transformers control the voltage of the electricity generated across the site before it reaches the electrical infrastructure.

Trip Ends Model

Program

Software which allows users to view the National Trip Ends Model dataset and provides forecasts of trip ends and associated documentation.

Visual Effects

Effects on specific views and on the general visual amenity

experienced by people.



Visual Receptors Individuals and/or defined groups of people who have the potential to

be affected by a proposal.

Water Framework
Directive Assessment

As part of its role, the Environment Agency must consider whether proposals for new developments have the potential to a) Cause a deterioration of a water body from its current status or potential; and/or b) Prevent future attainment of Good status (or potential where not already achieved). A WFD Assessment determines whether a scheme is compliant

with these criteria.

Well-to-tank (WTT) emissions

A Well-to-Tank emissions factor, also known as upstream or indirect emissions, is an average of all the GHG emissions released into the atmosphere from the production, processing and delivery of a fuel or energy

vector.

Written Scheme of Investigation

A Written Scheme of Investigation outlines known and potential archaeological features and deposits or built heritage elements on a site and suggests a structure for exploring them using the latest, most

appropriate and cost-effective archaeological techniques.

Zone of Influence The area for the assessment of combined effects. Zones of Influence (Zols)

are variable depending on the environmental factor being discussed.

Zone of Theoretical Visibility

A map, usually digitally produced, showing areas of land within which the

Scheme is theoretically visible.



1. Introduction

1.1 Background

- 1.1.1 This Preliminary Environmental Information (PEI) Report has been commissioned by Gate Burton Energy Park Limited (the 'Applicant') to present the preliminary environmental assessment for Gate Burton Energy Park (hereafter referred to as the 'Scheme'). Its purpose is to inform the statutory consultation process.
- 1.1.2 The Scheme will comprise the construction, operation, maintenance and decommissioning of a solar photovoltaic (PV) electricity generating facility and energy storage facility with a total capacity exceeding 50 megawatts (MW) and export connection to the National Grid, at the existing Cottam Power Station.
- 1.1.3 The Scheme is classed as a Nationally Significant Infrastructure Project (NSIP) for the purposes of the Planning Act 2008 (Ref 1-1) and requires an application for Development Consent Order (DCO). The application will be submitted to the Planning Inspectorate following completion of statutory consultation and consideration of feedback, completion of the environmental impact assessment, and preparation of other application documents. The decision whether to grant a DCO will be made by the Secretary of State for Business, Energy and Industrial Strategy (hereafter referred to as the 'Secretary of State').
- 1.1.1 The Scheme is considered to be 'EIA development' as defined by the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the 'EIA Regulations') (Ref 1-2), requiring an Environmental Impact Assessment ('EIA'). Under Regulation 12 of the EIA Regulations, the Applicant is required to set out in its Statement of Community Consultation ('SOCC') how it intends to publicise and consult on preliminary environmental information relating to the Scheme. Regulation 12(2) states that the purpose of the PEI Report is to provide sufficient information to enable stakeholders to develop an informed view of the likely significant effects of the development (and of any associated development). Advice Note 7 from the Planning Inspectorate (Section 8) (Ref 1-3) acknowledges that the PEI is a compilation of the environmental information available at the point in time the PEI Report has been produced.
- 1.1.2 This PEI Report therefore presents the preliminary findings of the EIA undertaken for the Scheme for the purposes of statutory consultation in accordance with the Planning Act 2008.
- 1.1.3 This chapter is supported by the following figures in **PEI Report Volume 2**:
 - Figure 1-1: Scheme Location; and
 - Figure 1-2: Scheme Boundary.
- 1.1.4 This chapter is supported by the following appendices in **PEI Report Volume 3**:



- Appendix 1-A: EIA Scoping Report;
- Appendix 1-B: EIA Scoping Opinion; and
- Appendix 1-C: EIA Scoping Opinion Responses.

1.2 The Scheme

- 1.2.1 The Scheme will comprise the installation of solar photovoltaic (PV) panels, on-site battery storage (referred to as the Battery Energy Storage System (BESS)), and associated infrastructure. Subject to obtaining the necessary consents, construction is anticipated to commence in Q1 2025 and completed ready for operation in Q1 2028.
- 1.2.2 The location of the Scheme is shown in PEI Report Volume 2: Figure 1-1, with the DCO Site shown on PEI Report Volume 2: Figure 1-2. The land within the DCO Site and its surroundings are described in Chapter 2: The Scheme, with the consideration of alternatives and progression of the site layout described in Chapter 3: Alternatives and Design Evolution. The DCO Site comprises approximately 1436 hectares (ha) of land for solar PV, battery storage, a grid connection and associated infrastructure; and landscaping and biodiversity measures. The DCO Site is comprised of the 'Solar and Energy Storage Park' and the 'Grid Connection Route'. The Solar and Energy Storage Park is centred on the approximate National Grid Reference SK 84377 83972 and located approximately 4 kilometres (km) south of Gainsborough and will contain the solar PV panels, BESS and associated development.
- 1.2.3 For the purposes of this PEI Report it is anticipated that the Scheme will have a 60 year lifetime, with decommissioning in 2088.
- 1.2.4 Further information on site design and infrastructure is provided in **Chapter 2: The Scheme**.
- 1.2.5 Environmental impacts arising from the Scheme have been studied systematically as part of the EIA process, and the initial results are presented within this PEI Report. The baseline for the assessment has been derived from surveys and studies within and around the DCO Site. This is explained further in **Chapter 5: EIA Methodology**, and in the methodology section of each technical assessment chapter.
- 1.2.6 The ongoing EIA process assesses impacts resulting from the construction, operation (including maintenance), and decommissioning of the Scheme, and considers measures to avoid, reduce or mitigate any significant adverse effects on the environment and, where possible, enhance the environment. It also identifies 'residual' impacts, defined as impacts remaining following the implementation of mitigation measures.
- 1.2.7 Where necessary and appropriate, the PEI Report technical chapters identify mitigation measures that would be provided as part of the Scheme. Over and above the Scheme and any proposed mitigation measures, the Applicant is considering providing various ecological enhancement measures, to provide additional biodiversity benefits across the DCO Site. These enhancement measures are not required to mitigate any significant adverse impacts of the Scheme, which have already been identified in the proposed mitigation



measures. The Applicant may or may not provide those enhancement measures and one of the purposes of this consultation is to obtain people's views on the types of measures being considered. For those enhancement measures voluntarily provided, the effects of the Scheme, along with such measures, would be no worse than assessed in this PEI Report.

1.2.8 The structure of this PEI Report (i.e. beyond Chapter 5) is outlined in Table 1-1 below.

Table 1-1 PEI Report Structure

Volume	Chapter	Description
	Chapter 6: Climate Change Chapter 7: Cultural Heritage Chapter 8: Ecology and Biodiversity Chapter 9: Water Environment Chapter 10: Landscape and Visual Amenity Chapter 11: Noise and Vibration Chapter 12: Socio-Economics and Land Use Chapter 13: Transport and Access Chapter 14: Human Health and Wellbeing Chapter 15: Other Environmental Topics	The PEI Report considers the environmental effects associated with a number of identified topics, which may result in significant environmental effects. Each topic is presented in a separate technical chapter and details the results of the environmental assessment, likely significant effects arising from the Scheme, and the proposed mitigation measures. The chapters also present a high-level assessment of the potential cumulative effects resulting from other past, present or reasonably foreseeable projects together (i.e., cumulatively) with the Scheme where information is available. The full cumulative effects assessment will be presented within the ES. Chapter 15: Other Environmental Topics includes consideration of air quality, ground conditions, glint and glare, major accidents and disasters, telecommunications and waste.
	Chapter 16: Cumulative Effects and Interactions	The effect interactions that lead to combined effects on sensitive receptors are documented within this chapter.
	Chapter 17: Summary of Environmental Effects	A brief summary of the PEI Report outlining the residual significant effects remaining following the implementation of mitigation.
Volume 2	Figures	This contains a set of figures to accompany the PEI Report to aid the reader's understanding.
Volume 3	Technical Appendices	A set of appendices is provided for reference. These comprise background data, technical reports, tables, figures and surveys which support the assessments in this PEI Report.
-	Non-Technical Summary (NTS)	The NTS is presented in a separate document to provide a concise description of the Scheme, the considered alternatives, baseline, assessment methodology, potential environmental effects and mitigation measures. The NTS is designed to



Volume Chapter Description

provide information on the Scheme in an accessible format using non-technical language which can be understood by a wide audience and to assist interested parties with their familiarisation of the Scheme.

1.3 The Applicant

- 1.3.1 The Applicant, Gate Burton Energy Park Ltd is a development proposed by Low Carbon Ltd ('Low Carbon') a privately-owned UK investment and asset management company specialising in renewable energy.
- 1.3.2 Founded in 2011, Low Carbon is committed to making a positive and significant impact on climate change by investing in large-scale renewable energy projects across a range of energy technologies including solar PV, onshore wind, offshore wind, waste-to-energy, battery storage and other proven renewable energy technologies. Deploying capital at scale into renewables, it invests across the full life cycle from concept through to development, construction, and operation.
- 1.3.3 To date, the Low Carbon investment model has enabled the deployment of more than £600 million in capital into renewable infrastructure with more than 1GW already developed. Its proprietary renewable energy pipeline currently stands at more than 5GW, ideally positioning it to capitalise on investment opportunities as the need for green power and energy security increases. Low Carbon's investments are generating sufficient clean energy to power more than 390,000 homes, avoiding in excess of 750,000 tonnes of CO₂¹ each year.
- 1.3.4 Low Carbon has been active in large-scale solar energy since its formation in 2011. With an established track record in the UK, it also has operations in Europe including the Netherlands and the Republic of Ireland. Low Carbon is a certified B Corp.

1.4 Legislative and Planning Policy

Consenting Process

- 1.4.1 The Scheme is defined as a Nationally Significant Infrastructure Project ('NSIP') under Sections 14(1)(a) and 15(2) of the Planning Act 2008 (Ref 1-1) as an onshore generating station in England exceeding 50MW generating capacity.
- 1.4.2 The Planning Act 2008 provides that the Secretary of State is responsible for determining the application for development consent, with the power to appoint a single person or a panel from the Planning Inspectorate to manage and examine the application (referred to as the 'Examining Authority'). In its role, the Examining Authority will examine the application for the Scheme and

¹ Low Carbon internal calculations using OFGEM Typical Domestic Consumption Values and BEIS Carbon Conversion Factors.



- make a recommendation to the Secretary of State who will then decide whether to grant a DCO.
- 1.4.3 In accordance with Section 104(2) of the Planning Act 2008 (Ref 1-1), the Secretary of State is required to have regard to any relevant National Policy Statement ('NPS'), amongst other matters, when deciding whether or not to grant a DCO. For renewable energy proposals this would generally involve consideration of EN-1: Overarching NPS For Energy, EN-3 Renewable Energy Infrastructure and EN-5: Electricity Networks Infrastructure. The Secretary of State must also have regard to any other matter which he considers to be important and relevant to his decision.
- 1.4.4 At present the Scheme's proposed energy generating technology (i.e. solar) is not specifically considered by an NPS. However, the Government has consulted on revised versions of the Energy NPS's and the consultation draft of EN-3 now contains a chapter dedicated to solar energy technology. It is expected that the revised Energy NPSs will be adopted prior to DCO submission.
- 1.4.5 In the meantime, section 105(2) of the Planning Act 2008 (Ref 1-1) provides the basis for deciding the DCO application and the Secretary of State must have regard to the provisions set out in this section of the Planning Act 2008. This includes any matters which the Secretary of State thinks are both important and relevant to their decision. When granting consent for The Little Crow Solar Park Order 2022, the Secretary of State confirmed that the draft NPS are important and relevant for this purpose (Ref 1-18).
- 1.4.6 A DCO, if granted, has the effect of providing consent for development, in addition to a range of other consents and authorisations, where specified, as well as removing the need for some consents (such as planning permission). Section 115 of the Planning Act 2008 (Ref 1-1) also states that a DCO can include consent for 'associated development', which is development that is not a NSIP in its own right, but is functionally related to the NSIP. This may be development that supports the construction, operation or decommissioning of the NSIP; which helps to address the impacts of the NSIP; or is of a type normally brought forward with the NSIP.

EIA Regulations

- 1.4.7 The EIA Regulations specify which developments are required to undergo EIA and schemes relevant to the NSIP planning process are listed under either of 'Schedule 1' or 'Schedule 2'. Those developments listed in Schedule 1 must be subject to EIA, while developments listed in 'Schedule 2' must only be subjected to EIA if they are considered "likely to have significant effects on the environment by virtue of factors such as its nature, size or location". The criteria on which this judgement must be made are set out in Schedule 3.
- 1.4.8 The Scheme is a 'Schedule 2' development under Paragraph 3(a) of Schedule 2 of the EIA Regulations as it constitutes 'Industrial installations for the production of electricity, steam and hot water'.
- 1.4.9 The Applicant has confirmed to the Planning Inspectorate under Regulation 8(1)(b) of the EIA Regulations that an Environmental Statement (ES) will be provided with the DCO application for the Scheme (as required by Regulation



- 5(2)(a) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 ('APFP Regulations') (Ref 1-2), as it is considered there is the potential for the Scheme to meet the criteria set out in Schedule 3 of the EIA Regulations.
- 1.4.10 The issues that the Applicant considers the EIA will need to address were identified in the EIA Scoping Report submitted to the Planning Inspectorate on 12 November 2021 (PEI Report Volume 3: Appendix 1-A). The EIA Scoping Report was developed following initial consultation with a number of statutory consultees and was informed by the EIA team's experience working on a number of other solar farm projects. The Planning Inspectorate reviewed and consulted on the EIA Scoping Report and adopted (on behalf of the Secretary of State) a Scoping Opinion on 20 December 2021 (the Scoping Opinion) which included the formal responses received by the Planning Inspectorate from consultees (PEI Report Volume 3: Appendix 1-B). Key issues raised in the Scoping Opinion are summarised and responded to in PEI Report Volume 3: Appendix 1-C. All issues are being considered during the EIA process.

National Policy Statements

- 1.4.11 The EIA will consider the following NPSs, which are considered to be matters that will be important and relevant to the Secretary of State's decision as to whether to grant a DCO for the Scheme:
 - Overarching National Policy Statement for Energy (EN1) (Ref 1-4) plus draft revisions;
 - National Policy Statement for Renewable Energy Infrastructure (EN-3) (Ref 1-5) plus draft revisions; and
 - National Policy Statement for Electricity Networks Infrastructure (EN-5) (Ref 1-6) plus draft revisions.
- 1.4.12 A summary of the relevant considerations for each technical assessment is provided for each environmental topic (**Chapters 6 to 15** of this PEI Report).

National Planning Policy Framework

1.4.13 The National Planning Policy Framework (Ref 1-7) (NPPF) sets out the Government's planning policies for England and how these are to be applied. It is a material consideration in planning decisions under the Town and Country Planning Act 1990. Paragraph 5 of the NPPF makes it clear that the document does not contain specific policies for NSIPs and that applications in relation to NSIPs are to be determined in accordance with the decision making framework set out in the Planning Act 2008 (Ref 1-1) and relevant NPSs, as well as any other matters that are considered both important and relevant. However, Paragraph 5 goes on to confirm that the NPPF may be a matter that is relevant for the purposes of assessing DCO applications. The EIA for the Scheme therefore has regard to the relevant policies of the NPPF as part of the overall framework of national policy.



Local Planning Policy

- 1.4.14 Policies in Local Plans may be considered 'important' and 'relevant' matters and can influence the content of local impact reports (which the relevant local authorities pursuant to Section 56A of the Planning Act 2008 will produce following submission of the application for the DCO) which the Secretary of State must have regard to in its decision making in accordance with Section 105(2) of the Planning Act 2008.
- 1.4.15 The Scheme lies within the administrative areas of Bassetlaw District Council and West Lindsey District Council, and at county level within Nottinghamshire County Council and Lincolnshire County Council.
- 1.4.16 Whilst the NPSs are the primary consideration in deciding applications for NSIPs, the local Development Plan is also an important and relevant matter. The relevant Development Plan documents for the land in which the Scheme is located includes the following documents:
 - Central Lincolnshire Local Plan 2012-2036 (covering West Lindsey), adopted 24 April 2017 (Ref 1-8);
 - Lincolnshire Minerals and Waste Local Plan including the Core Strategy & Development Management Policies Plan adopted in June 2016 and the Site Locations Plan adopted in December 2017 (Ref 1-9);
 - Treswell and Cottam Neighbourhood Plan, made February 2019 (Ref 1-10);
 - Rampton and Woodbeck Neighbourhood Plan, made May 2021 (Ref 1-11);
 - Lea Neighbourhood Development Plan, made January 2018 (Ref 1-19);
 - Bassetlaw District Council Core Strategy and Development Management Policies DPD, adopted 22 December 2011 (Ref 1-12);
 - Nottinghamshire Minerals Local Plan, adopted March 2021 (Ref 1-13);
 - Nottinghamshire Waste Local Plan, adopted 2002 (Ref 1-14); and
 - Nottinghamshire Waste Core Strategy, adopted 2013 (Ref 1-15).
- 1.4.17 It should be noted that Bassetlaw District Council recently consulted upon a new Local Plan 2020-2037 (Publication version) in late 2021 and early 2022. Based on the current Local Development Scheme it is expected that submission of the Plan will be made in 2022 with the Council anticipating adoption in Spring 2023. Accordingly, upon adoption the Local Plan would replace the current Core Strategy and therefore policies within the emerging plan are relevant considerations with appropriate weight being applied relative to the stage of production.
- 1.4.18 Work on a review of the Central Lincolnshire Local Plan has commenced with consultation on a Proposed Submission Local Plan taking place between 16 March and 9 May 2022. Based on the most recent details on the preparation timetable it is likely that the Local Plan will be adopted at some point after the planned submission and examination of the Scheme. The Applicant will continue to monitor the progress of the review of the Central Lincolnshire Local Plan when preparing its DCO application and consider it as appropriate.



Consideration of Planning Policy in EIA

- 1.4.19 This PEI Report describes the national and local planning policies that are relevant to the assessment. It does not assess the accordance of the Scheme with planning policy. This will be undertaken and set out in the Planning Statement. The Planning Statement will be a separate document that will be submitted as part of the DCO application.
- 1.4.20 The purpose of considering the planning policy in the EIA is twofold:
 - To identify policies that could influence the sensitivity of receptors (and therefore the significance of effects) and any requirements for mitigation; and
 - To identify planning policies that could influence the methodology of the EIA. For example, a planning policy may require the assessment of an impact or the use of a specific methodology.
- 1.4.21 A summary of national and local planning policy relevant to each technical assessment is provided within the relevant chapters for each environmental topic.

1.5 IEMA Quality Mark

1.5.1 AECOM is an Institute of Environmental Management and Assessment (IEMA) Registered Impact Assessor and holds the IEMA EIA Quality Mark as recognition of the quality of our EIA product and continuous training of our environmental consultants. A Statement of Competence will be included within the ES, outlining the relevant expertise or qualifications of the experts who prepared the ES.

1.6 Purpose of the PEI report

- 1.6.1 This PEI Report has been prepared to accompany formal consultation under Sections 42 and 47 of the Planning Act 2008.
- 1.6.2 'Preliminary environmental information' is defined in the EIA Regulations as information "which (a) has been compiled by the applicant; and (b) is reasonably required for the consultation bodies to develop an informed view of the likely significant environmental effects of the development (and of any associated development)".
- 1.6.3 Planning Inspectorate Advice Note 7 (EIA: Process, Preliminary Environmental Information, and Environmental Statements) (Ref 1-3) notes: "A good PEI document is one that enables consultees (both specialist and non-specialist) to understand the likely environmental effects of the Proposed Development and helps to inform their consultation responses on the Proposed Development during the pre-application stage."
- 1.6.4 In order to enable consultees to understand the likely environmental effects of the Scheme, this PEI Report presents preliminary findings of the environmental assessments undertaken to date and does not represent a final project design or include final environmental assessment conclusions.



- 1.6.5 The various assessments have considered the environmental effects of the Scheme systematically in accordance with current industry good practice and relevant guidance.
- 1.6.6 The Applicant is seeking the views of consultees on the information contained within this report, and there is opportunity within the process up to submission of the DCO application for both the EIA and the project design to be refined.
- 1.6.7 Following statutory consultation on this preliminary environmental information, and once the design is further refined, this PEI Report will be developed into a final ES taking into consideration comments raised during the consultation. The ES will be submitted as part of the suite of DCO application materials.
- 1.6.8 Table 1-2 below summarises where the requirements of Schedule 4 of the EIA Regulations (Ref 1-15) have been addressed in the PEI Report.

Table 1-2 Requirements of Part 1 of Schedule 4 of the EIA Regulations

Requirement	Location in this PEI Report
A description of the location of the development	Chapter 1: Introduction (this chapter) Chapter 2: The Scheme
A description of the physical characteristics of the whole development including, where relevant, requisite demolition works, and the land-use requirements during the construction and operational phases.	Chapter 2: The Scheme
A description of the main characteristics of the operational phase of the development (in particular any production processes), for instance, energy demand and energy used, nature and quantity of the materials and natural resources used.	Chapter 2: The Scheme
An estimate, by type and quantity, of expected residues and emissions (water, air, soil and sub-soil pollution, noise, vibration, light, heat, radiation and types of waste produced.) during the construction and operation phases.	Chapter 2: The Scheme Chapter 6: Climate Change Chapter 9: Water Environment Chapter 11: Noise and Vibration Chapter 13: Transport and Access Chapter 15: Other Environmental Topics
A description of the reasonable alternatives which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.	Chapter 3: Alternatives and Design Evolution
A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the	Chapters 6-15 (technical assessments) Baseline Conditions sections



Requirement

Location in this PEI Report

availability of environmental information and scientific knowledge.

A description of the factors specified in regulation 5(2) likely to be significantly affected by the development: population, human health, biodiversity, land, soil, water, air, climate, material assets, cultural heritage, and landscape.

Chapters 6-15 (technical assessments) Likely Impacts and Effects sections

A description of the likely significant effects of the development on the environment resulting from, inter alia: The construction and existence of the development;

Chapters 6-15 (technical assessments) Likely Impacts and Effects sections

The use of natural resources considering as far as possible the sustainable availability of these resources;

The emission of pollutants, noise, vibration, light, heat and radiation, the creation of nuisances, and the disposal and recovery of waste;

The risks to human health, cultural heritage or the environment;

The cumulation of effects with other existing and/or approved projects;

The impact of the project on climate and the vulnerability of the project to climate change;

The technologies and the substances used.

The description of the likely significant effects on the factors specified in regulation 4(2) should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development.

A description of the forecasting methods or evidence, used to identify and assess the significant effects on the environment, including details of difficulties encountered compiling the required information and the main uncertainties involved.

Chap assess the significant effects on the environment, including details of difficulties encountered compiling the required information and the main uncertainties section.

Chapters 6-15 (technical assessments) Scheme Design, Impact Avoidance, Mitigation and Enhancement Measures, and Limitations or Assumptions sections

A description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements during both the construction and operational phases.

Chapters 6-15 (technical assessments) Design, Mitigation and Enhancement Measures sections

A description of the expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks Chapter 15: Other Environmental Topics section 15.6 Major Accidents and Disasters



Requirement	Location in this PEI Report
of major accidents and/or disasters which are relevant to the project concerned.	
A non-technical summary of the information provided under paragraphs 1 to 5 of this Part.	Non-Technical Summary
A reference list detailing the sources used for the descriptions and assessments	Chapters 1-17 Reference section



1.7 References

Ref 1-1 HMSO (2008) The Planning Act 2008, Available at: https://www.legislation.gov.uk/ukpga/2008/29/pdfs/ukpga 20080029 en.pdf. Ref 1-2 Ref 1-2HMSO (2009) Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009. Available at: https://www.legislation.gov.uk/uksi/2009/2264/contents/made. Ref 1-3 Planning Inspectorate (2020) Advice Note 7: EIA: Process, Preliminary Environmental Information and Environmental Statements. https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advicenotes/advice-note-seven-environmental-impact-assessment-process-preliminaryenvironmental-information-and-environmental-statements/. Ref 1-4 Department of Energy and Climate Change (DECC), (2011) National Policy Statement for Energy (EN-1), Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachme nt data/file/47854/1938-overarching-nps-for-energy-en1.pdf. Ref 1-5 DECC (2011) National Policy Statement for Renewable Energy Infrastructure (EN-3), Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachme nt data/file/47856/1940-nps-renewable-energy-en3.pdf. Ref 1-6 DECC (2011) National Policy Statement for Electricity Networks Infrastructure (EN-5), Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachme nt data/file/47858/1942-national-policy-statement-electricity-networks.pdf. Ref 1-7 Ministry of Housing, Communities and Local Government (MHCLG) (2021) National Planning Policy Framework, Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachme nt data/file/1005759/NPPF July 2021.pdf Ref 1-8 Lincolnshire County Council, "Central Lincolnshire Local Plan 2012-2036," Lincolnshire County Council, Lincoln, 2017. Ref 1-9 Lincolnshire Minerals and Waste Local Plan including the Core Strategy & Development Management Policies Plan adopted in June 2006 and the Site Locations Plan adopted in December 2017. Available at: https://www.lincolnshire.gov.uk/planning/minerals-waste. Ref 1-10 Treswell and Cottam Neighbourhood Plan, made February 2019. Available at: https://www.bassetlaw.gov.uk/planning-and-building/planning-services/neighbourhoodplans/all-neighbourhood-plans/treswell-neighbourhood-plan-made/. Ref 1-11 Rampton and Woodbeck Neighbourhood Plan, made May 2021. Available at: https://www.bassetlaw.gov.uk/media/6194/rampton-woodbeck-02-neighbourhood-planfinal.pdf. Ref 1-12 Bassetlaw District Council Core Strategy and Development Management Policies DPD, adopted 22 December 2011. Available at: https://www.bassetlaw.gov.uk/media/1543/cs1adoptedcorestrategy.pdf. Ref 1-13 Nottinghamshire Minerals Local Plan, adopted March 2021. Available at: https://www.nottinghamshire.gov.uk/planning-and-environment/minerals-localplan/adopted-minerals-local-plan. Ref 1-14 Nottinghamshire Waste Local Plan, adopted 2002. Available at: https://www.nottinghamshire.gov.uk/planning-and-environment/minerals-localplan/adopted-minerals-local-plan. Ref 1-15 Nottinghamshire Waste Core Strategy, adopted 2013. Available at: https://www.nottinghamshire.gov.uk/media/109118/waste-core-strategy-1.pdf. Ref 1-16 The Infrastructure Planning (Environmental Impact Assessment) (Amendment) Regulations 2017). Available at: https://www.legislation.gov.uk/uksi/2017/571/schedule/4/made. Ref 1-17 Low Carbon. About Low Carbon. Available at: https://www.lowcarbon.com/about-lowcarbon/. Ref 1-18 Department for Business, Energy and Industrial Strategy (2022) Planning Act 2008:

Application for Development Consent for Little Crow Solar Park. Available at:

https://infrastructure.planninginspectorate.gov.uk/wp-



Ref 1-19 Lea Neighbourhood Development Plan (2018) Available at: https://www.west-lindsey.gov.uk/planning-building-control/planning/neighbourhood-planning/all-neighbourhood-plans-west-lindsey/lea-neighbourhood-plan-made



2. The Scheme

2.1 Introduction

- 2.1.1 This chapter provides a description of the physical characteristics of the Scheme and the key activities that would be undertaken during the construction, operation and decommissioning stages. The description contained within this chapter informs each of the technical assessments provided in **Chapters 6 to 14**.
- 2.1.2 In this chapter, the 'DCO Site' (also referred to as 'the Site') is defined as comprising both the Solar and Energy Storage Park and the Grid Connection Route (**PEI Report Volume 2**: **Figure 1-2**).
- 2.1.3 This chapter is supported by the following Figures in **PEI Report Volume 2**:
 - Figure 2-1: Environmental Constraints;
 - Figure 2-2: Public Rights of Way (PRoW);
 - Figure 2-3: Construction Compound and Access Locations; and
 - Figure 2-4: Indicative Site Layout Plan.

2.2 The DCO Site and Surroundings

The DCO Site Boundary

- 2.2.1 The DCO Site (**PEI Report Volume 2: Figure 2-1**) straddles the boundary between the counties of Nottinghamshire and Lincolnshire, within the districts of Bassetlaw and West Lindsey.
- 2.2.2 The maximum extent of land that is expected to be included within the DCO Application, including the maximum areas of the Grid Connection Route, is shown on **PEI Report Volume 2: Figure 2-1**. It should be noted, this represents the current maximum extent of land being considered and will be further refined as the Environmental Impact Assessment (EIA) progresses.

Existing Conditions Within and Surrounding the Site

2.2.3 The landscape features within the DCO Site consist of agricultural fields interspersed with individual trees, woodlands, hedgerows, linear tree belts, farm access tracks, and local transport roads. The figures contained within Chapters 6 to 16 in PEI Report Volume 2 show the location of existing baseline features in relation to the DCO Site. The land is predominantly Grade 3b (moderate quality agricultural land) with some 3a (good quality agricultural land). The hedgerows within the DCO Site are predominantly low and intermittent. The arable fields are large and generally of regular shape. Woodland is more prevalent in the north of the DCO Site.



- 2.2.4 The landscape features immediately surrounding the Solar and Energy Storage Park comprise several small rural villages, including:
 - Gate Burton approximately 50m to the west;
 - Knaith approximately 200m to the west;
 - Marton approximately 500m to the south west; and
 - Willingham by Stow 700m to the east and Kexby 1.8km to the east.
- 2.2.5 The Grid Connection Route passes through largely agricultural land, to the immediate south and east of Marton, 400m to the north of Brampton in Lincolnshire, then 50m to the north of Cottam and 300m east of Rampton to connect with Cottam Power Station in Nottinghamshire.
- 2.2.6 There are limited industrial or commercial land uses within the immediate vicinity of the DCO Site. The A1500 (Stow Park Road/Till Bridge Lane) and A156 (Gainsborough Road) cross to the south and west, intersecting the Grid Connection Route, contrasting with the north-south alignment of the River Trent (crossed by the Grid Connection Route) and the railway line connecting Lincoln and Doncaster (which intersects the Solar and Energy Storage Park). The B1241 intersects the northern part of the Solar and Energy Storage Park, Marton Road and Willingham Road border the southern extent of the Solar and Energy Storage Park.
- 2.2.7 Neither the DCO Site nor the immediate surrounding area is covered by any statutory landscape designations, i.e. National Parks, or Areas of Outstanding Natural Beauty (AONB).
- 2.2.8 There are no SSSIs, SACs, SPAs, Local Wildlife Sites, scheduled monuments or listed buildings within the DCO Site. For further details refer to **Chapter 7: Cultural Heritage** and **Chapter 8: Ecology and Nature Conservation.**
- 2.2.9 There are five areas of ancient woodland within the DCO Site and within 2km of the DCO Site, these include:
 - Burton Wood is within the Solar and Energy Storage Park;
 - Stag Wood is approximately 190m to the north of the Solar and Energy Storage Park;
 - Thurlby/Caistor's Wood is approximately 825m north of the Solar and Energy Storage Park;
 - Lea Wood (includes replanted woodland) approximately 1.9km to the north of the Solar and Energy Storage Park; and
 - Unnamed ancient woodland (includes replanted woodland) approximately 1.9km to the north of the Solar and Energy Storage Park.
- 2.2.10 Within a 10km radius of the DCO Site, there are a number of statutory designated nature conservation sites, including Ashton's Meadow Site of Special Scientific Interest (SSSI) located 1.5km to the west of the DCO Site and Lea Marsh SSSI located 1.7km north west of the DCO Site. There are 11



non-statutory sites designated for nature conservation within 2km of the DCO Site, all are designated Local Wildlife Sites.

- 2.2.11 There are no Scheduled Monuments within the DCO Site and there are 9 Scheduled Monuments within 3km of the DCO Site. The site of Heynings Priory (NHLE 1008685) is located just outside the northern boundary of the Solar and Energy Storage Park Site; the site of Torksey medieval town (NHLE 1004991) is located to the east of the River Trent: the ruins of Torksev Castle. a 16th century (post-medieval) Elizabethan mansion (NHLE 1005056) are located north of Torksey medieval town; the Roman fort south of Littleborough Lane (NHLE 1004935) is located on the eastern side of the River Trent; the scheduled Roman town of Segelocum (NHLE 1003669) is on the western bank of the River Trent; the remains of a medieval Bishops palace (NHLE 1019229) are located at Stow Park; the site of a college and Benedictine Abbey (NHLE 1012976) is located at St Mary's Church in Stow; a moated manorial complex located north-west of Elm Tree Farm (NHLE 1016920) is located on the north-eastern edge of the 3km study area; a cross located within All Saint's Churchyard (NHLE 1018290) is located towards the northeastern edge of the 3km study area; the Hermit Dam moated site (NHLE 1016110) is located north of Knaith Park; Coates medieval settlement and moated site (NHLE 1016979) is located on the south-eastern edge of the 3km study area; and a medieval settlement and open field system to the south-east of Low Farm (NHLE 1017441) is located west of the River Trent.
- 2.2.12 There are no listed buildings within the DCO Site and there are 93 listed buildings within 3km of the DCO Site, comprising seven Grade I, six Grade II* and 80 Grade II listed buildings. These listed buildings are largely grouped in the settlements of Gate Burton, Lea, Upton, Brampton, Marton, Willingham, Stow and Torksey.
- 2.2.13 The DCO Site is not within a Conservation Area and there is one Conservation Area within 3km of the DCO Site. Gainsborough Riverside Conservation Area is located on the northern edge of the 3km study area.
- 2.2.14 There are no other designated heritage assets recorded within the 3km study area, including World Heritage Sites, Registered Parks and Gardens, or Registered Battlefields.
- 2.2.15 The Solar and Energy Storage Park is located predominantly within Flood Zone 1¹, with areas of Flood Zone 2² in the north. To the east of the DCO Site there is an area of Flood Zone 3³ associated with Padmoor Drain. To the west there is an area of Flood Zone 2 and 3 which is associated with the River Trent.

¹ Flood Zone 1 refers to land and property with a low probability of flooding (less than 1 in 1,000 annual probability of river or sea flooding).

² Flood Zone 2 refers to land and property with a medium probability of flooding (between a 1 in 100 and 1 in 1,000 annual probability of river flooding, or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.

³ Flood Zone 3 refer to land or probability with a high probability of flooding (greater than 1 in 100 annual probability of river flooding, or greater than 1 in 200 annual probability of sea flooding).



- 2.2.16 The Grid Connection Route is located predominantly within Flood Zone 3, with a small area located within Flood Zone 1 in the vicinity of Marton.
- 2.2.17 Other infrastructure within the surrounding area includes 400kV overhead powerlines carried by pylons. These extend from Cottam Sub Station within the Grid Connection Route.

2.3 Design Parameters

- 2.3.1 The design of the Scheme is an iterative process, based on preliminary environmental assessments and consultation with statutory and non-statutory consultees. **Chapter 3: Alternatives and Design Evolution** describes this process further, including options that have been considered and discounted or amendments made to the Scheme design to date.
- 2.3.2 A number of the design aspects and features of the Scheme cannot be confirmed until the tendering process for design and construction has been completed. For example, the enclosure or building sizes may vary, depending on the contractor selected and their specific configuration and selection of plant.
- 2.3.3 Use of design parameters is therefore adopted to present a likely worst-case assessment of potential environmental effects of the Scheme that cannot yet be fixed. Wherever an element of flexibility is maintained, the likely worst-case impacts are reported in this PEI Report and will be reported in the ES.
- 2.3.4 The EIA has therefore been undertaken adopting the principles of the 'Rochdale Envelope', as described in the Planning Inspectorate Advice Note 9 (Ref 2-1). This involves assessing the maximum (and where relevant, minimum) parameters for the Scheme where flexibility needs to be retained.
- 2.3.5 Work will continue to further refine the proposed options prior to submission of the DCO Application. Table 2-1 sets out the parameters that have been assessed within this PEI Report.
- 2.3.6 Each scheme component is described in more detail in Section 2.3. Each technical chapter within the PEI Report has assessed the design considered to be the likely worst-case scenario for that discipline to determine significance of effect.

Table 2-1 Design parameters used for the PEI Report assessment

Scheme Component	Parameter Type	Applicable Design Principle
PV Tables (i.e. the mounting structure) and PV Panels	Maximum height of Solar PV Panel above ground level (AGL)	The maximum height of the highest part of the PV Panel will be 3.5m AGL.
	Minimum height of the flood sensitive equipment AGL	The minimum height of the lowest part of the PV Panel will be 0.8m



Scheme Component	Parameter Type	Applicable Design Principle
		AGL except in zones of higher flood risk where they will be 1.1m AGL.
	Indicative footprint	Approximately 30m length x up to 9m wide per PV table.
	Indicative slope and orientation of the PV Tables from the horizontal	The PV Tables will slope towards the south, at a fixed angle of 5 to 45 degrees from horizontal.
	Indicative PV Panel colour	The PV Panels will be dark blue, grey, or black in colour.
	PV Mounting Structure	Will be galvanised steel or anodised aluminium poles driven or screwed into the ground. Indicative maximum depth of 2m.
	PV foundation	Galvanised steel or aluminium poles to be driven or screwed into the ground. Indicative maximum depth of 2m. Use of concrete pad foundations in areas identified for no beneath ground intrusion.
Solar PV Array Area	Location	The proposed area for the Solar PV Array (see Figure 2-4).
	Indicative separation distance between rows of PV Tables	2m at the closest point and 15m at the furthest point.
Power Conversion Station	Туре	A Power Conversion Station will comprise an inverter, a transformer, and switchgear, which can be grouped together or distributed throughout the Site. The Power Conversion Station can sometimes be enclosed in a single container.
	Indicative number of Power Conversion Stations	Approximately 143 subject to detailed design.



Scheme Component	Parameter Type	Applicable Design Principle	
	Indicative dimensions	When the Power Conversion Station is enclosed in a single container, the maximum dimensions will be up to 30 square meters and up to 3.5m height. When the Power Conversion Station components are procured independently, their collective square footage may be larger due to spacing between the items (the individual footprints are listed below).	
	Colour	Externally finished in a colour in keeping with the prevailing surrounding environment, often with a green painted finish.	
	Inverters (these convert the the PV panels into alternating	direct current electricity collected by ag current):	
	Type of inverter	Centralised or string inverters. The former is grouped together in a few locations, whereas the latter are located next to each PV row or attached to the rear of the PV Tables.	
	Indicative dimensions of inverters	For string inverters, the maximum parameters will be 1.5m length by 0.5m depth by 1m in height. These are small enough to be mounted underneath the panels.	
		For central inverters the maximum parameters will be 6m by 3m and up to 3.5m in height.	
	Transformers (these control the voltage of the electricity generated before it reaches the on site Substation):		
	Type of transformer	Transformers may be standalone units or pre-assembled with inverters and switchgear to form a single contained unit (i.e. enclosed).	
	Indicative dimensions of transformers	A maximum footprint of 4m x 3.5m and 3.5m in height for an outdoor solution, and a maximum footprint of 8m x 5m and with a height of 3.5m for an indoor solution.	



Scheme Component	Parameter Type	Applicable Design Principle	
	Colour of transformers	Typically finished in a colour in keeping with the prevailing surrounding environment, often with a grey or green painted finish	
	Switchgear (this is a combination of electrical disconnect switches, fuses or circuit breakers used to control, protect and isolate electrical equipment)		
	Type of switchgear	The switchgear may be an individual standalone unit within its own enclosure or may be pre-assembled with transformers and inverters to form a single contained unit.	
	Indicative dimensions of switchgear	Maximum footprint of 3m x 3.5m and up to 3.5m in height.	
	Colour of switchgear	Typically finished in grey.	
Low Voltage Distribution Cables	Туре	Low voltage cables, which transmit electricity from the Power Conversion Stations or BESS to the on-site substation. All cable circuits will be secured to the PV Tables or will be buried within underground trenches.	
	Indicative cable trench dimensions	Maximum dimensions: 0.8 – 1.2m depth, and up to 1.2m wide.	
BESS Compound (compound to house the BESS Battery Containers)	Туре	The compound will include battery storage containers, battery inverters, transformers and switchgear and access tracks.	
	Indicative dimensions	BESS to be installed in compound with a maximum footprint up to 210m x 290m.	
	Foundations	Concrete base or monolith plinth. Maximum depth of 1m.	
Battery Energy Storage System (BESS) Battery Containers	Dimensions	Maximum dimensions of one container: up to 4.5m in height, 12.5m by 2.5m footprint.	
	Colour	Typically finished in white, green or grey.	



Scheme Component	Parameter Type	Applicable Design Principle	
Battery Energy Storage System	Dimensions	Maximum dimensions: Up to 4.5m in height, 12.5m by 2.5m footprint.	
(BESS) Switchgear & Control Room	Colour	Typically finished in white, green or grey.	
	Indicative dimensions	Footprint of up to 250m x 160m in plan and up to 11m in height.	
On-Site Substation	Location	The on-site substation will be located to the west of the railway line within the area shown in PEI Report Volume 2: Figure 2-4.	
Control building and Office	Dimensions	Maximum parameters: 20m by 20m footprint and 6m in height, adjacent to the BESS Compound.	
Warehouse and storage building	Dimensions	Maximum parameters: 36m by 15m and 7.2m in height.	
Grid Connection (from On-Site Substation to National Grid Connection at	Max width (construction)	The approximately 7.5km cable route is expected to require a 30m to 40m wide working area for the purposes of construction with a small number of wider areas up to 60m width for example at the location of the HDD entry and exit pits. The cable route will be located within the Grid Connection Route described below.	
Cottam substation)	Max depth (construction)	For open trench excavation, up to 2.5m subject to design and ground conditions.	
		For horizontal directional drilling is up to 12m depth subject to design and ground conditions.	
National Grid	Point of Connection	At the existing National Grid Substation at Cottam Power Station.	
Connection	Substation	Modification work within the footprint of the existing substation.	

2.4 Components of the Proposed Scheme

2.4.1 The Scheme will consist of the principal infrastructure described in Table 2-1 and further below. To ensure that the likely significant environmental effects



- of the Scheme are no worse than those assessed in the EIA and the effect of the Scheme has been robustly assessed, the parameters set out in this chapter are the basis upon which the Scheme has been assessed
- 2.4.2 As the Scheme design develops, the configuration of the Scheme components will be determined based upon environmental and technical factors. The use of the Rochdale Envelope approach will ensure that the likely significant effects of the Scheme do not exceed the reasonable worst-case scenario presented in the ES accompanying the DCO application.
- 2.4.3 The Scheme components comprise:
 - PV tables (mounting structures) and panels;
 - Inverters;
 - Transformers:
 - An on-site Substation;
 - Onsite cabling;
 - An energy storage system;
 - A circa 7.5km electrical connection route to connect to the National Grid Substation at Cottam Power Station:
 - Fencing and security measures;
 - Access tracks; and
 - Landscaping and biodiversity enhancement.
- 2.4.4 During the construction phase, one main construction compound and three secondary compounds will be established as well as temporary roadways to facilitate access to all land within the Solar and Energy Storage Park.

Solar PV modules

- 2.4.5 Solar PV modules convert sunlight into electrical current (as direct current (DC)). Individual panels are typically up to 2.5m long and up to 1.5m wide and typically consist of a series of PV cells beneath a layer of toughened glass (as shown in Plate 2-1 and Plate 2-2). Other PV technologies are developing rapidly and may be available at the time of construction. The module frame is typically built from anodised aluminium or steel.
- 2.4.6 Each module would likely have a DC generating capacity of between 400 and 850 watts (W), or more depending on advances in technology at the time of construction (the latest technology under development is up to 850 W). The modules are fixed to a mounting structure in groups known as 'strings'. Various factors will help to inform the number and arrangement of modules in each string, and it is likely some flexibility will be required to accommodate future technology developments.
- 2.4.7 The number of PV Panels which will make up each PV Table is not yet known. Various factors will help to inform the number and arrangement, and it is likely some flexibility will be required to accommodate future technology



developments. For this reason, the assessment will be based on the parameters outlined in Table 2-1.

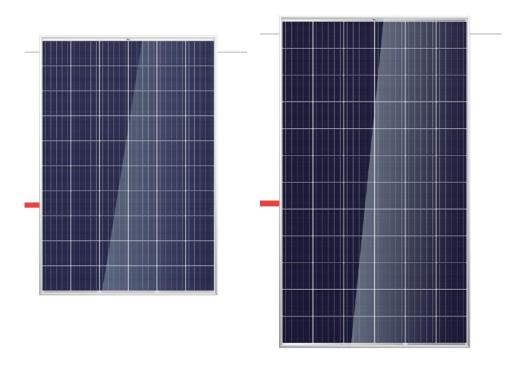


Plate 2-1 60 cells solar panel

Plate 2-2 72 cells solar panel

2.4.8 The PV Tables will slope towards the south at a fixed angle of 5 to 45 degrees from horizontal. For the purposes of assessment, a 15 degree slope is adopted which is considered to be the most likely option for the Scheme layout and informs the assessment of effects (predicted worst-case) for Glint and Glare and Landscape and Visual.

Module Mounting Structures

- 2.4.9 Each string of modules will be mounted on a metal rack, known as a frame. In all fixed panel options, the frames are usually supported by galvanized steel poles typically driven 1m 2m into the ground. This is the most common solution on existing UK solar farms.
- 2.4.10 For a south facing configuration, between each row of frames, the separation distance will range from approximately 2m to 15m, dependent upon angle and length of slope, to allow for appropriate maintenance and to minimise interrow shading.
- 2.4.11 The panel modules across the Solar and Energy Storage Park will be mounted on structures with a clearance AGL of up to 1.1m, and an upper height of up to 3.5m AGL. These dimensions are indicative at this stage as the final elevations of the racks will be influenced by various design factors such as local topography, flood risk and configuration.





Plate 2-3 Solar panels with south facing configuration

Supporting Infrastructure (Inverters, transformers, and switchgear)

- 2.4.12 The supporting infrastructure comprises inverters, transformers, and switchgear, which will be mounted on concrete foundations. This infrastructure is commonly termed as 'Power Conversion Stations' and fulfils a number of functions, namely converting the direct current to alternating current and stepping up the voltage, as well as containing isolators and monitoring equipment.
- 2.4.13 Two options are under consideration for the Power Conversion Stations, as described below.

Power Conversion Stations

- 2.4.14 A Power Conversion Station comprises the inverter, transformer, and switchgear. It could consist of the inverter, transformer and a switchgear being located separately (an "Outdoor Solar Station") or enclosed within a single container (referred to as "Indoor Solar Station"), as illustrated in Plate 2-4 and Plate 2-5.
- 2.4.15 The Power Conversion Stations will be located within the Solar PV Array area. A reasonable worst-case scenario has been assessed based on maximum parameters outlined in Table 2-1. It is anticipated that plant would be installed on compacted gravel and concrete bases.





Plate 2-4 Indoor equipment exterior (image reproduced courtesy of Power Electronics)

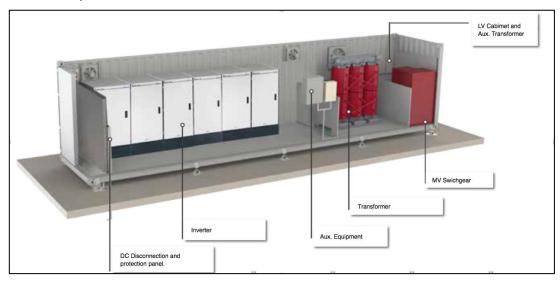


Plate 2-5 Indoor equipment interior (image reproduced courtesy of Power Electronics)
Inverters

2.4.16 As the Scheme design develops the likely configuration of equipment will be determined based upon environmental and technical factors, with string or central inverters being used. One single string inverter unit could be utilised, for example, for every 20 to 40 strings. String inverters are small enough to be mounted underneath the modules, as shown on Plate 2-6 and would be protected with mesh if sheep are to graze the site.





Plate 2-6 Typical string inverter (image reproduced courtesy of Huawei)

2.4.17 Central inverters are much larger because there are fewer of them and require their own electrical cabinet enclosures. These would be located at regular intervals amongst the PV arrays, and they occupy an area that depends on such intervals. Typically, this area is 6m x 3m and can be up to 3.5m in height.

Transformers

- 2.4.18 Transformers are required to step up the voltage of the electricity generated before it reaches the substation. Transformer cabins will therefore be located across the Solar and Energy Storage Park at regular intervals and would be outdoor or indoor.
- 2.4.19 The maximum footprint of an outdoor transformer would be up to 4m x 3.5m and 3.5m in height.
- 2.4.20 Indoor transformers can be installed in a cabin, jointly with indoor switchgear, typically with a footprint of 7m x 4m and with a height of 3.5m, as shown in Plate 2-7. Transformer cabins would be externally finished in keeping with the prevailing surrounding environment, often with a green painted finish. Alternatively, as described above, transformers can be installed in a high cube container together with an inverter and switchgear as part of an indoor solar station.





Plate 2-7 Typical transformer cabin (including switchgear) (alternative option for Solar Station) (Image reproduced courtesy of Selma)

Switchgear

- 2.4.21 Switchgear are the combination of electrical disconnector switches, fuses or circuit breakers used to control, protect and isolate electrical equipment. Switchgear is used both to de-energise equipment to allow work to be done and to clear faults downstream.
- 2.4.22 Switchgear have a typical footprint of 3m x 3.5m and up to 3.5m in height. Switchgear can be also located in a cabin together with the transformer and inverter.

Energy Storage Facility

- 2.4.23 The Scheme will include a battery energy storage system (BESS). The BESS is designed to provide peak generation and grid balancing services to the electricity grid. It will do this primarily by allowing excess electricity generated from the solar PV panels to be stored in batteries and dispatched when required. It may also import surplus energy from the electricity grid.
- 2.4.24 Batteries will be in individual enclosures or housed within a larger building or buildings. The precise number of individual battery storage enclosures will depend upon the level of power capacity and duration of energy storage that the Scheme will require; investigations are ongoing to determine this. There needs to be an element of flexibility in this element as both the technology and business models are evolving, as is relevant policy which may affect the business case and support for the systems.
- 2.4.25 The battery energy storage system will have a heating, ventilation, and cooling (HVAC) system to ensure the efficiency of the batteries, which are integrated into the containers. This may involve a HVAC system that is external to the



- containerised unit located either on the top of the unit or attached to the side of the unit. If this uses air to heat and cool it will have a fan built into it that is powered by auxiliary power.
- 2.4.26 The Switchgear/Control Room operates, isolates, and controls the exported power from the energy storage system. This would comprise a building of similar dimensions to the containers; either an adapted container or built from glass reinforced plastic (GRP), located within the main battery energy storage system compound.
- 2.4.27 Fire water would be stored within an onsite water tank and allowance made for fire water storage. The ES will contain details of the water supply (see Utilities below), tank dimensions and storage capacities.

On-Site Cabling

- 2.4.28 Low voltage on-site electrical cabling connects the PV modules and battery energy storage system to inverters (typically via 1.5/1.8kV cables), and the inverters to the transformers on-site (typically via 0.4/1 kV cables). The dimension of the trenches will vary depending on the number of ducts they contain but would typically be up to 1.2m in width and 0.8m to 1.2m in depth.
- 2.4.29 Medium voltage cables (around 33kV) are then required between the transformers and the switchgear and from switchgear to the on-site electrical infrastructure. The dimension of the trenches will vary depending on the number of circuits they contain but could be typically up to 1.2m in width and up to 1.2m in depth. Where possible, the higher voltage cables will share trenches with the lower voltage cables on the same route.
- 2.4.30 Cabling between PV modules and the inverters will typically be required to be above ground level (along a row of racks), fixed to the mounting structure, and then underground (between racks and in the inverter's input).
- 2.4.31 In identified archaeologically sensitive areas, cables will be installed to avoid or minimise disturbance below ground level.
- 2.4.32 Data cables will be installed, typically alongside electrical cables in order to allow for monitoring during operation, such as the collection of solar data from pyranometers and inverters.

Substation

- 2.4.33 A new on-site Substation will be located within the Solar and Energy Storage Park which will include transformers, switchgear and metering equipment required to facilitate the export of electricity to the National Grid.
- 2.4.34 The substation would have up to three transformers and would have a maximum footprint of up to 250m x 160m in plan and up to 11m in height. These maximum dimensions may be refined downwards as design and environmental assessment work continues.
- 2.4.35 The substation would also include a warehouse and storage building with a maximum footprint of 36m by 15m and a height of 7.2m and a control building,



- which would be up to 20m x 20m in plan, and up to 6m in height. This will include office space and welfare facilities as well as operational monitoring and maintenance equipment.
- 2.4.36 The substation will be connected to the PV modules and BESS via Medium Voltage Distribution Cables in order to collect electricity (at 33kV) from those components of the Scheme. The substation will convert the electricity to 400 kV for onward transmission to Cottam Substation via the Grid Connection Cable.

Fencing and Security

- 2.4.37 A security fence will enclose the operational areas of the Solar and Energy Storage Park. The fence will be similar to a deer fence or other mesh security fencing, approximately 2.5m to 3m in height. Pole mounted internal facing closed circuit television (CCTV) systems will be deployed around the perimeter of the operational areas of the Site. It is anticipated that these would be 5m high. CCTV cameras would be aligned to face internally and along the fence.
- 2.4.38 To comply with British Standard (BS) EN 62271-1:2017 (Ref 2-2), if outdoor transformers are used, they will be surrounded by a secure wire mesh fence. This fence is likely to be 1.8 to 2.5m in height.
- 2.4.39 Lighting sensors for security purposes will be deployed around the electrical infrastructure and potentially at other pieces of critical infrastructure. No areas are proposed to be continuously lit. It is anticipated that the lighting will be controlled via infrared.
- 2.4.40 The substation will also be fenced. This will be metal palisade fencing, approximately 2.5m in height.

Site Access and Access Tracks

- 2.4.41 For the Solar and Energy Storage Park, construction access would include up to four access/egress points: access to the main construction compound would be from one of two access options on the A156 Gainsborough Road (A156 Access Option North and A156 Option South). Other access/egress points include Kexby Lane North Access, Kexby Lane South Access and off Marton Road. Refer **PEI Report Volume 2: Figure 2-3** for locations. In addition, a new access would be constructed on the northern side of Cottam Road (in the vicinity of the existing power station access) and an access off the A156 south of Marton to provide construction vehicle access to the grid connection works. Refer to **Chapter 13: Transport and Access** for further information and the traffic and transport assessment.
- 2.4.42 Operational access would be from Gainsborough Road (A156), via Clay Lane (A156 Option South), together with a number of gated access points around the perimeter. The majority of routine visits by vans and four-wheel drive vehicles would utilise the Clay Lane rail underpass for access to the eastern part of the Site. If larger vehicles are required to access the eastern part of the



- Site, these would utilise the construction access points along Kexby Lane and Marton Road, which would be retained for the operational phase.
- 2.4.43 Access tracks will be constructed across the Solar and Energy Storage Park. These would typically be 3.5m to 6m wide compacted stone tracks with 1:2 gradient slopes on either side.

Surface Water Drainage

- 2.4.44 An outline Drainage Strategy will be developed alongside the impact assessment outlining how surface water will be managed in order to prevent any increase in flood risk. This would be developed into a detailed drainage strategy prior to construction. It will provide measures to manage drainage from new infrastructure required by the Scheme (e.g. PV panel arrays, access tracks and areas of hardstanding across the Site) and manage any required changes to existing land drainage arrangements.
- 2.4.45 The design of new drainage systems will be based on the Flood Risk Assessment (FRA), the preliminary results of which are provided within **Chapter 9: Water Environment**.
- 2.4.46 Infiltration drainage design will be in accordance with Building Research Establishment (BRE) Digest 365: Soakaway Design (Ref 2-3).

Biodiversity and Landscaping

2.4.47 The Scheme will involve new planting, field boundary enhancement and planting of seed mixes within the solar PV area as shown in **PEI Report Volume 2: Figure 2-4**. Planting will also be used to provide screening. The enhancements and planting would increase biodiversity and contribute to the Scheme achieving Biodiversity Net Gain (BNG) in line with the principles in the Environment Act 2021, PPF and local planning policy: Central Lincolnshire Local Plan (Ref 2-9), and Bassetlaw District Council Core Strategy and Development Management Policies DPD (Ref 2-10). Further information is provided within **Chapter 8: Ecology and Nature Conservation** and **Chapter 10: Landscape and Visual Amenity**.





Plate 2-8 Image showing enhanced planting surrounding the boundary of a PV farm (AECOM, 2021)

2.5 Construction

Construction Programme

2.5.1 Subject to being granted consent and following a final investment decision, construction is anticipated to start is Q1 2025 and construction will require an estimated 24 to 36 months, with operation therefore anticipated to commence around Q1 2028.

Construction Activities

- 2.5.2 The types of construction activities that are anticipated to be required include:
 - Site preparation;
 - Import of construction materials, plant and equipment to site;
 - Installation of utilities as required at compounds;
 - Establishment of construction compounds;
 - Upgrading of existing site tracks/access roads and construction of new tracks;
 - Marking out the location of infrastructure;
 - Import of components to site;
 - Erection of PV Mounting Structures;



- Mounting of PV Panels;
- Installation of electric cabling;
- Installation of Power Conversion Stations;
- Installation of BESS;
- Construction of on-site substation;
- Cable installation (including trenching);
- The establishment of mobilisation areas and running tracks;
- Stripping of topsoil in sections for the cable connection, sub-station and BESS area only;
- Trenching in sections;
- Appropriate storage and capping of soil;
- Appropriate construction drainage with pumping where necessary;
- Sectionalised approach of duct installation;
- Excavation and installation of jointing pits;
- Cable pulling;
- Testing and commissioning; and
- Site reinstatement and habitat creation.
- 2.5.3 The ES will provide further details of the proposed construction activities, their anticipated duration, along with an indicative programme of each phase of the works.

Solar and Energy Storage Park construction

- 2.5.4 The following activities will be undertaken to install the solar PV modules:
 - Import of components to site;
 - Piling and erection of module mounting structures;
 - Mounting of modules. This will be undertaken by hand;
 - Trenching and installation of electric cabling; and
 - Installation of Power Conversion Stations. Cranes will be used to lift equipment into position.

Construction of Electrical Infrastructure

- 2.5.5 The following activities will be undertaken to construct the onsite electrical infrastructure:
 - Site preparation and civils for the BESS Compound;
 - Trenching and installation of Distribution Cables;
 - Pouring of the concrete foundation base;



- Import of components to site. Cranes will be used to lift the components into position; and
- Installation of the BESS.

400kV Cable Connection to Cottam Sub-station

- The establishment of mobilisation areas and running tracks;
- Temporary construction compounds (to be located on or near the cable route, which are yet to be finalised);
- Stripping of topsoil in sections;
- Trenching in sections;
- Appropriate storage and capping of soil;
- Appropriate construction drainage with pumping where necessary;
- Sectionalised approach of duct installation;
- Excavation and installation of jointing pits;
- Cable joint installation;
- Cable pulling;
- Implementation of crossing methodologies for watercourses, infrastructure (including roads and rail), and sensitive habitats (e.g. Horizontal directional drilling, cable bridging);
- Testing and commissioning; and
- Site reinstatement and habitat creation.

On Site Sub-station and BESS Construction

- 2.5.6 The following activities will be undertaken to construct the On-Site Substation and BESS:
 - Topsoil strip and ground levelling;
 - Groundworks including piling and drainage installation;
 - Construction of foundations:
 - Installation of electric cabling;
 - Import of components to site; Installation of bus-bar, circuit breaker, isolators, earthing switch and transformers;
 - Installation of battery, transformers, inverters and switchgear; and
 - Installation of office, storage areas and warehouse.

Testing and Commissioning

2.5.7 Commissioning of the Scheme will include testing and commissioning of the process equipment. Commissioning of the solar PV infrastructure will involve mechanical and visual inspection, electrical and equipment testing, and commencement of electricity supply into the grid. Individual sub-systems will



be commissioned separately, with each having its own procedures and prerequisite lines, and it may be necessary to commission these elements separately or at the same time, depending on the end technology utilised at the time of construction.

2.5.8 This process will take place prior to operation of the Scheme which is anticipated to commence in 2028.

Construction Staff

2.5.9 At the peak of construction, which is expected to be during 2026, it is estimated that a maximum of up to 400 workers will be required. This number will be less at other times of the construction phase and if construction is carried out over a slightly longer period than the anticipated 36 months.

Construction Hours of Work

2.5.10 The core working hours are defined in Table 2-2.

Table 2-2 Core working hours

Works	Working hours
Summer	07:00 – 19:00 Monday to Friday and Saturday 09:00-13:00 with no Sunday or Bank Holiday working.
Winter	08:00 – 18:00 Monday to Friday and Saturday 09:00-13:00 with no Sunday or Bank Holiday working.

- 2.5.11 Some works activities may need to occur out of these hours/times due to activities requiring to be undertaken continuously (such as HDD and cable jointing). Where work outside of times is necessary prior notification will be provided to the LPA.
- 2.5.12 Additionally, quiet non-intrusive works such as the installation of PV modules may take place over longer periods during the high summer and other quiet non-intrusive works such as electrical testing, commissioning and inspection may take place over longer periods throughout the year.

Construction Traffic

- 2.5.13 An Access Strategy will be prepared to determine appropriate access during construction, operation, and decommissioning.
- 2.5.14 At this stage, it is anticipated that as a worst case during the peak construction period, there would be up to 60 HGV deliveries (120 movements) per day. In addition, there would be an average of approximately 30 Light Goods Vehicles (LGV) (60 movements) per day. There would also be an additional 154 daily vehicles associated with staff/ shuttle services (equating to 308 daily



- movements) during peak construction periods. Construction traffic predictions will be further refined and confirmed in the ES.
- 2.5.15 Temporary car parks will be provided within the proposed compound areas (**PEI Report Volume 2: Figure 2-3**). Construction workers will then be transported around site via mini-bus, or similar.
- 2.5.16 A Framework Construction Traffic Management Plan (CTMP) will be developed as part of the ES and will contain mitigation to avoid and/or reduce impacts relating to construction traffic including the delivery of materials and transport of staff during the construction phase.

Wheel Wash Facilities

2.5.17 A self-contained wheel wash will be installed near the site exits onsite to be used by vehicles prior to exiting the Site onto the public highway. For loads unable to use the fixed wheel wash, localised wheel washing would be set up to cater for these individually and as required to prevent detrimental effect to the highway.

Construction Compounds

2.5.18 In addition to the main compound and the three secondary compounds, smaller short-term use construction compounds will be located across the Site. The compounds will be approximately up to 150m x 150m and will contain a site office, mobile welfare units, canteen facility, a fenced area for storage and waste skips and space for short-term parking, storage, download and a turning area. The compounds will be converted to solar PV or landscaping at the end of their use.

Storage of Plant and Materials

- 2.5.19 No long-term onsite storage of materials is required during the construction phase. Materials will be delivered via HGVs at regular intervals to the construction compounds and transported directly to where it is required within the DCO Site using smaller LGVs.
- 2.5.20 Short term storage of materials and plant will be accommodated within the construction compound until required.

Spoil Management

- 2.5.21 There will be no site wide reprofiling required; however, there will be a need to level areas in a number of locations including the On-Site Sub-station and BESS. This is unlikely to create excess spoil and it is not expected that this would need to be removed from the DCO Site. Spoil material is only expected to be generated from cable trenches, temporary and permanent compounds, internal roads, BESS and On-Site Substation compounds.
- 2.5.22 During construction of the grid connection, spoil will be stored temporarily within designated areas adjacent to the cable route and within the construction compounds. The spoil will be utilised to backfill the cable trenches, reinstate



the temporary construction compounds and any temporary access roads. Any excess spoil will be utilised across the DCO Site. It is not anticipated that any spoil will be removed from the DCO Site.

Construction Lighting

2.5.23 During winter months, mobile lighting towers with a power output of 8kVA may be used during construction in isolated work areas. There will also be lighting at the main construction compounds while construction is underway.

Onsite Fuel

2.5.24 Fuel for machinery and generators will be delivered to site by a fuel truck and stored in above ground fuel storage tanks of 10–36 m³ capacity. The fuel storage tank will be sheltered, secured from unauthorised access, and equipped with a spill protection bund capable of holding 110% of the volume of the tank. Spill kits will be available at the fuelling point and other strategic locations of the construction site to allow for prompt clean up to limit soil and water contamination. Construction workers will be trained in spill kit use.

Utilities

- 2.5.25 It is expected that an electricity connection to the local electrical distribution network can be obtained for the temporary construction compounds to avoid the requirement for diesel generators. The connection options will be set out and assessed within the ES.
- 2.5.26 Based on an assumed 20 litres/day, an estimated 2,200m³ total (1,700m³ for welfare and 500m³ for wheel washes) of water will be required during construction to support welfare facilities onsite and other uses. The water will either be transported to the DCO Site by road from an existing nearby licenced water abstraction source and stored on site in tanks of up to 10m³ (10,000 litres) capacity or supplied through a mains connection.

Waste

2.5.27 Solid waste materials generated during construction will be segregated and stored onsite in containers of up to 30m³ capacity prior to transport to approved, licensed third party landfill and recycling facilities. During construction, removal of waste is estimated to require up to a maximum of 400 HGV loads over a period of 12 months, which equates to an average of just over 1 load per day. This will fluctuate with the largest waste numbers being the removal of pallets and recyclable cardboard during delivery of the PV modules.

Construction Environmental Management Plan and Construction Resource Management Plan

2.5.28 A Framework Construction Environmental Management Plan (CEMP) will be prepared to accompany the ES. This will describe the framework of mitigation measures to be followed, to be carried forward to a detailed CEMP prior to



construction. The aim of the CEMP is to avoid and/or reduce environmental impacts from:

- Use of land for compounds;
- Construction traffic (including parking and access requirements) and changes to access and temporary road or footpath diversions (if required);
- Noise and vibration;
- Utilities diversion;
- Dust generation;
- Soil removal;
- Lighting; and
- Waste generation.
- 2.5.29 The detailed CEMP will be produced by the Applicant following granting of the DCO and prior to the start of construction. It is expected the production of a CEMP will be a Requirement attached to the DCO. The CEMP will identify the procedures to be adhered to and managed by the Applicant and its contractors throughout construction.
- 2.5.30 Contracts with companies involved in the construction works will incorporate environmental control, health and safety regulations, and current guidance and will ensure that construction activities maximise opportunities for the incorporation of sustainability principles and that all contractors involved with the construction stages are committed to agreed best practice and meet all relevant environmental legislation including: Control of Pollution Act 1974 (COPA) (Ref 2-5), Environment Act 1995 (Ref 2-6), Hazardous Waste (England and Wales) Regulations 2005 (Ref 2-7) and the Waste (England and Wales) Regulations 2011 (Ref 2-8).
- 2.5.31 Records will be kept and updated regularly, ensuring that all waste transferred or disposed of has been correctly processed with evidence of signed Waste Transfer Notes (WTNs) that will be kept on-site for inspection whenever requested. Furthermore, all construction works will adhere to the Construction (Design and Management) Regulations 2015 (CDM) (Ref 2-4).

Site Reinstatement and Habitat Creation

- 2.5.32 Prior to and during the construction phase, and following construction, a programme of site reinstatement and habitat creation will be implemented.
- 2.5.33 The Scheme has been designed to integrate with and enhance the local green infrastructure network, improving ecological connectivity across the DCO Site. The initial proposed planting design shown in PEI Report Volume 2: Figure 2-4 has responded to the varied character by allowing views to remain open, where tall screening would not be appropriate. New planting would include:
 - New native hedgerows;



- Native hedgerow enhancement, gapping up and infill planting;
- New native grassland buffer planting to form ecological corridors;
- Native linear tree belts; and
- New species rich grassland and amenity grassland mixes under the panels and along perimeter buffers.
- 2.5.34 New species rich grassland will be created in advance of construction so that any displaced bird populations have alternative areas of habitat available during construction.
- 2.5.35 Embedded mitigation measures for the construction phase will be set out in the Framework CEMP as part of the ES, including measures such as construction and exclusion zones in relation to retained vegetation, heritage exclusion zones, lapwing fields, skylark plots, stockpile management, and storing topsoil in accordance with best practice measures.
- 2.5.36 A Framework Landscape and Biodiversity Management Plan (LBMP) will be prepared to accompany the ES. This document will set out the principles for how the land will be managed throughout the operational phase, following the completion of construction. A detailed Landscape and Ecology Management Plan will be produced following the granting of the DCO and prior to the start of construction and will be secured as a Requirement attached to the DCO.

2.6 Operational Activities

- 2.6.1 During the operational phase, activity on the Solar and Energy Storage Park will be limited and would be restricted principally to vegetation management, equipment maintenance and servicing, periodic replacement of components, periodic fence inspection, and monitoring to ensure the continued effective operation of the Scheme.
- 2.6.2 Given the 60-year operational life of the Scheme, there will be requirement for periodic replacement of some or all of the Solar and Energy Storage Park elements. The ES will include an assessment of the likely impact of component replacement (e.g. panels, batteries, inverters, transformers) and outline what measures will be put in place to ensure that these components are able to be diverted from the waste chain.
- 2.6.3 Access during the operational phase is expected to be from Gainsborough Road (A156), via Clay Lane, Kexby Lane and Gainsborough Road (B1241) together with a number of gated access points around the perimeter. These access points will be identified within the ES.
- 2.6.4 Fire suppression water at the BESS will be provided either via a connection to an existing water pipeline or will be stored on site in tanks.
- 2.6.5 It is anticipated that there will be up to fourteen permanent FTE staff during the operational phase working on a site and flexible office basis. Operational staff are expected to travel to site by four-wheel drive vehicle or medium/large van.



2.6.6 The design life of the Scheme is 60 years; however, if equipment is still operating successfully and safely, the Applicant may choose to operate beyond the Scheme's originally anticipated design life. This is a common occurrence for generating stations. Many stations operate beyond the design life if they are well maintained.

2.7 Decommissioning

- 2.7.1 The design life of the Scheme is expected to be at least 60 years, although the operational life could be longer than this; the condition of equipment will be reviewed at the end of the anticipated design life to determine whether it remains in a viable condition to continue operation after that time.
- 2.7.2 When the operational phase ends, the Solar and Energy Storage Park will require decommissioning. All PV modules, mounting poles, inverters and transformers would be removed and recycled or disposed of in accordance with good practice and market conditions at the time. Buried medium voltage cables would either be removed or left in situ. The majority of the Solar and Energy Storage Park would be returned to the landowner after decommissioning and will be available for its original use. The future of the substations and associated control buildings would be agreed with the relevant Local Planning Authority prior to commencement decommissioning. A Decommissioning Environmental Management Plan, to include timescales and transportation methods, would be agreed in advance with the relevant Local Planning Authority.
- 2.7.3 Decommissioning is expected to take between 24 and 48 months and would be undertaken in phases.
- 2.7.4 The effects of decommissioning are usually like or of a lesser magnitude than construction effects and will be considered in the relevant sections of the ES. The specific method of decommissioning the project at the end of its operational life is uncertain at present as the engineering approaches to decommissioning will evolve over the operational life of the Scheme.

Waste

2.7.5 Removal of waste is estimated to require approximately 1,300 HGV loads over a period of 12 months, which equates to an average of eight loads per day.

Land Reinstatement

- 2.7.6 The majority of land within the Solar and Energy Storage Park will be returned to its original use after decommissioning with medium voltage buried cables remaining in situ. Any modification work to the National Grid Cottam Substation to facilitate the connection would remain under National Grid's control. It is not currently known if the buried 400 kV cables would be left in situ or removed. For the purposes of assessment, both scenarios will be considered within the ES.
- 2.7.7 It is anticipated that some areas of habitat and biodiversity mitigation and enhancement may be left in-situ for species protection. Any required species licences would be obtained for reinstatement works if necessary.



2.8 References

- Ref 2-1 Rochdale Envelope: Planning Inspectorate Advice Note 9 (2008). Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2013/05/Advice-note-9.-Rochdale-envelope-web.pdf
- Ref 2-2 British Standards Institute (BSI) (2017) BS EN 62271-1:2017 High-voltage switchgear and controlgear. Common specifications for alternating current switchgear and controlgear. Brussels: BSI.
- Ref 2-3 Building Research Establishment (BRE) (2012) Digest 365: Soakaway Design and Sewers for Adoption (7th Edition). Watford: BRE.
- Ref 2-4 HMSO (2015) Construction (Design and Management) Regulations 2015. Available at: http://www.legislation.gov.uk/uksi/2015/51/pdfs/uksi_20150051_en.pdf.
- Ref 2-5 HMSO (1974); Control of Pollution Act 1974. Available at: https://www.legislation.gov.uk/ukpga/1974/40/pdfs/ukpga_19740040_en.pdf.
- Ref 2-6 HMSO (1995); Environment Act 1995. Available at: https://www.legislation.gov.uk/ukpga/1995/25/pdfs/ukpga_19950025_en.pdf.
- Ref 2-7 HMSO (2016); The Hazardous Waste (Amendment) Regulations 2016. Available at: http://www.legislation.gov.uk/uksi/2016/336/made.
- Ref 2-8 HMSO (2014); Waste (England and Wales) (Amendment) Regulations 2014. Available at: https://www.legislation.gov.uk/uksi/2014/656/contents/made.
- Ref 2-9 Lincolnshire County Council, "Central Lincolnshire Local Plan 2012-2036," Lincolnshire County Council, Lincoln, 2017.
- Ref 2-10 Bassetlaw District Council Core Strategy and Development Management Policies DPD 2011. Available at: https://www.bassetlaw.gov.uk/media/1543/cs1adoptedcorestrategy.pdf



3. Alternatives and Design Evolution

3.1 Introduction

- 3.1.1 This chapter of the Preliminary Environmental Information (PEI) Report describes the consideration of alternatives and design evolution in relation to the Scheme.
- 3.1.2 Paragraph 2 of Schedule 4 of the EIA Regulations (Ref 3-1) requires "A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects" to be presented in the Environmental Statement.
- 3.1.3 When considering assessment principles, National Policy Statement (NPS) EN-1 (Ref 3-2) paragraph 4.4.1 states that "as in any planning case, the relevance or otherwise to the decision-making process of the existence (or alleged existence) of alternatives to a proposed development is in the first instance a matter of law, detailed guidance on which falls outside the scope of this NPS". The NPS confirms that the NPS does not contain any general requirement to consider alternatives or to establish whether a development represents the best option.
- 3.1.4 It does, however, highlight that in addition to the requirement under the EIA Regulations set out above and referred to in the first bullet of paragraph 4.4.2 of NPS EN-1, there are other specific legislative requirements and policy circumstances which require the consideration of alternatives.
- 3.1.5 These include a requirement under the Habitats Directive, as transposed into UK law by the Conservation of Habitats and Species Regulations 2017, and also in relation to avoiding significant harm to biodiversity and geological conservation interests, flood risk, and development within nationally designated landscapes set out in sections 5.3, 5.7 and 5.9 of NPS EN-1. Paragraph 4.4.3 of NPS EN-1 states "where there is a policy or legal requirement to consider alternatives the applicant should describe the alternatives considered in compliance with these requirements".
- 3.1.6 Taking into consideration the policy and legal requirements as well as the iterative approach to the design to date, the following alternatives have been considered for the Scheme and are discussed in this chapter:
 - Alternative sites;
 - Alternative layouts;
 - Alternative cable route corridors; and
 - Alternative grid connection options at Cottam.



- 3.1.7 Consideration of 'no development' as an alternative to the Scheme has not been considered further. This is because 'no development' is not considered to be a reasonable alternative to the Scheme as it would not deliver the proposed additional electricity generation capacity. Other generation schemes such as wind power, nuclear, coal or gas fired power stations have also not been assessed, due to their obvious unsuitability to the DCO Site or inability to contribute to the UK's net zero aspirations.
- 3.1.8 Upon identification of the DCO Site, there were several stages of design evolution that took place. At EIA Scoping stage, the area under consideration (as shown on **PEI Report Volume 2: Figure 3-1**) comprised an area of 1654 ha to ensure that the maximum area of known works under consideration was assessed. The same area was considered at the Non-Statutory consultation stage, and then refined through desktop review, technical surveys, site visits and assessments for the PEI Report.
- 3.1.9 A grid connection corridor assessment was a significant contributing factor to refining the DCO Site boundary at PEI Report Stage, for the Grid Connection Route. Further information on this is detailed within Table 3-1 and Section 3.6.

3.2 Need for the Scheme

- 3.2.1 The Scheme's objective is to generate low-carbon electricity for an operational period of 60 years, to contribute to meeting the UK's urgent need for significant amounts of new large-scale low-carbon electricity generation infrastructure as established in National Policy Statement (NPS) EN-1 (Ref 3-5). The NPS sets out national policy for energy infrastructure.
- 3.2.2 EN-1 makes clear that in order to diversify and decarbonise electricity generation the Government is committed to "increasing dramatically the amount of renewable generation capacity". It goes onto highlight that "an increase in renewable electricity is essential to enable the UK to meet its commitments under the EU Renewable Energy Directive"
- 3.2.3 The inclusion of electricity (battery) storage assets provides a means of further enhancing the utility of the electricity generated by the Scheme by providing energy balancing capability (storing surplus renewable energy and releasing it to the grid when it is needed) alongside other system balancing services to support the operation of the National Electricity Transmission System.
- 3.2.4 Decarbonisation is a UK legal requirement and is of global significance. In June 2019, Government, passed "Net Zero" law to end the UK's contribution to global warming by 2050. The Government's independent expert, the Climate Change Committee (CCC), recommend Carbon Budgets which, once adopted by Government, set in law the trajectory for decarbonisation actions consistent with meeting the Net Zero commitment. In recommending Carbon Budgets the CCC recognise that atmospheric carbon has a cumulative global heating effect and therefore urgent action is necessary. The Sixth Carbon Budget (enshrined in law in June 2021) runs from 2033 to 2037, and requires a 78% reduction in UK territorial emissions between 1990 and 2035.



- 3.2.5 Decarbonisation requires the substitution of energy currently generated by burning fossil fuels, by energy from low-carbon sources. UK electricity demand is expected to double by 2050 because the UK's pathway to achieving Net Zero by 2050 will decarbonise transport, industry, agriculture and homes through electrification.
- 3.2.6 Emerging energy vectors, such as hydrogen, are also earmarked to enable the decarbonisation of traditionally hard-to-reach sectors, such as chemical processing and freight transport. A major source of hydrogen is expected to be through the electrolysis of water using low-carbon electricity. The need for a significant growth in new low carbon generation assets, including well-proven renewable technologies such as solar, is therefore clear.
- 3.2.7 The UK's energy security needs must also be met, and the decommissioning of existing generation assets increases the requirement to develop new lowcarbon generation with urgency in order to "keep the lights on". Nuclear power has historically met approximately 20% of demand in the United Kingdom, but existing nuclear stations began to close in 2021. Only one will remain beyond 2028 and only one new nuclear project is currently under construction. Any others will be unlikely to commission before the mid-2030s. Only one UK coal station is still in operation and it will close before 2024. Carbon Capture Use and Storage (CCUS) is being developed to support Net Zero by facilitating the decarbonisation of the UK's CCGT fleet, decarbonising industry, producing low-emissions hydrogen (an alternative to electrolysis) and delivering greenhouse gas removal technologies. Recent progress has been made towards bringing CCUS clusters forward by the end of the decade however Government recognises that "the technology has not been delivered at scale and significant risks remain".
- 3.2.8 The British Energy Security Strategy (Ref 3-6) sets out Government's strategy to address the country's underlying vulnerability to international oil and gas prices by accelerating the transition away from oil and gas through the roll out of new renewables. The UK has substantial renewable energy resources, including 40% of Europe's wind resource. Government signalled its intention to target 50GW of offshore wind to be operational by 2030 (an increase of 10GW in its previous target). But wind on its own is not sufficient and the same strategy expects the 85% cost reductions achieved in solar over the last decade (solar is already a leading low-cost generation technology in the UK) to drive an increase in deployment by 2035.
- 3.2.9 The development of large-scale solar in the UK (National Grid estimates up to 39.7GW by 2030 rising to 88.6GW by 2050) will provide an essential diversity to the UK's low-carbon generation portfolio, working with other technologies to deliver security of supply and value to UK consumers. Solar generation is a critical element of the plan to decarbonise the UK electricity sector with urgency and the national need for solar generation is urgent. The solar capacity required is significantly greater than the capacity of projects currently understood to be in development.
- 3.2.10 Solar addresses all important aspects of existing and emerging government policy. It will make a critical and timely contribution to decarbonisation and security of supply in the UK, will help shield consumer bills from volatile energy



- prices, and provides the potential to deliver biodiversity net gains through its development.
- 3.2.11 More detailed information on the need for the Scheme will be presented in the FS

3.3 Alternative Sites

- 3.3.1 The DCO application will be accompanied by an Alternative Site Assessment report which documents the multi-staged evaluation process which to the identification of the DCO Site.
- 3.3.2 This process consists of four distinct stages which can be summarised as follows:
 - Stage 1 identification of a 5km area of search for potential solar development sites which is based around operational criteria associated with the agreed and fixed point of connection;
 - Stage 2 within the study area identified via Stage 1, exclusionary and discretionary planning and environmental criteria are applied to discount land within the area of search where it would be unsuitable to locate a solar scheme;
 - Stage 3 of the land that remains within the area of search after the Stage 2 criteria has been applied a series of inclusionary criteria is applied such as site size, field size, topography, access, brownfield land and land allocated for energy use (where applicable). This stage identifies land which would be suitable for solar development; and
 - Stage 4 undertakes a desktop assessment and evaluation by qualified environmentalist and planning specialists which considers up to five discreet locations. This process demonstrates the most suitable land opportunities which are potentially available for the siting of a solar scheme should the land be available for such development.
- 3.3.3 The outputs from this study and the consideration of alternatives are then taken forward into the consideration of alternatives within the Environmental Statement.

3.4 Alternative Technology

3.4.1 As described in Chapter 2: The Scheme, the parameters of the DCO Application will maintain some degree of design flexibility to allow the latest technology to be utilised at the time of construction. Notwithstanding this, several technological design options have been considered and preferred options taken forward taking into consideration environmental effects and the Scheme's objectives and need for optimal functionality.

DCO Site and Alternative Layouts

3.4.2 The layout of the Scheme has evolved iteratively and will continue to evolve through the EIA process taking into consideration environmental effects, the



- Scheme's objectives and functionality, and feedback from stakeholders and the Statutory consultation process.
- 3.4.3 The purpose of this section is to describe the alternative layouts considered for the Scheme to date. The Design & Access Statement, which will be submitted with the DCO Application, will explain the design evolution of the Scheme. Table 3-1 summarises the main design layout iterations considered so far for the Scheme. The following figures (as shown in **PEI Report Volume 2**) illustrate the changes in terms of land area:
 - **Figure 3-1:** EIA Scoping Site Boundary (which illustrates the boundary at EIA Scoping Stage); and
 - **Figure 1-2:** Site Boundary (which illustrates the current boundary for this PEI Report).



Table 3-1: Main Design Iterations for the DCO Site

Stage	Proposed Layout	Consultation which influenced the proposed layout at this stage	Design evolution
EIA Scoping (12 November 2021)	Solar and Energy Storage Park Comprised several parcels of land within the Solar and Energy Storage Park	This was prior to extensive consultation with relevant stakeholders and therefore was not influenced by external parties.	The EIA Scoping Site Boundary was produced with data from desk based and preliminary environmental surveys and was adopted with a view to including in the Scoping Report any land that could ultimately be within the DCO Site. The intention was that the area would be further refined following surveys, environmental assessment, and consultation.
	Grid Connection Route Four grid connection corridors were proposed		
	The Scoping Report Boundary, has an area totalling 1654ha		
Non-Statutory Consultation ndicative Concept Masterplan January / Eebruary 2022)	Solar and Energy Storage Park: The Concept Masterplan covered the Solar and Energy Storage Park and used the same boundary as	Receipt of the Scoping Opinion Landowner discussions	The Non-Statutory Consultation Indicative Concept Masterplan was developed with the feedback from the EIA scoping process, the design team, preliminary environmental mitigation recommendations in particular key areas for planting and screening, development of the Design Principles and ongoing landowner discussions.
and Grid Connection Options	shown for Scoping. Grid Connection Route:		



Stage	Proposed Layout	Consultation which influenced the proposed layout at this stage	Design evolution
	Four broad corridors were still included for the grid connection.		
	The total area remained the same as in the Scoping Report Boundary - 1654ha.		
PEI Report Layout (June 2022)	The current DCO Site comprises several parcels of land separated by areas of woodland totalling 1436 ha comprising both the Solar and Energy Storage Park and a single grid connection corridor. The Grid Connection Route taken forward is discussed further in Section 3.5 below. This is a reduction in size from EIA Scoping and the Non-Statutory Consultation.	Landowner discussions Non-statutory consultation feedback Agricultural Land Classification Surveys Environmental Surveys and desktop study, including landscape and visual, ecology, heritage, noise, transport, water and flood risk and other topics forming the PEI Report. Grid Connection Options Analysis.	Further reduction in land and refinement of the layout plan following desktop analysis and site surveys. Solar and Energy Storage Park: The larger built elements of the solar farm, such as the substation and BESS have been carefully located in areas of reduced flooding and are screened by existing woodland with views further screened by topography and existing vegetation. As a result of the environmental design process the Scheme incorporates the following design principles: Provision of buffers and offsets from existing landscape features such as ponds, hedgerows, woodland and Public Rights of Way. A heritage setting buffer to provide offset from listed buildings at Gate Burton, at the Solar and Energy Storage Park's western boundary. New grassland and wildflower mixes under the panels to enhance the range of fauna, enhancing biodiversity and providing resource for pollinators. Screening and planting design to reduce visual impact by providing environmental enhancement areas, off-sets and buffer zones.



Stage	Proposed Layout	Consultation which influenced the proposed	Design evolution
		layout at this stage	

- Siting of infrastructure to avoid below ground archaeological features wherever possible. Screening and planting will be designed to minimise impact on the setting of heritage assets.
- No disturbance to Burton Ancient and Semi-Natural Woodland.

These design principles are illustrated on **PEI Report Volume 2: Figure 2-4**:. This design has been developed for the PEI Report to respond to the environmental opportunities and constraints of the DCO Site and non-statutory consultation feedback, particularly in relation to scale, proximity to existing residential areas, visual impact, and ecological and heritage assets. This has identified developable areas for solar PV, battery storage and suitable locations for associated infrastructure as well as environmental mitigation.

Grid Connection Route:

Further refinement to the Grid Connection Route has been undertaken, with a single route selected from the original four presented in the EIA Scoping Report. Further information on this selection process is described in Section 3.5 below.



3.5 Alternative Cable Route Corridors

- 3.5.1 An optioneering process has been undertaken to identify the cable route corridors for the Scheme to connect to the existing Cottam Substation.
- 3.5.2 Four corridors for connection to Cottam substation were considered at EIA Scoping and non-statutory consultation stage. The four corridors considered are shown on **PEI Report Volume 2: Figure 3-2**.
- 3.5.3 An options appraisal exercise was undertaken to identify and review the planning, engineering, property and environmental constraints within each of the Corridors in order to identify a preferred corridor.
- 3.5.4 The options appraisal exercise and the non-statutory consultation undertaken in February 2021 included consideration of both an overhead power line (OHL) and an underground cable.
- 3.5.5 The corridors considered are referred to as Corridors A, B, C1 and C2 and are shown in **PEI Report Volume 2: Figure 3-2.**
- 3.5.6 Key feedback from the environmental and social options appraisal and the non-statutory consultation was:
 - An underground cable was identified as preferred during non-statutory consultation due to lower visual effect and less intrusion in the area particularly north and south of Marton, either side of the River Trent where the landscape is relatively flat and open, and at residential and agricultural properties between Cottam and Littleborough;
 - Installation of an OHL across the River Trent would potentially give rise to ecological Likely Significant Effects (LSEs) due to increased risk of collision of birds, including swans, geese and ducks using the River Trent corridor;
 - The River Trent is a major arterial river which results in a focus of historic settlement and development adjacent to the river. In all corridors, there are significant known archaeological assets. Should an underground option be progressed, further archaeological evaluation would be required to maximise opportunities to avoid impact to archaeological deposits;
 - An OHL option in Corridors A, B and C2 would give rise to significant permanent effects to designated built heritage assets including the parkland garden of Knaith Hall Grade II listed building, Gate Burton Grade II* listed building, the Burton Chateau Grade II* listed building, a Grade II listed building at Littleborough Cottage, the Grade II* listed Church of St Peter and St Paul in Sturton le Steeple, and a cluster of listed buildings at Torksey including the Grade I listed Torksey Castle (also a scheduled monument) and the Grade II* listed Torksey Viaduct over the River Trent;
 - In terms of air quality, noise and vibration and traffic and transport, there
 was relatively little to differentiate the corridors as they all cross the A156
 and the River Trent, have a similar number of receptors, and would be



likely to utilise similar access routes (being the A156 east of the River Trent and Cottam Road and Northfield Road west of the River Trent), for the purposes of construction;

- An OHL option was preferred for surface water, drainage and flood risk due to the more limited nature of intrusion during construction; and
- The existing flood defence embankments on the eastern and western sides of the River Trent were identified as a key constraint. Whichever option is adopted would be required to ensure no impact to the structure and integrity of the flood defence embankments.

3.6 Selection of the Preferred Corridor

Following receipt of the above feedback and the environmental options appraisal:

- Corridor C2 was ruled out on the basis of the significant number of ecological and heritage constraints together with the narrow nature of the corridor meaning opportunities to avoid constraints during detailed design would be limited;
- The OHL option was identified as less preferred. Whilst the cable may be required to be above ground in a number of locations (for example at the Cottam substation connection point or to avoid beneath ground archaeological assets), the general design principal of undergrounding the cable wherever possible was adopted;
- An OHL option in Corridor A and B was ruled out due to the high level of certainty that this option would give rise to Likely Significant Effects (LSEs) to the Grade II* listed buildings in those corridors, together with their setting:
- Further targeted archaeological work including walk-over, consultation, aerial analysis, and extended desk-top research was undertaken for Corridors A, B and C1; and
- This work resulted in ruling out Corridors A and B due to the presence of two scheduled monuments, the Roman Town at Segelocum, the Roman fort south of Littleborough Lane and the medieval moated site at Fleet Plantation.
- 3.6.1 The combination of a preference for an underground cable together with the extent of known beneath ground archaeological assets located in Corridors A & B and the ruling out of Corridor C2 resulted in the selection of Corridor C1 as the preferred option. Corridor C1 was identified as providing the best balance of minimising impacts on the environment and the local community whilst meeting the technical and constructability feasibility requirements.



3.7 Interaction with Island Green Power

Shared Grid Connection Corridor

- 3.7.1 Given the proximity of the Scheme to the proposed Island Green Power (IGP) Cottam and West Burton schemes, Low Carbon and IGP have worked collaboratively on design development and environmental avoidance mitigation to maximise opportunities for reducing overall environmental and social effects, in particular on communities in proximity to the grid connection corridor and on known ecological and archaeologically sensitive areas adjacent to the River Trent, including the Viking Great Army Winter Camp (MLI125067) on the eastern side of the River Trent (refer **Chapter 7: Cultural Heritage**)
- 3.7.2 Opportunities to combine the connection corridor areas have been explored and have resulted in the identification of a shared grid connection corridor area.
- 3.7.3 The Shared Grid Connection Corridor (**PEI Report Volume 2: Figure 3-3**) comprises an area within which Low Carbon will locate its 400kV connection to Cottam sub-station and Island Green Power will locate its 400kV connection to Cottam sub-station and its 132kV connection to West Burton.
- 3.7.4 Within this area, the installation of common elements (i.e. the cable ducts and associated installation activities) that will accommodate three cable connections in the future results in environmental and community benefit by reducing the amount of disturbance and in particular the level and frequency of construction activity. The common elements comprise:
 - Site survey, utility identification, site set out, fencing and security;
 - Provision of construction access off the A156 to the grid connection working area. The working area will be defined within the DCO and Environmental Statement;
 - Construction compound set up;
 - Topsoil strip in sections and storage;
 - Mark-out trench alignment;
 - Excavation and installation of jointing pits at approximately 100m to 400m spacing;
 - Installation of launch and exit pits for the River Trent directional drill;
 - Trench excavation and placement of protective layer;
 - Installation of cable ducts, either laid within the trench or via directional drill; and
 - Trench and jointing pit backfill and reinstatement.
- 3.7.5 The above activities will be subject to a common environmental assessment approach, the results of which will be included in each of the three ES's and DCOs.



3.8 References

- Ref 3-1 Her Majesty's Stationary Office (HMSO) (2017) The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017. Available at: http://www.legislation.gov.uk/uksi/2017/572/pdfs/uksi_20170572_en.pdf.
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- Ref 3-3 Intergovernmental Panel on Climate Change (October 2018) 'Special Report on the impacts of global warming of 1.5°C above pre-industrial levels' https://www.ipcc.ch/sr15/ [Date Accessed: 21/03/2022].
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4. Consultation

4.1 Overview

- 4.1.1 Consultation is integral to the preparation of DCO applications and to the EIA process. The views of consultation bodies and the local community serve to focus the environmental studies and to identify specific issues that require further investigation, as well as to inform aspects of the design of the Scheme. Consultation is an ongoing process, which enables mitigation measures to be identified and, where appropriate, incorporated into the project design thereby limiting adverse effects. Consultation also provides a platform for exploring and where possible incorporating environmental enhancements and benefits. The publication of this Preliminary Environmental Information (PEI) Report forms an important part of the consultation process on the proposed DCO application.
- 4.1.2 The Scheme has a wide range of stakeholders (including landowners, statutory consultees, local communities and specialist interest groups) with differing interests. Specific communication activities therefore need to be focused to meet the needs of particular individuals and groups. This requires an understanding of the stakeholders and their interests in the Scheme.
- 4.1.3 Stakeholder engagement for the Scheme is based on the following principles:
 - Early and ongoing engagement to inform and influence the design process;
 - Seeking an appropriate level of feedback in the iterative design process and ensuring that comments received are taken into consideration;
 - Building long-term relationships with key stakeholders throughout the different stages of the Scheme to help better understand their views;
 - Where appropriate ensuring concerns are addressed; and
 - Ensuring appropriate statutory consultation is undertaken in compliance with requirements of the Planning Act 2008 (Ref 4-1), EIA Regulations (Ref 4-3), and associated guidance.

4.2 DCO Consultation Requirements

- 4.2.1 The DCO process sets out a number of statutory requirements regarding consultation. The Planning Act 2008 (Ref 4-1) requires applicants for DCOs to carry out formal (statutory) pre-application consultation on their proposals. There are several requirements as to how this consultation must be undertaken that are set out in the Planning Act 2008 (Ref 4-1) and related regulations:
 - Section 42 requires the applicant to consult on the proposed application with 'prescribed persons', which includes certain consultation bodies such as the Environment Agency and Natural England, relevant statutory



undertakers, relevant local authorities, those with an interest in the DCO Site and persons who would or might be able to make a relevant claim for compensation;

- Section 47 requires the applicant to consult with the local community on the proposed application. Prior to this, the applicant must prepare a Statement of Community Consultation (SoCC) and consult on it with the relevant local host authorities and have regard to their responses. The SoCC must set out the proposed community consultation including (pursuant to the EIA Regulations) how the preliminary environmental information will be publicised and consulted on. Once finalised, a SoCC Notice must be published in local newspapers circulating within the vicinity of the land in question and the SoCC itself made available for inspection by the public. The formal pre-application community consultation must then be carried out in accordance with the final SoCC:
- Section 48 places a duty on the applicant to publicise the proposed application in the 'prescribed manner' in a national newspaper, The London Gazette, and local newspapers circulating within the vicinity of the land. In addition, the EIA Regulations and Infrastructure Planning (Applications: Prescribed Forms and Procedures) (APFP) Regulations require certain prescribed consultees to be sent a copy of the Section 48 notice; and
- Section 49 places a duty on the applicant to have regard to any relevant responses received to the consultation and publicity that is required by Sections 42, 47 and 48.

4.3 Consultation to Date

- 4.3.1 A number of meetings with statutory consultees have already taken place to provide an introduction to the proposals, including:
 - The Planning Inspectorate;
 - Lincolnshire County Council;
 - Nottinghamshire County Council;
 - Bassetlaw District Council;
 - West Lindsey District Council;
 - Environment Agency;
 - Historic England;
 - Natural England; and
 - Parish Councils.
- 4.3.2 In addition, a project website has been set up to provide up to date information on the project: www.gateburtonenergypark.co.uk/ and information has been provided by direct mail to all addresses within a defined consultation zone.



Non-statutory consultation

- 4.3.3 The Applicant held an initial round of non-statutory public consultation on its proposals between 11 January and 18 February 2022. Through the non-statutory consultation, feedback was sought on early proposals for the Scheme, the approach to EIA, and the Applicant's approach to consultation.
- 4.3.4 Due to the COVID 19 pandemic, the consultation took place both remotely and through in-person events. It included a range of techniques to assist the dissemination of information whilst giving the opportunity for members of the public to provide feedback.
- 4.3.5 In total, 77 responses were received to the non-statutory consultation (68 from the local community and nine from prescribed stakeholders). This included responses from a range of statutory consultees and stakeholder groups, including:
 - Parish Councils (Marton & Gate Burton Parish Council, Willingham by Stow Parish Council, Knaith Parish Council);
 - Members of Parliament; and
 - Councillors.
- 4.3.6 Key themes raised in responses to the consultation included:
 - Loss of agricultural land and local food production, soil quality and erosion;
 - Pollution concerns from cleaning and potential noise nuisance;
 - Landscape and visual impacts (cumulative impact when considered alongside other nearby solar projects, impact on the landscape generally and loss of views, particularly for nearby properties, the scale of the project);
 - Traffic and access (potential loss of footpaths and byways, vehicle access, rights of way, safety on local roads, the condition of local roads and suitability for construction traffic, the impact on walkers and horse riders and the impact of increasing visitors to the site);
 - Cultural heritage and archaeology (local sensitive sites including a Roman Causeway at Littleborough);
 - Location of the site (proximity to residential properties, cumulative impact, the density of the project, a local network of underground fuel pipes, impact on local livestock from flooding and the potential impact on the Red Arrows);
 - Cable route preference to be buried rather than overhead;
 - Fire safety concerns; and
 - Waste concerns.
- 4.3.7 The Applicant has had due regard to all of the comments raised through the non-statutory consultation in preparing proposals for statutory consultation.



The design of the scheme will consider the points raised by the consultation process and refine where possible.

Scoping Consultation

- 4.3.8 The EIA Scoping Report was developed following initial consultation with a number of statutory consultees and was informed by experience working on a number of other solar farm projects and was submitted to the Planning Inspectorate on 12 November 2021. The Planning Inspectorate reviewed and consulted on the EIA Scoping Report and adopted (on behalf of the Secretary of State) a Scoping Opinion on 20 December 2021 (the Scoping Opinion) which included the formal responses received by the Planning Inspectorate from consultees (**PEI Report Volume 3: Appendix 1-C**). Following the adoption of the Scoping Opinion consultation has been undertaken with relevant statutory consultees in the preparation of PEI Report, and will continue as part of the preparation of the ES (including where recommended by the Scoping Opinion).
- 4.3.9 The pre-application consultation undertaken by the Applicant will also be documented within the Consultation Report that will form part of the DCO application. This will include a separate section on EIA related consultation as recommended within the Planning Inspectorate Advice Note (Advice Note 14: Compiling the Consultation Report (Ref 4-2)) on the preparation of consultation reports.

4.4 Public Statutory Consultation

- 4.4.1 In accordance with Section 47(1) of the Planning Act 2008 (Ref 4-1) for an NSIP, the Applicant has prepared a SoCC in consultation with West Lindsey District Council, Lincolnshire County Council, Bassetlaw District Council and Nottinghamshire County Council, hereafter referred to as 'the Host Authorities' (see Section 4.2 above). This outlined how the Applicant would consult with the local community about the Scheme, including, in accordance with Regulation 12 of the EIA Regulations (Ref 4-3), how it intends to publicise and consult on the PEI.
- 4.4.2 This PEI Report is being consulted upon as part of the statutory consultation. As part of this statutory consultation, members of the public are invited to comment on the Scheme, including its likely significant environmental impacts and proposed mitigation measures as presented within this PEI Report. That feedback will be taken into account when finalising the Scheme proposals and the ES for the DCO application.
- 4.4.3 The approach to public consultation set out in the SoCC includes:
 - Issuing a project consultation postcard/leaflet to all addresses within a core consultation zone;
 - A project information booklet to be made available on the project website:
 - A project feedback form and frequently asked questions (FAQ) in hard copy and on the project website;



- Hosting a number of in person events within Lincolnshire and Nottinghamshire, close to the DCO Site;
- Holding online consultation events to offer the opportunity to ask questions about the proposals;
- Making digital copies of consultation documents available at https://www.gateburtonenergypark.co.uk/ and physical copies available at Deposit Inspection Locations; and
- Publicising the consultation through the media, online and through liaison with stakeholders.
- 4.4.4 In addition to consultation with the local community, consultation is also being undertaken with prescribed consultation bodies as well as affected landowners, in accordance with Sections 42 and 48 of the Planning Act 2008 (Ref 4-1) and Regulation 13 of the EIA Regulations (Ref 4-3).
- 4.4.5 All responses received during consultation will be carefully considered and the Applicant will have due regard to them in the development of the Scheme in accordance with Section 49 of the Planning Act 2008 (Ref 4-1). Details of any responses received during consultation and the regard had to those responses will be included in a Consultation Report. This Consultation Report will be submitted with the application for a DCO to the Secretary of State and, if the application is accepted, will be available for public review.
- 4.4.6 The Consultation Report will demonstrate how the Applicant has complied with the consultation requirements of the Planning Act 2008 (Ref 4-1) and EIA Regulations (Ref 4-3) and will be considered by the SoS when determining whether to accept the application, and then in examining the application.



4.5 References

- Ref 4-1 HMSO (2008) The Planning Act 2008, Available at: https://www.legislation.gov.uk/ukpga/2008/29/pdfs/ukpga_20080029_en.pdf.
- Ref 4-2 Planning Inspectorate (2012) Advice Note 14: Compiling the consultation reports. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2013/04/Advice-note-14v2.pdf.
- Ref 4-3 Her Majesty's Stationery Office (HMSO) (2011) The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended by The Town and Country Planning and Infrastructure Planning (Environmental Impact Assessment) (Amendment) Regulations 2018). Available at: http://www.legislation.gov.uk/uksi/2018/695/pdfs/uksi/2017/572/pdfs/uksi/20170572 en.pdf and http://www.legislation.gov.uk/uksi/2018/695/pdfs/uksi/20180695 en.pdf



5. Environmental Impact Assessment Methodology

5.1 Introduction

EIA Process

- 5.1.1 Environmental Impact Assessment (EIA) is the process undertaken to identify and evaluate the likely significant effects of a proposed development on the environment and to identify measures to mitigate or manage any significant negative effects. The EIA should be informed by consultation with statutory consultees, other interested bodies and members of the public. The purpose of identifying significant effects is to ensure decision makers are able to make an informed judgement on the environmental impacts of a proposal.
- 5.1.2 The Preliminary Environmental Information (PEI) Report provides the preliminary environmental information obtained and assessed as part of the EIA of the Scheme.
- 5.1.3 Following statutory consultation, the PEI Report will be updated to provide an Environmental Statement (ES), which will accompany the DCO application. It will follow a similar systematic approach to EIA and project design as presented in this PEI Report. The process of identifying environmental effects is both iterative and cyclical, running in tandem with the iterative design process.
- 5.1.4 The key elements in EIA for a Nationally Significant Infrastructure Project (NSIP) are:
 - Iterative project design, taking feedback from consultation and applying it to the development design process on an ongoing basis throughout the EIA process;
 - Scoping and ongoing consultation, including consideration of responses and how these should be addressed as part of the EIA;
 - Technical environmental impact assessments, including baseline studies, input to the design process, and identification of potential significant environmental effects;
 - Consultation on the PEI Report; and
 - Preparation and submission of the ES. Mitigation is proposed where available and appropriate to reduce or prevent likely significant adverse effects.
- 5.1.5 Each of the technical assessments follows a systematic approach, with the principal steps being:
 - Description of baseline conditions;
 - Assessment of likely significant effects;



- Identification of appropriate mitigation measures, including design changes;
- Assessment of residual (likely) environmental effects that remain following mitigation; and
- Assessment of cumulative effects when considering the Scheme along with other planned developments in the area. Note that this last step will be reported on at ES stage.
- 5.1.6 The assessments provided in this PEI Report are preliminary and the design of the Scheme is evolving as assessments continue. The conclusions in this PEI Report will be finalised following statutory consultation, continued assessment work, and consideration of consultation feedback as the design of the Scheme evolves. When those conclusions are finalised the significance of the effects identified in this PEI Report may well be revised such that adverse effects decrease in significance.

General Assessment Approach

- 5.1.7 This PEI Report has been prepared to satisfy the requirements of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (hereafter referred to as 'the EIA Regulations') (Ref 5-1).
- 5.1.8 In preparing this PEI Report, reference has been made to the following guidance:
 - Planning Inspectorate Advice Note 3: EIA Consultation and Notification (Ref 5-2);
 - Planning Inspectorate Advice Note 7: Environmental Impact Assessment: Process: Preliminary Environmental Information, Screening and Scoping (Ref 5-3);
 - Planning Inspectorate Advice Note 9: Rochdale Envelope (Ref 5-4);
 - Planning Inspectorate Advice Note 11: Working with Public Bodies in the Infrastructure Planning Process (Ref 5-5); and
 - Planning Inspectorate Advice Note 17: Cumulative Effects Assessment (Ref 5-6).

EIA Scoping

- 5.1.9 The aim of the scoping process is to identify key expected environmental issues at an early stage, to determine which elements of the Scheme are likely to result in likely significant effects on the environment and to establish the extent of survey and assessment requirements for the EIA.
- 5.1.10 The issues to be addressed within this PEI Report and the ES were identified in the EIA Scoping Report submitted to the Planning Inspectorate in November 2021. The Secretary of State's (SoS) Scoping Opinion was received on 20 December 2021 (**PEI Report Volume 3: Appendix 1-B**), including the formal responses received by the Planning Inspectorate from consultees on the EIA Scoping Report.



- 5.1.11 Key issues raised in the Scoping Opinion are summarised in **PEI Report Volume 3: Appendix 1-C.**
- 5.1.12 In response to the Scoping Opinion, the EIA and this PEI Report include assessments for the following environmental topics:
 - Chapter 6: Climate Change;
 - Chapter 7: Cultural Heritage;
 - Chapter 8: Ecology and Nature Conservation;
 - Chapter 9: Water Environment;
 - Chapter 10: Landscape and Visual Amenity;
 - Chapter 11: Noise and Vibration;
 - Chapter 12: Socio-Economics and Land Use;
 - Chapter 13: Transport and Access; and
 - Chapter 14: Human Health and Wellbeing.
- 5.1.13 The EIA Scoping Report (**PEI Report Volume 3: Appendix 1-A**) concluded that several topics did not require a full chapter within the PEI Report and ES. These topics are described in:
 - Chapter 15: Other Environmental Topics. This includes:
 - Air Quality;
 - Glint and Glare;
 - Ground Conditions;
 - Major Accidents and Disasters;
 - Telecommunications, Television Reception and Utilities; and
 - Waste.
- 5.1.14 Paragraph 4 within Schedule 4 of the EIA Regulations states that the ES should include 'a description of the factors [...] likely to be significantly affected by the development: population, human health, biodiversity (for example fauna and flora), land (for example land take), soil (for example organic matter, erosion, compaction, sealing), water (for example hydromorphological changes, quantity and quality), air, climate (for example greenhouse gas emissions, impacts relevant to adaptation), material assets, cultural heritage, including architectural and archaeological aspects, and landscape'. These factors are addressed within the relevant chapters listed above.

PEI Report

- 5.1.15 This PEI Report summarises the outcomes to date of the following ongoing EIA activities:
 - Establishing baseline conditions;
 - Consultation with statutory and non-statutory consultees;



- Consideration of relevant local, regional and national planning policies, quidelines and legislation relevant to the EIA;
- Consideration of technical standards for the development of significance criteria and specialist assessment methodologies;
- Design review;
- Review of secondary information, previous environmental studies, publicly available information and databases;
- Physical surveys and monitoring;
- Desk-top studies;
- Modelling and calculations; and
- Reference to current guidance.
- 5.1.16 Each technical chapter follows the same structure for ease of reference, as outlined below:
 - Introduction;
 - Consultation;
 - Legislation and Planning Policy;
 - Assessment Assumptions and Limitations;
 - Assessment Methodology;
 - · Baseline Conditions;
 - Future Baseline;
 - Potential Impacts;
 - Mitigation Measures;
 - Assessment of Likely Impacts and Effects;
 - Residual Effects and Conclusions;
 - Cumulative Assessment; and
 - References.

5.2 Rochdale Envelope

5.2.1 As discussed in **Chapter 2: The Scheme**, several technical parameters have yet to be finalised for the Scheme. This is important as the technology for solar Photovoltaic (PV) and Battery Energy Storage Systems (BESS) continues to evolve and to maintain commercial flexibility to meet the changing demands of the UK market, prior to construction. The 'Rochdale Envelope' approach has therefore been applied within the EIA to ensure a robust assessment of the likely significant environmental effects of the Scheme, in accordance with the Planning Inspectorate's Advice Note 9: The Rochdale Envelope (Planning Inspectorate, 2018) (Ref 5-4). This involves assessing the maximum (and where relevant, minimum) parameters for the elements where flexibility needs to be retained, recognising that the worst-case parameter for one technical



- assessment may differ from another. Where this approach is applied, this has been confirmed within the relevant chapters of this PEI Report.
- 5.2.2 As is relevant for each technical discipline, the maximum parameters under the Rochdale Envelope approach have been assessed, in order to predict worst-case overall impacts. These have been used in the assessment of significance of effects. Each of the **Chapters 6** to **15** describe the parameters applied in relation to the particular discipline. As the Scheme design evolves, key elements of the design may be fixed. However, flexibility will need to be maintained for some aspects of the Scheme for the DCO application. Where flexibility is to be retained in the application, any changes to design parameters will remain within the likely worst-case envelope.
- 5.2.3 In terms of the Grid Connection Route, as discussed in **Chapter 2: The Scheme** and **Chapter 3: Alternatives and Design Evolution**, while the routing has been reduced from three possible route options to one selected route, the final working width will be reduced further as more information is gathered from fieldwork and through consultation. As such, the assessment of effects in relation to the Grid Connection Route for the majority of topics is necessarily preliminary in this PEI Report. Further detailed assessment will be undertaken based on a Grid Connection Route that will be defined following statutory consultation. Detailed assessment will be contained within the ES submission with the DCO Application.

5.3 Spatial Scope

5.3.1 The topic chapters of this PEI Report (**Chapters 6** to **15**) describe the spatial scope, including the rationale for determining the specific area within which the assessment is focussed. The study areas are a function of the nature of the impacts and the locations of potentially affected environmental resources or receptors. Justification for the spatial scope considered appropriate is documented in each topic chapter (**Chapters 6** to **15**).

5.4 Determining the Baseline Conditions

- 5.4.1 In order to predict the potential environmental effects of the Scheme, it is important to determine the baseline environmental conditions that currently exist within the DCO Site and surrounding area, in the absence of any development.
- 5.4.2 Detailed environmental baseline information has been collected and the methodology for the collection process is detailed within each technical chapter of the PEI Report. The baseline information has been gathered from various sources, including:
 - Online / digital resources;
 - Data searches, e.g. GroundSure, Historic Environment Record, etc.;
 - Baseline site surveys; and
 - Environmental information submitted in support of other planning applications for developments in the vicinity.



5.5 Development Design, Impact Avoidance and Mitigation

- 5.5.1 The design process for the Scheme has been heavily influenced by the findings of early environmental appraisals and the EIA process. The Scheme has had several measures incorporated into the design to avoid or minimise environmental impacts. The key aspects where the design has evolved are described in Chapter 3: Alternatives and Design Evolution. These include measures needed for legal compliance, as well as measures that implement the requirements of good practice guidance documents. The initial assessment has been undertaken on the basis that these measures are incorporated in the design and construction practices (i.e. they are 'embedded mitigation'). Embedded mitigation measures for the construction phase are set out in the Framework Construction Environmental Management Plan (CEMP) (PEI Report Volume 3: Appendix 2-A), including measures such as construction and exclusion zones in relation to retained vegetation, ensuring a tidy and neat working area, covering stockpiles and storing topsoil in accordance with best practice measures.
- 5.5.2 Implementation of embedded mitigation relied upon in the assessment will be secured in the DCO, either through the setting of limits of deviation (e.g. development extents or specific maximum Above Ordnance Datum (AOD) heights) or specifying mitigation measures via a DCO Requirement.
- 5.5.3 Consideration has been given to any 'additional mitigation' over and above the embedded mitigation that may be required to mitigate any significant adverse effects. The residual effects (after the implementation of mitigation) have then been assessed and are presented in each topic chapter. Significant residual effects are also summarised in **Chapter 17: Summary of Environmental Effects** of the PEI Report.

5.6 Temporal Scope: Timescales and Assessment Years

Construction Phase Effects

5.6.1 For the purposes of the assessment, the construction phase effects are those effects that may result from activities during enabling works, construction, and commissioning activities. This covers sources of effects such as construction traffic, noise and vibration from construction activities, dust generation, site runoff, mud on roads, risk of fuel / oil spillage, and the visual intrusion of plant and machinery on site. Some aspects of construction-related effects will last for longer than others. For example, impacts related to earth moving are likely to be relatively short in duration compared with the construction of energy infrastructure and landscaping activities, which are likely to persist throughout the entire construction period.

Operational Phase Effects

5.6.2 Operational effects are the effects that are associated with operational and maintenance activities during the generating lifetime of the Scheme. This includes the effects of the physical presence of the solar PV infrastructure,



and its operation, use and maintenance. Timescales associated with these enduring effects are as follows:

- Short term endures for up to 12 months;
- Medium term endures for 1 to 5 years;
- Long term endures for more than 5 years;
- Reversible Long-Term Effects long-term effects, which endure throughout the lifetime of the Scheme, but which cease once the Scheme has been decommissioned; and
- Permanent Effects effects which cannot be reversed following decommissioning.

Decommissioning Phase Effects

5.6.3 Decommissioning effects are changes resulting from activities beginning and ending during the decommissioning stage. This covers sources of effects such as decommissioning site traffic, noise and vibration from decommissioning activities, dust generation, site runoff, mud on roads, risk of fuel / oil spillage, and the visual intrusion of plant and machinery on site, for example. Typically, decommissioning phase effects are similar in nature to the construction phase, although may be of shorter duration and of less intensity.

Assessment Years

- 5.6.4 The assessment considers the environmental impacts of the Scheme at key stages in its construction and operation and, as far as practicable, its decommissioning.
- 5.6.5 The 'existing baseline' date is 2021/2022 since this is the period in which the baseline studies for the EIA has been undertaken. As described above, 'future baseline' conditions are also predicted for each assessment scenario, whereby the conditions anticipated to prevail at a certain point in the future (assuming the Scheme does not progress) are identified for comparison with the predicted conditions with the Scheme. This can include the introduction of new receptors and resources into an area, or new development schemes that have the potential to change the baseline.
- 5.6.6 The assessment scenarios that are being considered for the purposes of the EIA (and considered in this PEI Report) are as follows:
 - Existing Baseline (2022) this is the principal baseline against which environmental effects will be assessed:
 - Future Baseline (No Development) in 2025-2027, 2043 (for landscape and visual only) and 2088 (to assess construction, operation, and decommissioning impacts against), against which the environmental effects of the Scheme will be assessed. These assessment years are explained below. The future baseline is defined within the technical chapters.
 - Construction (2025 2027-28) (With Development):



- The peak construction years for the purpose of the EIA is anticipated to be 2026; this assumes commencement of construction in Q1 2025 and that the Scheme is built out over a 24 36 month period. The 24-month construction period is a likely worst case from a traffic generation point of view because it compresses the trip numbers into a shorter duration and represents the greatest impact on the highway network. A lengthened construction phase of 36 months would likely result in lower traffic, air quality and noise impacts; therefore, the likely worst-case scenario has been defined and assessed within each technical chapter.
- Operation (2028) (With Development):
 - This is the opening year of the Scheme; it is assumed that the Scheme will be operational in Q1 2028.
- Decommissioning (2088 to 2089-90) –The design life of the scheme is expected to be at least 60 years although this may be extended if the Scheme is still operating efficiently after the 60-year period.
 Decommissioning is expected to take between 24 and 48 months and would be undertaken in phases.
- 5.6.7 A future year of 2043 (i.e. 15 years post opening of the Scheme) will also be considered for specific topics including landscape and visual amenity, in terms of the maturation of vegetation (i.e. 15 years after the operational assessment year to allow the consideration of mitigation planting).

5.7 Effect Significance Criteria

- 5.7.1 The evaluation of the significance of an effect is important; it is the significance that determines the resources that should be deployed in avoiding or mitigating a significant adverse effect, or conversely, the actual value of a beneficial effect. The overall environmental acceptability of the Scheme is a matter for the Secretary of State to determine, having considered the environmental information set out in the ES. Where it has not been possible to quantify effects, qualitative assessments will be carried out based on available knowledge and professional judgment. Where uncertainty exists, this will be noted in the relevant topic chapter.
- 5.7.2 The significance of residual effects will be determined by reference to criteria for each assessment topic. Specific significance criteria for each technical discipline has been developed, giving due regard to the following:
 - Extent and magnitude of the impact (described as high, medium, low and very low);
 - Effect duration (see Section 5.6.2), and whether effects are temporary, reversible or permanent;
 - Effect nature (whether direct or indirect, reversible or irreversible, beneficial or adverse);
 - Whether the effect occurs in isolation, is cumulative or interacts with other effects:
 - Performance against any relevant environmental quality standards;



- Sensitivity of the receptor (described as high, medium, low and very low); and
- Compatibility with environmental policies.
- 5.7.3 The significance of residual effects will be evaluated with reference to available definitive standards, accepted criteria and legislation. For issues where definitive quality standards do not exist, significance will be based on the:
 - Local, district, regional or national scale or value of the resource affected;
 - Number of receptors affected;
 - Sensitivity of these receptors; and
 - Duration of the effect.
- 5.7.4 In order to provide a consistent approach to expressing the outcomes of the various studies undertaken as part of the EIA, and thereby enable comparison between effects upon different environmental topics, the following terminology is used in the PEI Report to define residual effects:
 - Adverse detrimental or negative effects to an environmental / socioeconomic resource or receptor; or
 - **Negligible** (also referred to as 'neutral' for some topics) imperceptible effects to an environmental / socio-economic resource or receptor; or
 - Beneficial advantageous or positive effects to an environmental / socio-economic resource or receptor.
- 5.7.5 Where adverse or beneficial effects are identified, these will be assessed against the following scale:
 - Minor slight, very short or highly localised effect of no significant consequence;
 - Moderate noticeable effect (by extent, duration or magnitude) which may be considered significant; and
 - Major considerable effect (by extent, duration or magnitude) of more than local significance or in breach of recognised acceptability, legislation, policy or standards; considered significant.
- 5.7.6 Each of the technical chapters provides the criteria, including sources and justifications, for quantifying the different categories of effect. Where possible, this will be based upon quantitative and accepted criteria (for example, noise assessment guidelines), together with the use of value judgment and expert interpretation to establish to what extent an effect is environmentally significant.
- 5.7.7 Table 5-1 illustrates an example of the classification of effects matrix.



Table 5-1: Example matrix to classify environmental effects

Sensitivity or value of resource / receptor	Magnitude of impact				
	High	Medium	Low	Very low	_
	High	Major	Major	Moderate	Minor
	Medium	Major	Moderate	Minor	Negligible
	Low	Moderate	Minor	Negligible	Negligible
	Very low	Minor	Negligible	Negligible	Negligible

5.7.8 Following the classification of an effect, clear statements will be made within the topic chapters as to whether that effect is significant or not significant. As a rule, major and moderate effects are considered to be significant (as shown by the shaded cells in Table 5-1 above), whilst minor and negligible effects are considered to be not significant. However, professional judgement will be applied, including taking account of whether the effect is permanent or temporary, its duration / frequency, whether it is reversible, and / or its likelihood of occurrence. Generic definitions for the classification of effects are shown in Table 5-2.

Table 5-2: Generic effect descriptions

Effect	Generic description
Major	These effects may represent key factors in the decision-making process. Potentially associated with sites and features of national importance or likely to be important considerations at a regional or district scale. Major effects may relate to resources or features which are unique and which, if lost, cannot be replaced or relocated.
Moderate	These effects, if adverse, are likely to be important at a local scale and on their own could have a material influence on decision making.
Minor	These effects may be raised as local issues and may be of relevance in the detailed design of the project but are unlikely to be critical in the decision-making process.
Negligible	Effects which are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error. These effects are unlikely to influence decision making, irrespective of other effects.

- 5.7.9 Where mitigation measures are identified to eliminate, mitigate or reduce adverse impacts, these have either been incorporated into the design of the Scheme, translated into construction commitments, or included as operational or managerial standards / procedures. The topic chapters in this PEI Report present any 'residual' effects, which are the effects which remain following the implementation of embedded and additional mitigation measures and classify these in accordance with the effect classification terminology given above.
- 5.7.10 It should be noted that some technical disciplines may utilise different criteria when undertaking assessments due to differences in industry accepted guidelines and specifications. Where this is the case, the technical topic will discuss how the assessment methodology or classification of effects differs



for the general EIA methodology as described in this section and provide justification.

Assessment of Construction and Decommissioning Effects

- 5.7.11 The assessment of construction and decommissioning effects will be undertaken based on existing knowledge, techniques and equipment. A 'reasonable worst-case' scenario will be used with respect to the envisaged construction methods, location (proximity to sensitive receptors), phasing and timing of construction activities.
- 5.7.12 As described above, the assessment of construction and decommissioning effects assumes the implementation of standard good practice measures, for example the use of dust suppression measures on haul roads and using containers with 110% capacity to store fuel and other chemicals onsite. The purpose of this is to focus on the Scheme-specific effects, rather than generic construction effects that can be easily addressed using generic good practice mitigation measures which the Applicant has committed to. Construction and decommissioning assumptions, including what has been assumed in terms of good practice measures, are set out within the technical chapters of the PEI Report, and the Framework CEMP (which will be submitted with the DCO application). Each technical topic chapter of the PEI Report identifies and assesses construction and decommissioning effects that are likely to remain after these mitigation measures are in place.

5.8 Interaction and Accumulation

- 5.8.1 In accordance with the EIA Regulations, 'cumulative effects' will be considered. These are effects that result from incremental changes caused by other past, present or reasonably foreseeable actions together (i.e. cumulatively) with the Scheme.
- 5.8.2 This chapter of the ES will be accompanied by a figure illustrating the location of other developments (cumulative projects) in the local area that have the potential to increase the impacts associated with the Scheme. These cumulative schemes are currently being discussed with the Host Authorities.
- 5.8.3 For the cumulative impact assessment, two types of impact are considered:
 - The combined effect of individual impacts from the Scheme, for example noise or pollutants on a single receptor (these are referred to as 'effect interactions'); and
 - The combined effects of other development scheme(s) which may interact cumulatively with the Scheme and result in different likely significant effect (these are referred to as 'cumulative effects').

Effect Interactions

5.8.4 There is no established EIA methodology for assessing and quantifying effect interactions that lead to combined effects on sensitive receptors, however the European Commission (EC) has produced guidelines for assessing effect interactions "which are not intended to be formal or prescriptive, but are



- designed to assist EIA practitioners in developing an approach which is appropriate to a project..." (Ref 5-7).
- 5.8.5 AECOM has reviewed these guidelines and has developed an approach which uses the defined residual effects of the Scheme to determine the potential for effect interactions that lead to combined effects.
- 5.8.6 The EIA predicts beneficial and adverse effects during construction, operation and decommissioning of the Scheme, which are classified as minor, moderate or major. Several effects on one receptor or receptor group could theoretically interact or combine to produce a combined significant overall effect.
- 5.8.7 An exercise which tabulates the effects on receptors or receptor groups has been undertaken to determine the potential for effect interactions and therefore any combined effects (**Chapter 16: Cumulative Effects and Interactions**). Only adverse or beneficial residual effects classified as minor, moderate, or major have been considered in relation to potential effect interactions. Residual effects classified as negligible are excluded from the assessment of the effect interactions as, by virtue of their definition (see Table 5-2), they are considered to be imperceptible effects on an environmental receptor.

Cumulative Effects with Other Developments

5.8.8 The Planning Inspectorate's Advice Note 17 on the assessment of cumulative effects (Ref 5-6) identifies a four-stage approach. Adopting that approach, as appropriate, the Applicant's methodology for the assessment of cumulative effects is as follows:

Stage 1 – Establish the National Significant Infrastructure Project's Zone of Influence and identify long list of 'other developments'

- 5.8.9 A review of other developments has been undertaken, initially encompassing a 'Zone Of Influence (ZOI)' defined by the environmental topic specialists to prepare a long list of 'other developments'. The long list includes all identified EIA and NSIP developments within 5km of the DCO Site, large scale major developments within 5km of the DCO Site, and key Local Development Plan allocations within 5km of the DCO Site. 5km is considered the maximum ZOI.
- 5.8.10 The long list of 'other developments' included in the assessment of cumulative effects (**PEI Report Volume 3: Appendix 5-A)** has been shared with the host planning authorities for comment. The long list in the ES will take account of any requests from the host authorities for additional 'other developments' to be considered and any comments on the long list set out in this PEI Report that are raised during statutory consultation.
- 5.8.11 Developments included in the initial long-list are based on the following criteria. The criteria has been developed having regard to Advice Note 17 and utilising experience of assessing cumulative effects for schemes of a similar nature and scale to the Scheme:
 - a) Development currently under construction that meets one of (d) to (i);
 - b) Approved applications which have not yet been implemented (covering the past five years and taking account of those that received planning



- consent over three years ago and are still valid but have not yet been implemented), and meets one of (d) to (i);
- c) Submitted applications not yet determined meeting one of (d) to (i);
- d) On the National Infrastructure Planning Programme of Projects and within 5km of the DCO Site;
- e) Applications for EIA development and within 5km of the DCO Site;
- f) Development identified in the relevant Development Plan such as Allocated Sites, within 5km;
- g) Any sites that have been registered or achieved a positive EIA screening opinion, which are within 5km of the DCO Site;
- h) Other applications for solar development, excluding householder or smallscale roof mounted solar developments, within 5km of the DCO Site; and
- i) Other schemes that do not meet the above criteria but which a statutory stakeholder specifically requests to be included.
- 5.8.12 The long list has taken account of the criteria in the Planning Inspectorate's Advice Note 17 (Ref 5-6).

Stage 2 – Identify shortlist of 'other developments' for Cumulative Effects Assessment

- 5.8.13 At Stage 2, which will occur prior to development of the ES, any developments of a nature or scale without the potential to result in likely significant cumulative impacts will be excluded, following discussion with the local planning authorities and consideration of the likely zone of influence for each environmental topic. The justification for including or excluding developments from the long list will be provided in a matrix, modelled on the example given within Appendix E of the Planning Inspectorate's Advice Note 17 (Ref 5-6). This will be included within the ES.
- 5.8.14 A preliminary shortlist of cumulative developments has been prepared and is currently being discussed with the Host Authorities. The final shortlist, along with inclusionary criteria and full justification will be presented within the ES to ensure a robust cumulative assessment is undertaken.

Stage 3 – Information gathering

- 5.8.15 Information relating to other developments will be collected from appropriate sources (which may include the local planning authorities, the Planning Inspectorate or directly from the applicant / developer) and include, but are not limited to:
 - a) Proposed design and location information;
 - b) Proposed programme of construction, operation and / or decommissioning; and
 - c) Environmental assessments that set out baseline data and effects arising from 'other developments'.



Stage 4 – assessment (to be provided within the ES)

- 5.8.16 The full assessment of cumulative effects is not available at this PEI Report stage and will be included in the ES. It will include a list of those developments considered to have the potential to generate a cumulative effect together with the Scheme, and will be documented in a matrix which will include the following:
 - a) A brief description of the development;
 - b) An assessment of the cumulative effect with the Scheme;
 - c) Proposed mitigation applicable to the Scheme including any apportionment; and
 - d) The likely residual cumulative effect.
- 5.8.17 The criteria for determining the significance of any cumulative effect are based upon:
 - a) The duration of effect, i.e. will it be temporary or permanent;
 - b) The extent of effect, e.g. the geographical area of an effect;
 - c) The type of effect, e.g. whether additive or synergistic;
 - d) The frequency of the effect; The 'value' and resilience of the receptor affected; and
 - e) The likely success of mitigation.



5.9 References

- Ref 5-1 The Infrastructure Planning (Environmental Impact Assessment) (Amendment) Regulations 2017).
- Ref 5-2 Planning Inspectorate (2018) Advice Note 3: EIA Notification and Consultation.
- Ref 5-3 Planning Inspectorate (2020) Advice Note 7: EIA: Process, Preliminary Environmental Information, Screening and Scoping.
- Ref 5-4 Planning Inspectorate (2018); Advice Note 9: Using the Rochdale Envelope.
- Ref 5-5 Planning Inspectorate (2017); Advice Note 11: Working with Public Bodies in the Infrastructure Planning Process.
- Ref 5-6 Planning Inspectorate (2019); Advice Note 17: Cumulative Effects Assessment. Cumulative effects assessment relevant to nationally significant infrastructure projects.
- Ref 5-7 European Commission (1999) Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions.



6. Climate Change

6.1 Introduction

- 6.1.1 This chapter of the Preliminary Environmental Information (PEI) Report presents the findings of an assessment of the likely significant effects on climate change as a result of the Scheme. For more details about the Scheme, refer to **Chapter 2: The Scheme** of this PEI Report.
- 6.1.2 This chapter identifies and proposes measures to address the potential impacts and likely effects of the Scheme on climate change, during the construction, operation, and decommissioning phases of the Scheme.
- 6.1.3 In line with the requirements of The Infrastructure Planning (Environmental Impact Assessment) Regulations (2017) (Ref 6-1), consideration has been given to the following aspects of climate change assessment:
 - Lifecycle greenhouse gas (GHG) impact assessment the impact of GHG emissions arising over the lifetime of the Scheme on the climate; and
 - Climate change resilience (CCR) review the resilience of the Scheme to projected future climate change impacts, including damage to the Scheme caused by accidents resulting from climate change.
 - In-combination climate change impact (ICCI) assessment which identifies how the resilience of receptors in the surrounding environment are affected by the combined impact of future climate conditions and the Scheme.

6.2 Consultation

- 6.2.1 A request for an EIA Scoping Opinion was sought from the Secretary of State through the Planning Inspectorate in 2021 as part of the EIA Scoping Process. The Scoping Opinion was received on 20 December 2021 (PEI Report Volume 3: Appendix 1-B). Consultation responses in relation to climate change, to date, are presented in PEI Report Volume 3: Appendix 1-C.
- 6.2.2 The following changes have been made to the climate change assessment as a result of responses to the Scoping Opinion:
 - GHG Impact Assessment No change to proposed scope.
 - CCR Review Sea level rise will now be scoped into the climate resilience review on the basis that the River Trent is tidal in the area of the DCO Site.
 - ICCI Assessment In-combination effects on surface water or groundwater levels have been incorporated as part of the ICCI assessment within this Climate Change chapter of the PEI Report. This includes reference to Chapter 9: Water Environment which will address flood management and mitigation options through a Flood Risk Assessment and Surface Water Drainage Strategy.



6.3 Legislation and Planning Policy

6.3.1 Legislation, planning policy and guidance relating to climate change, and pertinent to the Scheme comprises:

Legislation

- 6.3.2 This section lists the legislation and planning policy relevant to the assessment methodology for climate change. These comprise:
 - Climate Change Act 2008 (Ref 6-2) which sets a target for the year 2050 for the reduction of targeted greenhouse gas emissions and to provide for a system of carbon budgeting (amongst others);
 - Climate Change Act 2008 (2050 Target Amendment) Order 2019 (Ref 6-3) which amended the 2050 target in the Climate Change Act 2008 to "net zero" i.e. that the net UK carbon account, in terms of carbon dioxide and other targeted greenhouse gases, for the year 2050 is at least 100% lower than the relevant baseline year; and
 - Carbon Budgets Order 2009 (Ref 6-4), Carbon Budget Order (2011) (Ref 6-5), Carbon Budget Order (2016) (Ref 6-6) and Carbon Budget Order (2021) (Ref 6-7) which set the carbon budgets for relevant budgetary periods.

National Planning Policy

- National Policy Statement (NPS) EN-1 (Ref 6-8), with particular reference to paragraphs 2.2.9 and 4.8.2 in relation to climate impacts and adaptation; paragraphs 4.1.3 to 4.1.4 in relation to adverse effects and benefits; paragraphs 4.2.1, 4.2.3, 4.2.4, 4.2.8 to 4.2.10 and 5.1.2 in relation to EIA and Environmental Statement (ES) requirements; paragraphs 4.5.3 and 4.8.1 to 4.8.12 in relation to adaptation measures in response to climate projections; and paragraphs 5.7.1 to 5.7.2 in relation to climate projections, flood risk and the importance of relevant mitigation. A revised NPS EN-1 is currently under review but retains these provisions: paragraph 4.9.8 of the draft would also require applicants to assess the impacts on and from proposed energy projects across a range of climate change scenarios, while paragraph 5.3.4 would require all proposals for energy infrastructure projects to include a carbon assessment as part of their ES.
- NPS EN-3 (Ref 6-9) paragraph 2.3.1 regarding NPS EN-1 and the importance of climate change resilience, and paragraph 2.3.5 in relation to ES requirements regarding climate change resilience. A revised NPS EN-3 is currently under review but retains these provisions;
- NPS EN-5 (Ref 6-10) paragraph 2.4.1 regarding NPS EN-1 and the importance of climate change resilience, and paragraph 2.4.2 in relation to ES requirements regarding climate change resilience. A revised NPS EN-5 is currently under review but retains these provisions, albeit at paragraphs 2.6.1 and 2.6.2; and
- National Planning Policy Framework (NPPF) (Ref 6-11) paragraphs 8 and 20 in relation to adaptation, mitigation and climate change resilience; paragraphs 153 and 158 in relation to reduction of CO2 emissions through



design and reduced energy consumption; and paragraphs 152 and 159 to 169 in relation to climate projections, associated flood risk and adaptation.

National Guidance

Planning Practice Guidance for Climate Change (March 2019) (Ref 6-12).

Local Planning Policy

- Central Lincolnshire Local Plan 2012 2036 (2017) (Ref 6-13) with particular reference to Policy LP14 (Managing Water Resources and Flood Risk), LP18 (Climate Change and Low Carbon Living), LP19 (Renewable Energy Proposals) and LP20 (Green Infrastructure Network);
- Central Lincolnshire Local Plan Proposed Submission Draft March 2022 (Ref 6-14) with particular reference to Policy S11 (Embodied Carbon), Policy S12 (Water Efficiency and Sustainable Water Management), Policy S14 (Renewable Energy), Policy S15 (Protecting Renewable Energy Infrastructure), Policy S16 (Wider Energy Infrastructure), Policy S17 (Carbon Sinks) and Policy S20 (Resilient and Adaptable Design);
- Draft Bassetlaw Local Plan 2020 2037 (2021) (Ref 6-15) with particular reference to Policy ST50 (Reducing Carbon Emissions, Climate Change Mitigation and Adaptation), Policy ST51 (Renewable Energy Generation), Policy ST52 (Flood Risk and Drainage); and
- Bassetlaw District Council Core Strategy & Development Management Policies DPD (2011) (Ref 6-16) particularly strategic object SO6 related to ensuring that all new development addresses the causes and effects of climate change by, as appropriate, reducing or mitigating flood risk; realising opportunities to utilise renewable and low carbon energy sources and/or infrastructure, alongside sustainable design and construction; taking opportunities to achieve sustainable transport solutions; and making use of Sustainable Drainage Systems. And development management policies DM10 (Renewable and Low Carbon Energy) and DM12 (Flood Risk, Sewerage and Drainage).
- 6.3.3 The national planning policies referred to above identify the requirement for consideration of climate change adaptation and resilience, specifically NPS EN-1 Section 4.8 (Ref 6-8), NPS EN-3 Section 2.3 (Ref 6-9) and NPS EN-5 Section 2.6 (Ref 6-10). Climate projections should be (and have been) analysed, and appropriate climate change adaptation measures considered throughout the design process (NPS EN-1 Section 4.8 (Ref 6-8)). Specific climate change risks identified within these policies include flooding (NPS EN-1 Section 5.7 (Ref 6-8)), drought, coastal change (NPS EN-1 Section 5.5 (Ref 6-8)), rising temperatures and associated damage to property and people.
- 6.3.4 Local planning policies identify the need to consider and, where appropriate, mitigate GHG emissions associated with new development (Central Lincolnshire Local Plan LP 18 (Ref 6-13), Central Lincolnshire Local Plan Proposed Submission Policy S11 (Ref 6-14)). New development should aim for reduced or zero carbon development by incorporating renewable or low carbon energy sources and maximising energy efficiency where practicable and should build in resilience to projected climate change impacts (Draft Bassetlaw Local Plan Policy ST50 (Ref 6-15)).



6.4 Assessment Assumptions and Limitations

6.4.1 This section outlines the limitations of the data used, and any key assumptions made within the lifecycle GHG impact assessment, CCR review and ICCI assessment.

Scheme Parameters Assessed

- 6.4.2 The climate assessment has been based on the parameters outlined in the **Chapter 2: The Scheme** of this PEI Report.
- 6.4.3 The technology for solar photovoltaic (PV) and Battery Energy Storage Systems (BESS) continues to evolve, to maintain commercial flexibility to meet the changing demands of the UK market. The 'Rochdale Envelope' approach has been applied within the EIA to ensure a robust assessment of the likely significant environmental effects of the Scheme, however adverse impacts are expected to be lower as a result of developing technology. We have assumed a Scheme energy generation capacity of 500MW and anticipated yields based on existing PV technology. We further note that the consent sought will not limit the maximum generation capacity of the Scheme.

Components and materials

- 6.4.4 The largest single source of GHG emissions from the Scheme is likely to result from the manufacture and transport of solar PV panels and the BESS. The infrastructure manufacturer has not been confirmed and therefore for the purposes of estimating the GHG impact of the Scheme, a conservative estimate is to assume that the PV panels will be sourced from China (or a country of similar distance from the UK) as this will increase the embodied and transport emissions compared to panels being sourced from Europe.
- 6.4.5 A description of the PV panel components is provided within **Chapter 2: The Scheme**. An Indicative Site Layout Plan is provided within **PEI Report Volume 2: Figure 2-4.**
- 6.4.6 The EPD used as a reference for embodied carbon from the manufacture and supply of PV panels is for the Jolywood JW-D144N-166 module rated at 470 Watts (W) (Ref 6-17) (the "Jolywood EPD"). The Jolywood EPD includes data on embodied carbon in kilograms carbon dioxide equivalent per kilowatt hour (kg CO₂e/kWh) of electricity generated for various lifecycle stages including supply of raw materials, manufacture, and transport to a solar farm in China. The Jolywood EPD was published in November 2020, prepared in accordance with ISO 14025 and EN 15804, and subject to independent third-party verification.
- 6.4.7 The Jolywood EPD shows upstream manufacturing with an embodied carbon figure of 0.00748 kg CO₂e/kWh, but the generation data is from an actual site in southern China with 22% higher yield than anticipated for the Scheme. When a correction is made for the lower anticipated generation for the Scheme, the embodied carbon figure rises to 0.00956kg CO₂e/kWh generated over the development's operational lifetime.



- 6.4.8 Minimum yields for the Scheme are assumed to be 922 kilowatt hours per year per kilowatt peak (kWh/yr/kWp), with the output of the PV panels assumed to degrade by 2% in the first year and by 0.45% per year thereafter (Ref 6-17). For an installation rated at 595 MWp operating for 60 years, lifetime generation is estimated at 23,802 gigawatt hours (GWh) of electricity.
- 6.4.9 The Scheme will also require other components and materials during the construction phase, including PV inverters, BESS inverters, cables, a steel framework to support the PV Panels, concrete and aggregates. Emissions factors for each of these have been derived from a literature review (PV and BESS inverters) or standard factors (cables, steel framework and building materials).
- 6.4.10 For the embodied carbon within the PV inverters and BESS inverters, embodied energy benchmarks reported by Rajput and Singh (2017) (Ref 6-18) have been applied to the Scheme specifications, as set out in **Chapter 2: The Scheme**. The embodied energy was then converted from kilowatt hours (kWh) to kilograms of CO₂ equivalent (kgCO₂e) using the energy intensity of the countries in which they are produced (Ref 6-19;Ref 6-20), assuming that the energy used in the factories is predominantly electricity.
- 6.4.11 The embodied carbon of switchgear was estimated using a benchmark reported by FutureFirma (Ref 6-21), while the embodied carbon of lithium ion batteries (for the BESS) was estimated using a benchmark reported by Philippot et al (2019) (Ref 6-22). To estimate the embodied carbon within cabling, it has been assumed that the cables are 50% plastic, 40% copper, and 10% aluminium by weight. Embodied carbon factors for each of these materials from the ICE v3 database (Ref 6-23) have been applied.
- 6.4.12 Another significant source of embodied carbon is the steel structure supporting the panels. The embodied carbon factor for galvanised steel from the ICE v3 database (Ref 6-23) has been applied to the total module structure weight provided by the Applicant's design team to estimate the embodied carbon of module structures.

Transport of components, materials, and waste

- 6.4.13 Emissions from the transportation of components and materials to the DCO Site have been calculated based on assumed transport modes and distances for all materials and components.
- 6.4.14 HGV and sea freight distances assumed for transportation of materials and waste are outlined below. The longest distance (worst-case) country of origin has been assumed for each of the key assets of the Scheme, and assumptions have been made around the specific ports used based on proximity to relevant manufacturing facilities within each country:



- a. HGV transport of materials within China prior to sea freight transportation
 150km (based on the average distance of a number of major manufacturing centres in and around Shanghai to the nearest port)¹;
- b. HGV transport of materials within South Korea prior to sea freight transportation 50km (based on the proximity of various BESS manufacturers to the nearest port);
- c. HGV transport of materials within Europe, including distance prior to, and following, sea freight transportation 1,600km (based on half of the reasonable maximum distance equipment might be transported within Europe, plus the distance between Dover and the DCO Site boundary);
- d. Sea freight distance from China to England (Ref 6-24) 22,315km (based on the sea freight distance between Shanghai and Immingham);
- e. Sea freight distance from South Korea to England (Ref 6-24) 23,352km (based on the sea freight distance between Port of Jinhai and Immingham);
- f. Sea freight distance from Europe to England (Ref 6-24) 50km (based on the sea freight distance between Calais and Dover)
- g. HGV transport of materials following sea freight 370km (based on the road distance between Dover and the DCO Site boundary); and
- h. Building materials such as concrete and aggregate are assumed to be sourced locally and transported by HGV a maximum of 50km.
- 6.4.15 For sea freight transportation, the BEIS 2021 emissions factor for 'Products tanker Average' has been applied, including well-to-tank (WTT) emissions (Ref 6-25).
- 6.4.16 For HGV transportation during construction and decommissioning, the BEIS 2021 emissions factor for 'Rigid HGV 7.5-17t' has been applied, including WTT emissions (Ref 6-25). It has been assumed that HGVs are on average 50% laden as they will be empty travelling one way (e.g. to the Scheme for waste collections), and 100% laden for other leg of the journey.
- 6.4.17 Emissions from the transport of materials and components away from the DCO Site at the end of design life have been estimated on the assumption that all recycling and landfilling will take place in the UK at a maximum distance of 50km for concrete and aggregate, and no more than 200km for other materials. These are considered to be reasonable assumptions for the purposes of this assessment following discussions with waste management specialists. Transport is assumed to be by HGV and applies the most recent emissions factor from the conversion factors for company reporting published by the UK Government (Ref 6-25). As HGV transport is very likely to be decarbonised, these emissions are almost certainly an overestimate.

Prepared for: Gate Burton Energy Park Limited

¹ Please note, HGV transportation of PV modules within China has been omitted here to avoid double counting as the upstream emissions data used to calculate the embodied carbon of the PV modules already includes transportation from the manufacturing facility to a solar farm in China.



Waste management

- 6.4.18 Emissions from the disposal of construction waste assume standard wastage rates for materials (5% for concrete and aggregate; 2.5% for steel, aluminium and plastics). Volumes of packaging waste have been estimated on a pro-rata basis of installed capacity from other, similar, schemes. To calculate GHG emissions associated with waste treatment during construction and decommissioning, a conservative assumption that 70% of waste will be recycled, while 30% will be sent to landfill, has been applied. Emissions factors for waste disposal are taken from the UK Government conversion factors for company reporting (Ref 6-25). Transport emissions from the disposal of waste assume that all disposal will take place within a 100km radius of the DCO Site boundary.
- 6.4.19 Emissions from the disposal of materials and components at the end of the design life are subject to significant uncertainty. For the purposes of this assessment, emissions factors for recycling of different categories of products and materials have been taken from the conversion factors for company reporting published by the UK Government (Ref 6-25). At the decommissioning stage a conservative assumption that 70% of waste will be recycled, while 30% will be sent to landfill, has also been applied.

Use of plant and machinery

6.4.20 Emissions from the use of plant and machinery during construction and decommissioning have been calculated based on a stated assumption that consumption of diesel for running machinery and generators will average 3,300 litres per week. However, it is hoped that consumption will be reduced to lower levels as there is a prospect of connecting construction compounds into the local electrical distribution network at either 11kV or 33kV. The emissions factors for diesel were taken from the 2021 conversion factors for company reporting published by the UK Government (Ref 6-25).

Consumption of water

6.4.21 As provided in **Chapter 2: The Scheme** consumption of water during the construction phase assumes that based on an assumed 10 litres/day, an estimated 1,100m³ total (850m³ for welfare and 250m³ for wheel washes) of water will be required during construction. It is assumed that construction activities account for a further 33% over and above consumption by workers. Emissions factors for water supply and wastewater treatment are taken from the 2021 conversion factors for company reporting (Ref 6-25); as a conservative estimate, it is assumed that all water supplied is removed for treatment via the wastewater network (refer to **Chapter 2: The Scheme**).

Worker travel

6.4.22 Emissions from construction worker travel have been calculated based on information provided in **Chapter 2: The Scheme** and **Chapter 13: Transport and Access**. In terms of construction staff vehicles, the following has been included as part of this assessment:



- 55% of construction staff (220 persons) to be transferred to/from the Scheme by shuttle service (each with capacity for 50 staff) e.g. to/ from Gainsborough (north) and Lincoln (south), as well as Retford (west) and Newark on Trent (south). On the assumption that an average of 55 staff would reside within each of the four areas listed above, two shuttle services would be required to/from each area equating to a total of eight shuttle services in the morning (16 movements) and eight shuttle services in the evening (16 movements).
- 45% of construction staff (180 persons) to travel by private vehicle with an average occupancy of 1.3 staff per vehicle, resulting in 138 staff vehicles (276 two-way daily movements).
- 6.4.23 A maximum one-way distance of 30km per journey has been assumed for the worker transportation calculations, which is a conservative estimate as, it is expected staff will reside closer to the DCO Site boundary, and employees not from the local area would stay in local accommodation as stated within **Chapter 12: Socio-economics and Land Use**. An emissions factor for a typical van of unknown fuel has been applied, taken from the 2021 conversion factors for company reporting published by the UK Government (Ref 6-25).
- 6.4.24 Operational worker travel data has been estimated based on an assumption of 14 workers on site every day over the design life of the scheme. In addition, there is expected to be approximately 3-4 visitors per week (equating to 1 visitor per day) for deliveries, and replacement of any components that fail. Workers are assumed to travel alone by car a maximum of 30km each way. Operational staff are expected to travel to site by four-wheel drive vehicle or medium/large van. An emissions factor for an average van of unknown fuel has been applied. These emissions are likely to be a worst-case scenario, as private vehicles are increasingly likely to be powered by electricity rather than by internal combustion engines.
- 6.4.25 Worker travel during decommissioning has been assumed to be equivalent to that during construction. This is a conservative estimate; as there is likely to be significantly less work involved in decommissioning compared to construction.

Land use change

6.4.26 An assessment of GHG impacts from land use change associated with the conversion of arable land to grassland has been omitted from this chapter. Land use change as a result of the Scheme is anticipated to have a beneficial GHG impact due to the conversion of large areas of cropland to grassland, which has a higher carbon sequestration value than cropland. However, it is assumed that the new areas of grassland will be returned to cropland following decommissioning of the Scheme, with any carbon stored in soil or vegetation re-released to the atmosphere. The beneficial GHG impact from land use change is therefore considered to only be temporary (approximately 60 years) and has therefore been excluded from the lifecycle GHG impact assessment. This is considered to be a robust worst-case approach and likely to underestimate the beneficial effect of the Scheme, as it is expected that tree and hedgerow planting will be retained after decommissioning. Any carbon



sequestered in these areas would remain in the ground following decommissioning.

Construction Phase

6.4.27 As stated in **Chapter 5: EIA Methodology** construction is assumed to commence in Q1 2025 and the Scheme will be built over an estimated 24 to 36 months, with operation therefore anticipated to commence around Q1 2028. A 36-month construction programme has been assumed for the purposes of this assessment. This is expected to be a realistic worst-case assumption for this assessment, as it represents the expected maximum build time and therefore the maximum total emissions and impacts occurring as a result of the construction phase.

Operational phase

- 6.4.28 It is assumed that the on-site control building will have an average power demand of 10kW, and that this will be supplied from the distribution network. Projections of future grid carbon intensities are taken from data published by the UK Government (Ref 6-26). Energy consumption and associated carbon emissions of the heating, ventilation, and air conditioning (HVAC) system associated with the BESS, have not yet been confirmed. Additionally, power losses and associated carbon footprint of connecting cables to the grid need will be estimated as part of the Environmental Statement.
- 6.4.29 Operational energy generation data has been based on an assumed Scheme capacity of 500MW and anticipated yield (922 kWh/kWp/yr). This data accounts for efficiency losses of the PV Panels over time based on an initial degradation factor of 2% for the first year, and 0.45% degradation for each subsequent year to the end of the warranty of the panels (25 years). In order to model efficiency losses over the entire lifetime of 60 years, this 0.45% degradation rate will also be applied to remaining operational lifetime.
- 6.4.30 Operational maintenance from the replacement of components during the design lifetime of the Scheme are based on replacement rates for similar schemes and based on the design life of the components. It is assumed that all of the PV Panels will require replacement once during the Scheme's design life, with a further 10% requiring replacement to cover equipment failures, at a constant rate throughout the 60-year project life. All the inverters and BESS cells are assumed to require replacement twice, with a further 50% requiring replacement to cover equipment failures, at a constant rate throughout the 60-year project life. All transformers will require replacement once, with a further 10% requiring replacement to cover equipment failures.
- 6.4.31 Sulphur hexafluoride (SF₆) is an extremely powerful GHG with a global warming potential of 23,900. Fugitive emissions of SF₆ from certain electrical items such as gas insulated switchgear have historically been a significant source of emissions. Manufacturers of such equipment are now increasingly able to offer SF₆-free components, and those that do continue to use SF₆ are sealed-for-life with extremely low leakage rates. For this reason, it is assumed that emissions of SF₆ from this Scheme will be minimal and not material to this GHG assessment.



Decommissioning phase

6.4.32 Emissions from the decommissioning process at the end of the design life are very difficult to estimate due to the substantial uncertainty surrounding decommissioning methodologies and approaches so far into the future. It has been assumed that the resources and effort required for decommissioning will be equivalent to those required for construction. Once again, this is considered to be a worst-case scenario.

6.5 Study Area

Lifecycle GHG Impact Assessment

6.5.1 The study area for the lifecycle GHG impact assessment considers all GHG emissions arising over the lifecycle of the Scheme. This includes direct GHG emissions arising from activities within the DCO Site boundary and indirect emissions from activities outside the DCO Site boundary (for example, the transportation of materials to the Scheme boundary and embodied carbon within construction materials).

Climate Change Resilience (CCR) Review

6.5.2 The study area for the CCR review is the DCO Site boundary i.e. it covers all assets and infrastructure which constitute the Scheme, during construction, operation, and decommissioning.

In-Combination Climate Change Impact (ICCI) Assessment

6.5.3 The study areas used for the ICCI assessment for this PEI Report is the DCO site boundary and is limited to the assessment of in-combination effects on surface water and groundwater receptors as defined in **Chapter 9: Water Environment** of this PEI Report. This assessment aims to determine the influence of climate change and project-related impacts to the identified receptors in this chapter.

6.6 Assessment Methodology

Impact Assessment Methodology

Lifecycle GHG Impact Assessment

6.6.1 The potential effects of the Scheme on the climate during construction have been calculated in line with the GHG Protocol (Ref 6-29) and the GHG 'hot spots' (i.e. materials and activities likely to generate the largest amount of GHG emissions) have been identified. This will enable priority areas for mitigation to be identified. This approach is consistent with the principles set out by the Institute for Environmental Management and Assessment (IEMA) document 'Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance' (Ref 6-30).



- 6.6.2 This lifecycle approach considers emissions from the following lifecycle stages of the Scheme: construction, operation and maintenance, and decommissioning.
- 6.6.3 Where activity data allows, expected GHG emissions arising from the construction, operation and maintenance, and decommissioning activities, and embodied carbon in materials of the Scheme, have been quantified using a calculation-based methodology as per the following equation as stated in the methodology paper accompanying the conversion factors for company reporting published by the UK Government (Ref 6-25):
 - Activity data x GHG emissions factor = GHG emissions value
- 6.6.4 In line with 'The GHG Protocol' (Ref 6-29), when defining potential impacts the seven Kyoto Protocol GHGs have been considered, specifically:
 - Carbon dioxide (CO₂);
 - Methane (CH₄);
 - Nitrous oxide (N₂O);
 - Sulphur hexafluoride (SF₆);
 - Hydrofluorocarbons (HFCs);
 - Perfluorocarbons (PFCs); and
 - Nitrogen trifluoride (NF₃).
- 6.6.5 These GHGs are broadly referred to in this chapter under an encompassing definition of 'GHG emissions', with the unit of tCO₂e (tonnes CO₂ equivalent).
- 6.6.6 Where data are not available, a qualitative approach to addressing GHG impacts has been followed, in line with the IEMA guidance on assessing GHG emissions in EIA (Ref 6-30).
- 6.6.7 Table 6-1 summarises the key anticipated GHG emissions sources associated with the Scheme, which were scoped in during the consultation process.

Table 6-1 Potential sources of GHG emissions

Lifecycle stage	Activity	Primary emission sources
Product Stage	Raw material extraction and manufacturing of products required to build the equipment for the Scheme. Due to the complexity of the equipment, this stage is expected to make a significant contribution to overall GHG emissions. Transportation of materials for manufacturing.	Embodied GHG emissions from energy use in extraction of materials and manufacture of components and equipment. Emissions of GHG from transportation of products and materials. Due to the nature of the equipment, this could require shipment of certain aspects over significant distances.
Construction process stage	On-site construction activity including emissions from construction compounds. Transportation of construction materials (where these are not included in product-stage embodied GHG emissions). Travel of construction workers	Consumption of energy (electricity; other fuels) from plant, vehicles, generators and worker travel. Fuel consumption from transportation of materials to site, where these are not included in product-stage embodied emissions.



Lifecycle stage	Activity	Primary emission sources
	Disposal of waste materials generated by the construction process. Land use change. Water use	GHG emissions from transportation and disposal of waste. GHG impact of changes to carbon sink value of the Site. Provision of clean water, and treatment of wastewater.
Operation stage	Operation and maintenance of the scheme	GHG emissions from energy consumption, provision of clean water and treatment of wastewater. These operational emissions are expected to be negligible in the context of the overall GHG impact. Leakage of potent GHGs, such as SF ₆ , during operation. GHG emissions from energy consumption, material use and waste generation resulting from ongoing site maintenance. Emissions from routine maintenance are expected to be negligible, but the periodic replacement of components has the potential to have significant impacts given the complexity of the equipment involved.
Decommissioning stage	On-site decommissioning activity. Transportation and disposal of waste materials. Worker travel.	Consumption of energy (electricity and other fuels) from plant, vehicles and generators on-site. Emissions from the disposal and transportation of waste. This has the potential to be significant give the complexity of the equipment. GHG emissions from transportation of workers to the Site.

Climate Change Resilience Review

- 6.6.8 The EIA Regulations (Ref 6-1) require the inclusion of information on the vulnerability of the Scheme to climate change. Consequently, an assessment of climate change resilience for the Scheme has been undertaken which identifies potential climate change impacts in accordance with IEMA Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation (Ref 6-31).
- 6.6.9 The review has included all infrastructure and assets associated with the Scheme. It covers resilience against both gradual climate change, and the risks associated with an increased frequency of extreme weather events as per the UKCP18 projections (Ref 6-28).
- 6.6.10 The review of potential impacts and the Scheme's vulnerability considers the mitigation measures that have been designed into the Scheme as discussed in Section 6.9 on Mitigation Measures. Potential impacts considered include higher temperatures in the future, and more extreme rainfall events.



- 6.6.11 The review also identifies and accounts for existing resilience measures for each risk either already in place or in development for infrastructure and assets.
- 6.6.12 As agreed during the consultation process, the scope of the CCR assessment is detailed in Table 6-2.

Table 6-2 Scope of the CCR assessment

Climate Risk	Scoped In/Out	Rationale
Extreme weather events	ln	The Scheme may be vulnerable to extreme weather events such as storm damage to structures and assets.
Increased average temperatures and incidence of heatwaves	In	Extremes in temperatures may result in heat stress of materials and structures.
Increased frequency of heavy precipitation events	ln	The Scheme may be vulnerable to changes in precipitation, for example, land subsidence and damage to structures and drainage systems during periods of heavy rainfall.
Increase in strong wind events	In	The Scheme may be vulnerable to changing wind patterns, for example, high winds and falling trees could damage structures and assets.
Sea level rise	In	Based on the Scoping Opinion, sea level rise has been scoped into the climate resilience review on the basis that the River Trent is tidal in the area of the Grid Connection. However, according to Chapter 9: Water Environment the National Tidal Limit (NTL) is approximately 28km upstream of the DCO Site, and whilst there is a tidal influence in this area it is reasonable to assume that the fluvial influence is likely to outweigh the tidal influence and therefore the risk from tidal flooding is considered low based on the distance upstream from river mouth and flood defences in the area.

6.6.13 Once potential climate risks have been identified, the likelihood of their occurrence during the project phase is categorised. Likelihood is categorised into five levels depending on the probability of the hazard occurring. Table 6-3 presents the likelihood levels and definitions used. This is in line with the definitions presented in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (Ref 6-32).

Table 6-3 Level of likelihood of a climate risk occurring

Likelihood Category	Description (probability of occurrence)
Very likely	>90-100% probability that the impact will occur

Likely	>66-90% probability that the impact will occur
Possible, about as likely as not	>33-66% probability that the impact will occur

Unlikely >10-33% probability that the impact will occur



Very unlikely

0-10% probability that the impact will occur

6.6.14 The consequence of an impact has been measured using the criteria detailed in Table 6-4. The probability and consequence will take into account embedded design and impact avoidance measures. The embedded design and impact avoidance measures are secured via implementation of the Construction Environmental Management Plan (CEMP), Operational Environmental Management Plan (OEMP) and Decommissioning Environmental Management Plan (DEMP) which will be a requirement of the DCO.

Table 6-4 Level of consequence of a climate risk occurring

Consequence of Impact	Measure of Consequence for Climate Change Risk
Very high	Permanent damage to structures/assets; Complete loss of operation/service; Complete/partial renewal of infrastructure; Serious health effects, possible loss of life; Extreme financial impact; and Exceptional environmental damage.
High	Extensive infrastructure damage and complete loss of service; Some infrastructure renewal; Major health impacts; Major financial loss; and Considerable environmental impacts.
Medium	Partial infrastructure damage and some loss of service; Moderate financial impact; Adverse effects on health; and Adverse impact on the environment.
Low	Localised infrastructure disruption and minor loss of service; No permanent damage, minor restoration work required; and Small financial losses and/or slight adverse health or environmental effects.
Very low	No damage to infrastructure; No impacts on health or the environment; and No adverse financial impact.

In-Combination Climate Change Impact Assessment

- 6.6.15 The ICCI assessment considers the ways in which projected climate change will influence the significance of the impact of the Scheme on receptors in the surrounding environment. As agreed with the Planning Inspectorate via the Scoping process, the scope of the ICCI assessment is limited to effects on surface water or groundwater levels as solar panels have the potential to alter runoff rates and patterns, as detailed in Table 6-5.
- 6.6.16 The ICCI assessment considers the existing and projected future climate conditions for the geographical location and assessment timeframe. It identifies the extent to which identified receptors in the surrounding environment are potentially vulnerable to and affected by these factors. The receptors for the ICCI assessment are those that will be impacted by the Proposed Development. These impacts will be assessed in liaison with the technical specialists responsible for preparing the applicable technical chapters.



Table 6-5 Scope of the ICCI assessment

Climate Risk	Scoped In/Out	Rationale
Temperature change	Out	While impacts are expected as a result of projected temperature increases, these temperature increases in combination with the Scheme are not expected to have a significant impact upon receptors identified by other environmental disciplines.
Sea level rise	In	Based on the Scoping Opinion, sea level rise has been scoped into the ICCI assessment on the basis that the River Trent is tidal in the area of the Grid Connection. However, according to Chapter 9: Water Environment the National Tidal Limit (NTL) is currently approximately 28km upstream of the DCO Site, and whilst there is a tidal influence in this area it is reasonable to assume that the fluvial influence is likely to outweigh the tidal influence and therefore the risk from tidal flooding is considered low based on the distance upstream from river mouth and flood defences in the area.
Precipitation change (frequency and magnitude of precipitation events and droughts)	In	Climate change may lead to an increase in substantial precipitation events that could lead to flash flooding or changes to groundwater levels. Impacts to surface water or groundwater levels as a result of precipitation changes, may occur in combination with the Scheme, as the flow of precipitation to ground may be affected by the installation of the solar modules. The Scheme, in combination with projected changes in precipitation, is not expected to have a significant impact upon receptors identified by other environmental disciplines.
Wind	Out	The Scheme, in combination with projected changes in wind patterns, is not expected to have a significant impact upon receptors identified by other environmental disciplines.

- 6.6.17 Once potential ICCIs have been identified to the Proposed Development, the likelihood of their occurrence during the project phase is categorised. This is the same process as was undertaken for the CCR, as detailed in Table 6-3.
- 6.6.18 In consideration of the likelihood of the climate risk occurring, the sensitivity of the receptor, the likelihood of an impact occurring to the receptor is then defined. This includes any embedded mitigation measures. These classifications are defined in Table 6-6.

Table 6-6 Likelihood of climate risks impacting receptor

Level of likelihood of climate impact occurring	Definition of likelihood
Likely	>66-100% probability that the impact will occur during the life of the project
Possible, about as likely as not	>33-66% probability that the impact will occur during the life of the project
Unlikely	0-33% probability that the impact will occur during the life of the project

6.6.19 The likelihood of a climate risk occurring and the likelihood of an impact to a receptor is then combined to determine the likelihood of an ICCI occurring. This matrix is illustrated in Table 6-7.



Table 6-7 Level of likelihood of an ICCl occurring

Likelihood of a climate risk occurring

		Very Unlikely	Unlikely	Possible	Likely	Very Likely
Likelihood of Impact to Receptor	Unlikely	Low	Low	Low	Medium	Medium
	Possible	Low	Low	Medium	Medium	Medium
·	Likely	Low	Medium	Medium	High	High

- 6.6.20 Once the likelihood of an ICCI impact occurring on a receptor has been identified, the assessment then considers how this will affect the significance of the identified effects.
- 6.6.21 The ICCI consequence criteria are defined in Table 6-8 and are based on the change to the significance of the effect already identified by the environmental discipline. To assess the consequence of an ICCI impact, each discipline will assign a level of consequence to an impact based on the criteria description and their discipline assessment methodology.

Table 6-8 Consequence of ICCI occurring

Consequence	Consequence criteria		
High	The climate change parameter in-combination with the effect of the proposed development causes the significance of the effect of the proposed scheme on the resource/receptor, as defined by the topic, to increase from negligible, minor or moderate to major.		
Medium	The climate change parameter in-combination with the effect of the proposed development causes the effect defined by the topic, to increase from negligible or minor to moderate.		
Low	The climate change parameter in-combination with the effect of the proposed development, causes the significance of effect defined by the topic, to increase from negligible to minor.		
Very low	The climate change parameter in-combination with the effect of the proposed development does not alter the significance of the effect defined by the topic.		

Significance Criteria

Lifecycle GHG Impact Assessment

- 6.6.22 Due to the absence of any defined industry guidance for assessing the magnitude of GHG impacts for EIA, standard GHG accounting and reporting principles have been followed to assess impact magnitude. According to the IEMA guidance on assessing GHG emissions in EIA (Ref 6-30), "GHG emissions have a combined environmental effect that is approaching a scientifically defined environmental limit, as such any GHG emissions or reductions from a project might be considered to be significant".
- 6.6.23 The IEMA guidance (Ref 6-30) also states it is down to the professional judgement of the practitioner to determine how best to contextualise a project's GHG impact and assign the level of significance. It is suggested that sectoral, local, or national carbon budgets can be used, as available and appropriate, to contextualise a project's GHG impact and determine the level



- of significance. The approach adopted for the purposes of this assessment is outlined below.
- 6.6.24 In GHG accounting it is common practice to consider exclusion of emission sources that are <1% of a given emissions inventory on the basis of a 'de minimis' contribution. Both Department of Energy and Climate Change (DECC) (Ref 6-33) and the Publicly Available Specification PAS 2050:2011 (Ref 6-34) allow emissions sources of <1% contribution to be excluded from emission inventories, and these inventories to still be considered complete for verification purposes.</p>
- 6.6.25 Where available, UK national carbon budgets will be used for the purposes of this assessment to represent future emissions inventory scenarios for the UK. These legally binding limits outline the total amount of GHGs that the UK can emit over a five-year period.
- 6.6.26 UK National carbon budgets are currently available to 2037 (Ref 6-35). The Carbon Budget Order 2021, containing details of the 6th carbon budget for the period 2033-37 was signed into law in June 2021 (Ref 6-7). Therefore, a qualitative approach has been taken for assessing the significance of GHG emissions arising as a result of the Scheme for the years beyond 2037. A quantitative approach is not possible beyond 2037 as although the carbon budgets are set to decrease over time, there will still be permitted GHG emissions beyond 2050, but with offsetting measures in place to ensure net emissions are zero. The rate at which they will decrease is not known, so it is not possible to predict the quantity of emissions permitted within the carbon budgets beyond 2037.
- 6.6.27 It should be noted that the 1st to 5th carbon budgets were based on the previous UK Government target of an 80% reduction in GHG emissions by 2050, rather than the current net zero target for 2050 (Ref 6-4), with only the 6th carbon budget being based on the UK's net-zero target.
- 6.6.28 For the purposes of this assessment, a development with emissions of <1% of the relevant carbon budget would be considered not material and would therefore be unlikely to impact the UK's ability to meet its net zero carbon emissions target for 2050. Equally, if a development results in an annual reduction in GHG emissions, the beneficial impact will also be assessed using this 1% threshold.
- 6.6.29 This approach has been used to assess the magnitude of the GHG impact associated with the Scheme and the associated criteria are outlined in Table 6-9. This differs from the standard criteria used in the EIA process by omitting the 'Very Low' and 'Medium' categories for magnitude. This is because the magnitude of the impact is determined by a boundary of less than, or equal to or more than, 1% of the carbon budgets.

Table 6-9 Magnitude Criteria for GHG Impact Assessment

Magnitude	Magnitude Criteria
High	Annual GHG emissions, or GHG emissions reductions, represent moreless than 1%
	of the relevant annual National Carbon Budget.



Magnitude Magnitude Criteria

Low Annual GHG emissions, or GHG emissions reductions, represent less than 1% of the relevant annual National Carbon Budget.

- 6.6.30 The UK carbon budgets are in place to restrict the amount of GHG emissions the UK can legally emit in a five-year period (Ref 6-35). The UK is currently in the 3rd carbon budget period, which runs from 2018 to 2022.
- 6.6.31 The construction phase of the Scheme is estimated to commence not earlier than Q1 of 2025 and run for an estimated 24-36 months. Construction is therefore expected to fall within the period of the 4th UK national carbon budget which will run from 2023 to 2027.
- 6.6.32 Where possible, the operational phase of the Scheme (estimated to be not earlier than Q1 2028) will be compared to the relevant and available carbon budgets within the design life of the Scheme: the 5th and 6th carbon budgets covering the periods 2028-32 and 2033-37, respectively.
- 6.6.33 Beyond 2037, the Committee on Climate Change has not issued formal advice on later carbon budgets, nor have these been approved and ratified by the UK parliament. But the CCC has published annual emissions totals that are consistent with a so-called Balanced Net Zero Pathway, and it is possible to aggregate these annual figures into 5 year totals for the 7th, 8th and 9th carbon budget periods.
- 6.6.34 Table 6-10 shows the approved UK carbon budgets up to 2037, which highlights a reduction in the amount of GHG the UK can legally emit in the future. Beyond 2037, the table shows indicative carbon budgets derived from the CCC's Balanced Net Zero Pathway. Clearly, any source of emissions contributing to the UK's carbon inventory will have a greater impact on the UK carbon budgets in the future.

Table 6-10 Relevant Carbon Budgets for this Assessment

Carbon Budget	Total budget (MtCO₂e)
3 rd (2018-2022)	2,544
4 th (2023-2027)	1,950
5 th (2028-2032)	1,725
6 th (2033-2037)	965
7 th (2038-2042)	526
8 th (2043-2047)	195
9 th (2048-2050)	17

6.6.35 The significance of effects has been determined using the matrix in Table 6-11. The sensitivity of the receptor (global climate) to increases in GHG emissions is always considered 'High', and the magnitude of the impact is determined by a boundary of less than, or equal to or more than, 1% of the carbon budgets (i.e. minor or major).



6.6.36 This is in line with the IEMA guidance on assessing the significance of GHG emissions in EIA (Ref 6-30) which states that the application of the standard EIA significance criteria is not considered to be appropriate for climate change mitigation assessments. It is therefore considered that any emissions, or emissions reductions, as a result of the Scheme might be considered significant. For the purposes of this assessment, the magnitude of significance will be determined using the criteria outlined in Table 6-11.

Table 6-11 Significance of Effects Matrix for GHG Impact Assessment

Magnitude	Significance
Low (<1% of carbon budget)	Minor significance
High (≥1% of carbon budget)	Major significance

6.6.37 From 2050 onwards, the UK is legally obliged to offset any residual emissions in line with its net zero target for 2050. Therefore, over time, the level of impact of any emissions, or emissions reductions, could be considered to become more significant in the context of the UK meeting its carbon reduction target as the quantity of permitted emissions gets smaller.

Climate Change Resilience Review

6.6.38 The significance of CCR is determined as a function of the likelihood of a climate change risk occurring and the consequence to the receptor if the hazard occurs. This is detailed in Table 6-12. Where a risk is determined as High or Very high, this has been deemed significant.

Likelihood of a climate impact occurring

Table 6-12 Level of effect criteria for climate change resilience impacts

Very unlikely Unlikely Likely Very likely Possible, about as likely as not Consequence Catastrophic Adverse/ VΗ VH VΗ M L Substantial Beneficial Major M Η Η VH Considerable L M Н Η Н Н Moderate L M M M Minor L L M M Insignificant L L L L L No change ı

 $VH = Very \ high \ effect, \ H = High \ effect, \ M = Moderate \ effect, \ L = Low \ effect$

In-Combination Climate Change Assessment

6.6.39 The significance of potential effects is determined using the matrix in Table 6-13. Where an effect has been identified as moderate or major will be classed as a significant ICCI effect. If significant ICCI effects are assessed, then



appropriate additional mitigation measures (secondary mitigation) are identified.

Table 6-13 ICCI Significance Matrix

Likelihood of an ICCI occurring

		Low	Medium	High
Consequence of an ICCI occurring	Very low	Negligible	Negligible	Minor
	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

6.7 Baseline Conditions

6.7.1 This section describes the baseline environmental characteristics for the Scheme and surrounding areas with specific reference to GHG emissions and climatic conditions.

Lifecycle GHG Impact Assessment

- 6.7.2 The land within the Solar and Energy Storage Park consists mainly of arable land, managed hedgerows, and trees. Trees are present individually in some areas as well as rows of trees and small woodland areas. Also, the current use of the Solar and Energy Storage Park has minor levels of associated GHG emissions as the land use is largely agricultural. Baseline agricultural GHG emissions are dependent on soil and vegetation types present, and fuel use for the operation of vehicles and machinery.
- 6.7.3 The lifecycle GHG impact assessment for the wider Scheme boundary, comprising the Solar and Energy Storage Park and the Grid Connection Route are included in Section 0.
- 6.7.4 For the lifecycle GHG impact assessment, the future baseline is a 'business as usual' scenario whereby the Scheme is not implemented, for those lifecycle stages that have been scoped into the assessment, presented in Table 6-1. The future baseline comprises existing carbon stock and sources of GHG emissions within the DCO Site boundary from the existing activities on-site.
- 6.7.5 While the current land use within the DCO Site boundary will have minor levels of associated GHG emissions, it is anticipated that these emissions will not be material in the context of the overall Scheme. Therefore, for the purposes of the lifecycle GHG impact assessment, a GHG emissions baseline of zero is applied.

Climate Change Resilience Review and In-Combination Climate Change Impact Assessment

Existing Baseline

6.7.6 The current baseline for the CCR review and ICCI assessment is the current climate in the location of the Scheme. Historic climate data obtained from the Met Office website (Ref 6-27) recorded by the closest Met Office station to the



Scheme (Scampton) for the 30-year climate period of 1981-2010 (the standard baseline for climate data) is summarised in Table 6-14 below.

Table 6-14 Historic climate data

Climatic Factor	Month	Figure
Average annual maximum daily temperature (°C)	-	13.44
Warmest month on average (°C)	July	21.32
Coldest month on average (°C)	February	0.64
Mean annual rainfall levels (mm)	-	613.15
Wettest month on average (mm)	June	60.48
Driest month on average (mm)	February	35.93

6.7.7 The Met Office historic 10-year averages for the 'England East and North East' region identify gradual warming between 1972 and 2021, with increased rainfall. Information on mean maximum annual temperatures (°C) and mean annual rainfall (mm) is summarised in Table 6-15.

Table 6-15 Historic 10-year averages for temperature and rainfall for the East and North East region

Climate Period	Climate Variable			
	Mean maximum annual temperatures (°C)	Mean annual rainfall (mm)		
1972-1981	12.7	1,195.7		
1982-1991	13.1	1,214.5		
1992-2001	13.4	1,392.9		
2002-2011	13.8	1,210.0		
2012-2021	13.9	1,322.9		

6.7.8 A site-specific flood risk assessment will be prepared for the Scheme. Details of the baseline flood risk can be found within **Chapter 9: Water Environment** of this PEI Report.

Future Baseline

- 6.7.9 The future baseline scenarios are set out in **Chapter 5: EIA Methodology**.
- 6.7.10 The future baseline is expected to differ from the present-day baseline described above. United Kingdom Climate Change Projections 2018 (UKCP18) (Ref 6-28) provides probabilistic climate change projections for predefined 30-year periods for annual, seasonal, and monthly changes to mean climatic conditions over land areas. For the purpose of the assessment, UKCP18 probabilistic projections for pre-defined 30-year periods for the following average climate variables have been obtained:
 - Mean annual temperature;
 - Mean summer temperature;
 - Mean winter temperature;



- Maximum summer temperature;
- Minimum winter temperature;
- Mean annual precipitation;
- Mean summer precipitation;
- Mean winter precipitation;
- Mean annual cloud cover;
- · Mean summer cloud cover; and
- Mean winter cloud cover.
- 6.7.11 Projected temperature, precipitation, and cloud cover variables are presented in Table 6-16, Table 6-17 and Table 6-18 respectively. UKCP18 probabilistic projections have been analysed for the 25km² grid square within which the Scheme is located (487500.00, 387500.00). These figures are expressed as temperature/precipitation anomalies in relation to the 1981-2000 baseline.
- 6.7.12 UKCP18 uses a range of possible scenarios, classified as Representative Concentration Pathways (RCPs), to inform differing future emission trends. These RCPs "... specify the concentrations of greenhouse gases that will result in total radiative forcing increasing by a target amount by 2100, relative to preindustrial levels." RCP8.5 has been used for the purposes of this assessment as a worst-case scenario.
- 6.7.13 As the design life of the Scheme is expected to be at least 60 years, the CCR assessment has considered a scenario that reflects a high level of GHG emissions at the 10%, 50%, and 90% probability levels up to 2089 to assess the impact of climate change over the lifetime of the Scheme.
- 6.7.14 The tables below show projected changes in temperature (expected to increase), precipitation (expected to increase in winter and decrease in summer) and cloud cover (expected to increase in winter and decrease in summer). The climate projections do not take account of the Scheme.

Table 6-16 Projected changes in temperature variables (°C)

Climate Variable	Time Period				
	2020-2049	2040-2069	2060-2089		
Mean annual air temperature anomaly at 1.5 m (°C)	+1.04 (+0.44 to +1.68)	+1.83 (+0.89 to +2.85)	+2.88 (+1.43 to +4.43)		
Mean summer air temperature anomaly at 1.5 m (°C)	+1.24	+2.22	+3.50		
	(+0.48 to +2.05)	(+0.85 to +3.65)	(+1.39 to +5.81)		
Mean winter air temperature anomaly at 1.5 m (°C)	+0.93	+1.65	+2.53		
	(-0.06 to +1.96)	(+0.43 to +2.91)	(+0.85 to +4.24)		
Maximum summer air temperature anomaly at 1.5 m (°C)	+1.36	+2.51	+3.97		
	(+0.44 to +2.4)	(+0.85 to 4.3)	(+1.35 to 6.72)		
Minimum winter air temperature anomaly at 1.5 m (°C)	+0.87	+1.6	+2.45		
	(-0.14 to +1.94)	(+0.37 to +3.03)	(+0.72 to +4.42)		



Table 6-17 Projected changes in precipitation variables (%)

Climate Variable	Time Period				
	2020-2049	2040-2069	2060 - 2089		
Annual precipitation rate anomaly (%)	+0.58	-1.42	-0.69		
	(-3.43 to +4.72)	(-7.32 to +4.57)	(-5.83 to +4.42)		
Summer precipitation rate anomaly (%)	-8.32	-18.6	-24.45		
	(-24.42 to +7.32)	(-40.69 to +4.25)	(-50.67 to +2.04)		
Winter precipitation rate anomaly (%)	+3.68	+7.47	+13.42		
	(-3.84 to +11.55)	(-4.07 to +20.12)	(-1.45 to +29.47)		

Table 6-18 Projected changes in cloud cover variables (%)

Climate Variable	Time Period				
	2020-2049	2040-2069	2060 - 2089		
Annual total cloud anomaly (%)	-1.84	-3.26	-4.89		
	(-4.8 to +0.99)	(-7.45 to +0.88)	(-10.46 to +0.39)		
Summer total cloud anomaly (%)	-4.09	-7.95	-11.6		
	(-9.99 to +1.37)	(-17.85 to +1.75)	(-24.43 to +1.26)		
Winter total cloud anomaly (%)	+0.18	+0.69	+1.16		
	(-2.39 to +2.52)	(-1.12 to +2.34)	(-0.57 to +2.87)		

6.8 Potential Impacts

- 6.8.1 Mitigation measures being incorporated in the design and construction of the Scheme are set out below. The potential impacts of the Scheme during construction, operation and during decommissioning, which will be considered in the assessment are summarised in:
 - Table 6-1 Potential sources of GHG emissions:
 - Table 6-2 Scope of the CCR assessment; and
 - Table 6-5 Scope of the ICCI assessment.

Summary of Sensitive Receptors

- 6.8.2 Based on a review of the baseline conditions, the global climate is the receptor for the lifecycle GHG impact assessment. The sensitivity of this receptor is high, in line with the IEMA guidance on assessing GHG emissions in EIA (Ref 6-30), which highlights the importance of mitigating GHG emissions to reduce the impacts of climate change.
- 6.8.3 The receptor for the review of climate change resilience is the Scheme itself, including all infrastructure, assets, and workers on-site during construction, operation, and decommissioning. The sensitivity of the receptor has not been defined for the CCR review as only a review of the impacts is required in line with UK industry (IEMA) guidance (Ref 6-30), rather than an assessment of the significance.
- 6.8.4 In the ICCI assessment, sensitive receptors are determined by each socioenvironmental discipline in their assessment, in this case that relates to



Chapter 9: Water Environment. The ICCI assessment is undertaken by individual technical disciplines in regard to the identified sensitive receptors in each assessment.

6.9 Mitigation Measures

- 6.9.1 A framework CEMP will be prepared to accompany the ES. This will identify various mitigation measures to be embedded within the Scheme to reduce the GHG impact including:
 - a. Increasing recyclability by segregating construction waste to be re-used and recycled where reasonably practicable;
 - b. Adopting the Considerate Constructors Scheme (CCS) to assist in reducing pollution, including GHGs, from the Scheme by employing best practice measures which go beyond the statutory requirements;
 - c. Designing, constructing, and implementing the Scheme in such a way as to minimise the creation of waste and maximise the use of alternative materials with lower embodied carbon such as locally sourced products and materials with a higher recycled content;
 - d. Encouraging the use of lower carbon modes of transport by identifying and communicating local bus connections and pedestrian and cycle access routes to/from the Scheme to all construction staff, and providing appropriate facilities for the safe storage of cycles;
 - e. Liaising with construction personnel for potential to implement staff minibuses and car sharing options;
 - f. Implementing a Travel Plan to reduce the volume of construction staff and employee trips to the DCO Site;
 - g. Switching off vehicles and plant when not in use and ensuring construction vehicles conform to current EU emissions standards; and
 - h. Conducting regular planned maintenance of the Scheme to optimise efficiency.
- 6.9.2 Further climate change resilience measures embedded within the Scheme, particularly in relation to flood risk, are outlined below. The specific flood risk impacts and associated mitigation measures are discussed in more detail in **Chapter 9: Water Environment** of the PEI Report. These measures include:
 - a. The design of drainage systems will ensure that there will be no significant increases in flood risk downstream during storms up to and including the 1 in 100 (1%) annual probability design flood, with an allowance of 40% for climate change;
 - b. Sustainable Drainage Systems (SuDS) features will be utilised to ensure the surface water drainage strategy adequately attenuates and treats runoff from the Scheme, whilst minimising flood risk to the DCO Site and surrounding areas; and



c. The rate of runoff from each development location within the whole Solar and Energy Storage Park would ensure nil detriment in terms of no increase in runoff rate from the Site to receiving watercourses.

Construction and Decommissioning

- 6.9.3 The framework CEMP will also include various climate change resilience measures embedded within the Scheme. These include:
 - a. Storing topsoil and other construction materials outside of the 1 in 100year floodplain extent (Flood Zone 3), as far as reasonably practicable; and
 - b. Appointing at least one designated Flood Warden who is familiar with the risks and remains vigilant to news reports, Environment Agency flood warnings, and water levels of the local waterways.
- 6.9.4 Health and safety plans developed for construction and decommissioning activities will be required to account for potential climate change impacts on workers, such as flooding and heatwaves.
- 6.9.5 An implementation mechanism analogous to the framework CEMP but focussing on decommissioning will be developed prior to the decommissioning phase to encourage the use of lower-carbon and more climate change resilient methods. A DEMP (including a GHG assessment) will be prepared prior to decommissioning.

Operation

- 6.9.6 The effect of projected temperature increases on electrical equipment over the course of the Scheme's design life has been taken into account. Inverters (PV and BESS) will have a cooling system installed to control the temperature and allow the inverters to operate efficiently in warmer conditions. The PV modules and transformers have a wide range of acceptable operating temperatures, and it has been determined that increasing temperatures will not adversely affect their operation.
- 6.9.7 Consideration will also be given to the UKCP18 climate change projections outlined in Section 6.6, and the resilience of the Scheme's infrastructure to these, through the detailed design process.

6.10 Assessment of Likely Impacts and Effects

- 6.10.1 Taking into account the committed avoidance and mitigation measures as detailed in Section 6.9 above, the potential for the Scheme to generate effects was assessed using the methodology as detailed in Section 6.6 of this Chapter.
- 6.10.2 The effects have been assessed following consideration of the potential impacts outlined in Section 6.8 and the mitigation measures in Section 6.9.



Lifecycle GHG Impact Assessment

- 6.10.3 Within this section, GHG emissions arising as a result of the Scheme are first identified and assessed for each lifecycle stage individually (construction, operation, and decommissioning).
- 6.10.4 While it is important to understand the GHG impacts at each individual lifecycle stage, it is also important to understand the net lifecycle GHG impact of the Scheme due to the long-term, cumulative nature of GHG emissions over the lifetime of the Scheme.
- 6.10.5 Therefore, the net impact of the Scheme is also identified and assessed, taking into account the renewable energy generation and the benefit of this in the context of the wider energy generation sector and the National Grid average GHG intensity. The overall assessment, which will account for all GHG emissions over the lifetime of the Scheme, will compare the GHG intensity of the Scheme with the GHG intensity of other predicted grid energy generation sources.

Construction (2025 to 2027-28) and Decommissioning (2087 to 2088-89)

6.10.6 The greatest GHG impacts occur during the construction phase as a result of the manufacture of the materials and components required. The manufacture of the PV Panels is estimated to account for 239,273 tCO₂e, with the manufacture of BESS leading to a further 62,000 tCO₂e based on the layout plan and the description of the Scheme provided in **Chapter 2: The Scheme**. Table 6-19 summarises the emissions resulting from the manufacture of materials required for the construction of the Scheme.

Table 6-19 Embodied emissions from the manufacture of materials and components

Emissions Source	Embodied emissions (t CO ₂ e)	Proportion of total embodied emissions
PV Panels	239,273	65%
BESS	62,000	17%
PV framework	37,670	10%
PV Inverters	18,591	5%
Transformers	5,127	1.4%
Cables	2,473	<1%
Concrete	845	<1%
Aggregate	116	<1%
Total Products	366,094	100%

6.10.7 Other sources of emissions during construction within the scope of the GHG emissions assessment include water, energy, and fuel use for construction activities including fuel consumed by construction plant and machinery, fuel use for the transportation of construction materials to the DCO Site, transportation of construction workers to and from the DCO Site and the



- transportation and disposal of waste. For details of assumptions and limitations refer to Section 6.4.
- 6.10.8 Based on the scheme details and assumptions included in Section 6.4 total GHG emissions from the construction phase are estimated to equate to around 394,518 tCO₂e. Table 6-20 below summarises overall construction emissions from various emissions sources.

Table 6-20 Emissions resulting from the construction phase

Emissions Source	Embodied emissions (t CO₂e)	Proportion of overall construction emissions	
Products and materials	366,094	92.8%	
Transportation of products and materials	20,566	5.2%	
Worker commuting	3,245	0.8%	
Waste (including transport)	2,866	0.7%	
Fuel use	1,746	0.4%	
Water use	0.6	<1%	
Construction total	394,518	100%	
6.10.9			

Operation (2028 to 2088)

- 6.10.10 GHG emissions sources within the scope of the operational emissions include operational energy use (i.e. for auxiliary services and standby power), fuel used for the transportation of workers to the DCO Site, and maintenance activities (including embodied carbon in replacement parts, plant and machinery requirements, fuel and water use during maintenance activities, transportation of materials and waste to and from the DCO Site, and waste management activities).
- 6.10.11 It is assumed that the on-site control building will have an average power demand of 10kW of continuous power demand, and that this will be supplied from the distribution network overnight for a total annual grid electricity consumption of 46,355 kWh/yr. The UK Government publishes projections of grid carbon intensity for each year to 2100, with emissions per kWh of electricity generated set to decline over the period to 2050. Emissions therefore will be highest in year one of operation and fall thereafter. Applying these projected grid factors, emissions in the first year of operations are estimated to be just over 5 tCO₂e/yr, falling to 1 tCO₂e/yr by the final year of the design life when the national grid is assumed to be largely renewables fed. Lifetime emissions from grid power consumption total 110 tCO₂e. This is likely to be an overestimate given that the power will sometimes be generated onsite from the Solar PV or from the BESS.
- 6.10.12 Based on the estimated lifetime and replacement rates for PV Panels, PV Inverters, BESS cells and transformers, refer Section 0, and applying the same embodied and transportation emissions factors used to quantify the impact of construction, the replacement of these components is estimated to



- result in embodied emissions of 408,317 tCO₂e, and additional emissions of 12,002 tCO₂e from their transportation from country of origin to the DCO Site.
- 6.10.13 With the exception of the emissions data for PV Panels, which have been derived from an Environmental Product Declaration, the embodied carbon factors on which these figures are based are subject to considerable uncertainty, with there being no industry-standard emissions factors for many of these items. Furthermore, if the replacement of inverters and BESS cells takes place mid-way through the Scheme's 60-year design life, it is extremely likely that by the time of replacement, the embodied carbon impact of manufacturing the replacement components will be much lower than the values that have been applied in this GHG assessment, and that much more reliable data will be available.
- 6.10.14 Emissions from the transportation of workers assume 14 workers on site each day and approximately 3-4 visitors per week, with each worker driving to site in their own vehicle a maximum of 30km each way. This is assumed to be a conservative assumption that is likely to overestimate the distance travelled. The emissions factor applied is for an average van of unknown fuel, from the most recent conversion factors for company reporting. Based on these assumptions, emissions from commuting and visitor travel are estimated at 124 tCO₂e per year, for a total of 7,468 tCO₂e over the 60-year design life of the Scheme. This figure is a highly conservative worst-case scenario, with the actual operational transport emissions likely to be much lower with the inevitable transition to EVs combined with the ongoing decarbonisation of UK grid electricity.
- 6.10.15 Emissions from the supply of water and treatment of wastewater can be estimated by applying the same emissions factors as for construction emissions. Based on 14 workers each consuming 90 litres per day, annual emissions from water and wastewater are estimated at 0.19 tCO₂e per year or 11.6 tonnes over the design life of the Scheme. This is also a worst-case scenario, as the carbon intensity of water supply and wastewater treatment are expected to fall over time.
- 6.10.16 While SF₆ is a potential source of GHG emissions over the lifetime of the Scheme (from its use in certain electric components such as gas-insulated switchgears and transformers during production, operation through leakage, and dismantling), it is not likely to be possible to accurately quantify the small level of fugitive emissions from the leakage of SF₆ due to insufficient data. Manufacturers of electrical switchgear and transformers are increasingly able to provide equipment that either does not contain any SF₆ or is sealed for life with extremely low leakage rates. This will therefore not be considered further in the assessment and is not expected to have a material impact on the predicted effects on GHG emissions associated with the Scheme (Ref 6-37).
- 6.10.17 As discussed in Section 0, land use change is anticipated to have a beneficial impact during the lifetime of the Scheme. However, as this beneficial impact is largely reversed during decommissioning, the GHG impact associated with land use change has been excluded from the lifecycle GHG impact assessment. This is assumed to represent a robust worst-case scenario as



trees planted during construction will be retained beyond the decommissioning phase.

- 6.10.18 Total operational emissions over the design life of the Scheme are estimated at 427,909 tCO₂e. 98.2% of this figure results from the supply of replacement components, with only the remaining 1.8% the result of ongoing operational emissions.
- 6.10.19 Table 6-21 summarises operational emissions sources.

Table 6-21 Emissions resulting from the operational phase

Emissions Source	Embodied emissions (t CO ₂ e)	Proportion of overall operational emissions 95.4%	
Materials (replacement components)	408,317		
Transportation of materials	12,002	2.8%	
Worker transport	7,468	1.7%	
Grid electricity	110	<0.1%	
Water/wastewater	11.6	<0.1%	
Operations total	427,909	100%	

Decommissioning (2087 to 2088-89)

- 6.10.20 GHG emissions from the Scheme during decommissioning are subject to a very high degree of uncertainty, as the conditions that will apply over six decades into the future cannot be described with any confidence. Conservatively, for the purpose of this assessment, and following discussions with the Applicant's design team, it is assumed that decommissioning emissions from the use of plant, worker travel, water and wastewater consumption would be set at 100% of the corresponding emissions during the construction phase. This is very likely to be a highly conservative estimate which overestimates decommissioning emissions.
- 6.10.21 Emissions from the disposal and recycling of materials and components at the end of the Scheme's design life have been estimated based on an assumption that 70% of materials and components will be recycled at the end of life, with 30% going to landfill, together with the most recent emissions factors for recycling published by the UK Government. This is also likely to be a conservative estimate as it is expected that a higher proportion of materials will be recycled. Emissions from end-of-life disposal of all materials and products are estimated at 1,041 tCO₂e.
- 6.10.22 Emissions from the transportation of materials and products at end of life have been estimated on the assumption that concrete and aggregate will be disposed of within a 50km radius, while all other products will be disposed of within 200km. Applying the most recent BEIS emissions factor (Ref 6-25) for HGV travel gives end of life transport emissions of 4,071 tCO₂e. This is very likely to be a highly conservative estimate as HGV transport decarbonises in the future.



- 6.10.23 Land use change has been excluded from the GHG assessment as discussed in Section 0 and Section 6.10.17 due to the beneficial GHG impacts of conversion of cropland to grassland during operation, being returned to cropland following decommissioning of the Scheme, with any carbon stored in soil or vegetation re-released to the atmosphere. This is considered to be a robust worst-case approach and likely to underestimate the beneficial effect of the Scheme, as it is expected that tree and hedgerow planting will be retained after decommissioning. Any carbon sequestered in these areas would remain in the ground following decommissioning.
- 6.10.24 Table 6-22 summarises the emissions resulting from the decommissioning phase.

Table 6-22 Emissions resulting from the decommissioning phase

Emissions Source	Embodied emissions (t CO ₂ e)	Proportion of overall decommissioning emissions
Transportation of materials	4,071	36%
Worker commuting	3,245	28%
Fuel use	3,050	27%
Waste recycling/disposal	1,041	9%
Water use	0.6	<0.01%
Decommissioning sub-total	11,408	100%

- 6.10.25 A DEMP (including a GHG assessment) will be prepared prior to decommissioning.
- 6.10.26 Lifetime emissions from the construction, operation and decommissioning of the Scheme are summarised in Table 6-23. The sum is 833,835 tCO₂e being emitted over the Scheme lifetime. This is prior to consideration of the CO₂e avoidance that can be attributed directly to the Scheme.

Table 6-23 Emissions resulting over the lifetime of the Proposed Development

Phase	Embodied emissions (t CO ₂ e)	Proportion of overall lifetime emissions	
Construction	394,518	47.3%	
Operations	427,909	51.3%	
Decommissioning	11,408	1.4%	
Lifetime total	833.835	100.0%	

Carbon intensity of the Proposed Development

6.10.27 Renewable energy generation from the Scheme during the first year of operation is estimated to be 451,780 MWh based on the scheme description and layout plan contained within **Chapter 2: The Scheme**, taking into consideration a 2% reduction in PV Panel performance during the first year. A 0.45% degradation factor has been applied for each subsequent year, resulting in an estimated energy generation figure of 346,228 MWh in the final year of operation, and a total energy generation figure of around 23,802,332 MWh over the 60-year Scheme lifetime. It is possible this is a slightly



conservative estimate, however, as future climate projections indicate a reduction in annual cloud cover over time (see Section 0) which may have a beneficial impact on the energy generation potential of the Scheme and has not been taken into account in the calculations.

- 6.10.28 Dividing this lifetime generation figure into the lifetime emissions total shown in Table 6-23 gives a total carbon intensity value of 35.03 gCO₂e/kWh.
- 6.10.29 The current UK grid carbon intensity of 212 gCO₂e/kWh, however these figures cannot be directly compared as the published UK grid carbon intensity figure only takes into account operational emissions from the generation of electricity, overwhelmingly from the fossil fuels used to power gas-fired and occasionally coal-fired power stations (40Ref 6-36). For a meaningful comparison to be made between the Scheme and the UK grid, the operational carbon intensity of the Scheme must only include emissions from the ongoing operations of the Scheme and exclude emissions from construction and decommissioning.
- 6.10.30 Combining lifetime generation figures and operational emissions figures gives an operational carbon intensity value of 17.98 gCO₂e/kWh.
- 6.10.31 Comparing the Scheme against a gas-fired Combined Cycle Gas Turbine (CCGT) generating facility, currently the most carbon-efficient fossil-fuelled technology available, a representative figure for the carbon intensity of a CCGT is 354g CO₂e/kWh (Ref 6-38). The operational carbon intensity of the Scheme is therefore 95% lower than that of the counterfactual CCGT. Each kilowatt hour of electricity generated by the Scheme will emit 336g CO₂e less than if it was generated by a gas fired CCGT generating facility.
- 6.10.32 Combining this figure with the estimated lifetime output from the Scheme indicates an overall lifetime carbon reduction, relative to the counterfactual CCGT, of over 8 million tonnes CO₂e.

Significance of Effect (Construction)

- 6.10.33 GHG emissions from construction will be assessed against the relevant carbon budget periods during which they arise in order to identify the significance of their impact. Construction emissions will fall under the 4th UK carbon budget.
- 6.10.34 As the construction phase and the first year of the operation phase are anticipated to fall within the 4th carbon budget, the annual emissions of each phase have been compared to the relevant annualised carbon budgets to enable assessment of the phases individually.
- 6.10.35 Based on the nature of the Scheme and experience with similar projects, it is not expected that annual emissions from the construction of the Scheme will contribute to equal to or more than 1% of the annualised 4th carbon budgets. The magnitude of effect is therefore expected to be low. GHG emissions from the construction of the Scheme are therefore anticipated to have a minor adverse and not significant effect on the climate.



Significance of Effect (Operation)

- 6.10.36 The Scheme will be operational from no earlier than 2028, and therefore operational emissions up to 2037 (the end of the 6th carbon budget) will fall under the 4th, 5th and 6th UK carbon budgets, beyond which point no carbon budgets have yet been published. Based on the nature of the Scheme and experience with similar projects, it is not anticipated that operational emissions to 2037 will contribute to be equal to or more than 1% of the annualised 4th, 5th or 6th carbon budgets. The magnitude of effect is therefore considered low.
- 6.10.37 Beyond 2037, it is anticipated that direct operational emissions will decrease over time as a result of continuing grid decarbonisation, and of machinery and vehicle electrification, in line with the UK's net-zero carbon emissions target for 2050. Indirectly, the generation of electricity with a much lower carbon intensity than the grid average will result in reduced GHG emissions overall. This indirect emissions reduction will far outweigh any direct emissions resulting from the operations of the Scheme over its lifetime and overall, the operation of the project will provide GHG performance that supports the trajectory towards net zero.
- 6.10.38 GHG emissions from the operation of the Scheme are therefore anticipated to have a **negligible** effect on the climate and are therefore **not significant**, both for the years up to and including 2037 and from 2038 onwards.

Significance of Effect (Decommissioning)

- 6.10.39 While there will be GHG emissions associated with the decommissioning phase of the Scheme, actual emissions are anticipated to be lower as the figures that will be estimated and presented in the ES will represent a worst-case scenario. Also, the overall GHG reductions achieved by the Scheme are considered to offset and outweigh any GHG impacts associated with the decommissioning phase of the Scheme. Therefore, the magnitude of impact is considered to be low.
- 6.10.40 GHG emissions from the decommissioning phase are therefore anticipated to have a **minor adverse** and **not significant** effect on the climate.

Overall GHG Impact

- 6.10.41 The GHG impact of construction and decommissioning are anticipated to result in **minor adverse** effects on the climate, while the impact of operations is considered to have a **negligible** effect. Overall, the whole-life GHG impact can be expressed in terms of the average GHG intensity of the electricity generated by the Scheme over its lifetime.
- 6.10.42 As the GHG intensity figure for the Scheme is anticipated to sit continually below the forecast grid average, GHG emissions savings are expected to be achieved throughout the lifetime of the Scheme. Therefore, the GHG emissions during construction, operation, and decommissioning of the Scheme can be considered to be 'offset' by the net positive impact of the Scheme on GHG emissions and the UK's ability to meet its carbon targets.



- 6.10.43 The GHG savings achieved throughout the lifetime of the Scheme demonstrate the role solar energy generation has to play in the transition to, and longer-term maintenance of, a low carbon economy. Without low-carbon energy generation projects such as the Scheme, the average grid GHG intensity will not decrease as is projected, which could adversely affect the UK's ability to meet its carbon reduction targets.
- 6.10.44 It would be possible for a low-carbon energy generation project to have a GHG intensity below the projected grid for most of its lifetime, but above it towards the end of its lifetime and still have an overall positive impact on the UK's ability to meet its carbon targets. As the GHG intensity of the Scheme remains below the projected grid average throughout its lifetime, however, it is considered that the overall GHG impact of the Scheme be beneficial as it will play a part in achieving the rate of transition required by nationally set policy commitments and supporting the trajectory towards net zero. Therefore, the Scheme overall is considered to have a **negligible** effect on the climate.

Climate Change Resilience Review

- 6.10.45 Potential climate risks to the construction, operation and decommissioning phase, including the likelihood, consequence and significance are detailed in **PEI Report Appendix 6-A:** Summary of Non-Significant Effects.
- 6.10.46 Future climate change projections have been reviewed and the sensitivity of assets have been examined, before commenting on the adequacy of the climate change resilience measures built into the Scheme. As a result of the proposed resilience measures no significant climate change risks during the construction, operation or decommissioning phase have been identified.

In-Combination Climate Change Assessment

6.10.47 Future climate change projections have been reviewed and the sensitivity of identified sensitive receptors to these hazards examined. Project risks to receptors are examined together with climate hazards to understand if the impact is exacerbated. The influence of climate change combined with potential impacts from the construction, operation and decommissioning of the Scheme on sensitive receptors are included in **PEI Report Appendix 6-A.**

Monitoring

6.10.48 As no potential significant effects have been identified for climate change, no monitoring of significant effects is required and/or proposed.

6.11 Cumulative Assessment

6.11.1 Climate change is the result of cumulative impacts as it is the result of innumerable minor activities, a single activity may itself result in a minor or insignificant impact, but when combined with many other activities, the cumulative impact could be significant. The nature of greenhouse gases is such that their impact on receptors (the global climate) is not affected by the location of their source. The GHG emissions assessment by its nature is a



- cumulative assessment and considers whether the Proposed Development would contribute significantly to emissions on a national level.
- 6.11.2 The global atmosphere is the receptor for climate change impacts and has the ability for holding GHG emissions. Nevertheless, as stated by IEMA (Ref 6-30), all GHG emissions are considered significant and therefore would contribute to climate change. While the impact of any individual proposed development may be limited, it is the cumulative impact of many proposed developments over time that could have a significant impact on climate change.
- 6.11.3 As such it is not possible to define a study area for the assessment of cumulative effects of GHG emissions nor to undertake a cumulative effects assessment, as the identified receptor is the global climate and effects are therefore not geographically constrained. Consequently, consideration of the effects of the Proposed Development together with other developments on GHG emissions is not considered to be applicable.
- 6.11.4 The ICCI assessment is, by nature, a cumulative assessment, and any effects are detailed in **PEI Report Appendix 6-A.** As the CCR Review is only concerned with the assets of the Scheme and a broader consideration of existing interdependent infrastructure, a cumulative assessment is not required.



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7. Cultural Heritage

7.1 Introduction

- 7.1.1 This chapter of the Preliminary Environmental Information Report (PEI Report) presents the findings of an assessment of the likely significant effects on cultural heritage as a result of the Scheme. For more details about the Scheme, including construction methodology, layout and life span, refer to **Chapter 2: The Scheme** of this PEI Report.
- 7.1.2 This chapter identifies and proposes measures to address the potential impacts and likely significant effects on cultural heritage, during the construction, operation, and decommissioning phases of the Scheme.
- 7.1.3 This chapter is supported by the following appendices in **PEI Report Volume** 3:
 - Appendix 7-A Heritage Legislation
 - Appendix 7-B Known Heritage Assets
 - Appendix 7-C Summary of non-significant effects
- 7.1.4 This chapter is supported by the following figures:
 - Figure 7-1 Designated Heritage Assets Solar and Energy Storage Park.
 - Figure 7-2 Non-designated Heritage Assets Solar and Energy Storage Park.
 - Figure 7-3 Previous Archaeological Events Solar and Energy Storage Park.
 - Figure 7-4 Historic Landscape Character Solar and Energy Storage Park
 - **Figure 7-5** Designated Heritage Assets Grid Connection Route.
 - Figure 7-6 Non-designated Heritage Assets -Grid Connection Route.
 - Figure 7-7 Previous Archaeological Events Grid Connection Route.
 - Figure 7-8 Historic Landscape Character Grid Connection Route.
- 7.1.5 This chapter is based on the extent of research and evaluation works undertaken at the time of writing. A Cultural Heritage Desk-Based Assessment is currently in progress and the initial outcomes of that assessment have guided the baseline and impact assessment presented in this chapter. Research into the historic landscape, through documentary and aerial imagery analysis and interpretation, is ongoing and the results of that assessment will form part of the desk-based assessment, and will further inform understanding of the significance and setting of heritage assets within the study area. A programme of geophysical survey and aerial photographic and LiDAR analysis are currently in progress, and consultation with the local authority archaeological advisors is ongoing in relation to further phases of evaluation work. They were not available at time of writing the PEI Report. The results of



these elements of research and on site investigation will be presented in the ES.

7.2 Consultation

- 7.2.1 A request for an EIA Scoping Opinion was sought from the Secretary of State through the Planning Inspectorate in 2021 as part of the EIA Scoping Process. Consultation responses in relation to cultural heritage, to date, are presented in **PEI Report Volume 3: Appendix 1-C**.
- 7.2.2 Consultation has been undertaken with key stakeholders with specific focus on the historic environment including Lincolnshire County Council, Nottinghamshire County Council, West Lindsey District Council, Bassetlaw District Council and Historic England. The following matters have been discussed:
 - Evaluation works including, but not limited to geophysical survey, evaluation trenching and aerial photographic assessment;
 - The significance of the historic landscape;
 - Site selection of the Grid Connection Route;
 - The potential for Horizontal Directional Drilling (HDD); and
 - The potential of archaeological assessment within the Grid Connection Route undertaken jointly with adjacent applications

7.3 Legislation and Planning Policy

7.3.1 This section includes a list of the relevant legislation and planning policies to cultural heritage. Further information is provided in **PEI Report Volume 3: Appendix 7-1.** The applicable legislation and planning policy includes:

Legislation

- Infrastructure Planning (Environmental Impact Assessment) Regulations (2017) (Ref 7-1);
- Infrastructure Planning (Decisions) Regulations 2010 (Ref 7-2);
- Planning (Listed Buildings and Conservation Areas) Act 1990 (Ref 7-3);
- Ancient Monuments and Archaeological Areas Act 1979 (Ref 7-4);

National Planning Policy

- National Policy Statement (NPS) EN-1 (Ref 7-5) with particular reference to Section 5.8 in relation to the significance, impact and recording of the historic environment;
- National Policy Statement EN-5 (Ref 7-6) with particular reference to paragraph 2.8.9 in relation to the archaeological consequences of electricity line installation and considering undergrounding;
- National Planning Policy Framework (Ref 7-11) with particular reference to Section 16: Conserving and Enhancing the Historic Environment;
- Draft Overarching National Policy Statement for Energy (EN-1) (Draft NPS EN-1) (Ref 7-8) in relation to section 5.9, Historic Environment:



- Draft National Policy Statement for Renewable Energy (EN-3) (Draft NPS EN-3) (Ref 7-9) in relation to Section 2.59 solar photovoltaic generation impacts: cultural heritage; and
- Draft National Policy Statement for Renewable Energy (EN-3) (Draft NPS EN-3) (Ref 7-10) in relation to Section 2.1.14.

National Guidance

- Planning Practice Guidance, Conserving and enhancing the historic environment (Ref 7-12);
- Historic Environment Good Practice Advice in Planning Note 2. Managing Significance in Decision Taking in the Historic Environment. Historic England (Ref 7-13);
- Historic Environment Good Practice Advice in Planning Note 3. The Setting of Heritage Assets. Historic England (2nd edition, 2017) (Ref 7-14);
- Historic Environment Statement of Heritage Significance: Analysing Significance in Heritage Assets Historic England Advice Note 12. Historic England (2019) Ref 7-15;
- Historic England Advice Note 15 Commercial Renewable Energy Development and the Historic Environment (Ref 7-16)
- Chartered Institute for Archaeologists (ClfA) Standard and Guidance for Historic Environment Desk-Based Assessment (2020) (Ref 7-17);
- ClfA Code of Conduct (Ref 7-18); and
- Institute of Environmental Management and Assessment (IEMA), the Institute of Historic Building Conservation (IHBC) and the Chartered Institute for Archaeologists (ClfA), Principles of Cultural Heritage Impact Assessment in the UK (Ref 7-19).

Local Planning Policy

- Central Lincolnshire Local Plan 2012-2036 (Ref 7-20);
- Central Lincolnshire Draft Local Plan 2021 ((Ref 7-21); and
- Bassetlaw Core Strategy & Development Management Policies DPD (2011) (Ref 7-22).

7.4 Assessment Assumptions and Limitations

- 7.4.1 This chapter forms an assessment based on available information at the time of preparation and represents a realistic worst case and precautionary approach based on the Rochdale Envelope approach. The assessment is based on the Scheme parameters as outlined in **Chapter 2: The Scheme** and shown on **PEI Report Volume 2: Figure 2-5** and the maximum likely extents of land take required for its construction and operation described therein. The assessment will be developed and refined following statutory consultation and as additional information becomes available, including desk-based research, visualisations and the results of trial trenching data, with a final assessment presented within the Environmental Statement (ES).
- 7.4.2 This assessment is based on the extent of the research and evaluation works undertaken at the time of writing. A Cultural Heritage Desk-Based Assessment is currently in progress and the initial outcomes of that assessment have



guided the baseline and impact assessment presented in this chapter. Research into the historic landscape through documentary and aerial imagery analysis is ongoing and the results of that assessment will form part of the desk-based assessment, and will further inform understanding of the significance and setting of heritage assets within the study area. A programme of geophysical survey and aerial photographic and LiDAR analysis are currently in progress and consultation with the local authority archaeological advisors is ongoing in relation to further phases of evaluation work. The full results of these reports (desk-based assessment, geophysical survey and LiDAR) were not available at time of writing the PEIR.

- 7.4.3 It is assumed that data provided by third parties is accurate at the time of reporting.
- 7.4.4 It is assumed that there will be access to all required land to undertake both intrusive and non-intrusive archaeological surveys and evaluation, and that the results will be available to incorporate within the ES. In the event that access is not available, professional judgement will be used, based on available research and data, to assess the archaeological potential of the area.
- 7.4.5 The findings of the preliminary assessment may be subject to change as the design of the Scheme is developed and refined through the Environmental Impact Assessment (EIA) and consultation process; and as further research and investigative surveys are undertaken to further understand the potential effects of the Scheme.

7.5 Study Area

7.5.1 The study area was defined to include heritage assets likely to be at risk from possible direct and indirect impacts that might arise from the Scheme. The Scheme if formed of the Solar and Energy Storage Park and Grid Connection Route, collectively known as the 'DCO Site' and the study areas have been defined to appropriately identify heritage assets that may be affected by each element.

Main study area

- 7.5.2 A study area of 1km from the Solar and Energy Storage Park has been defined taking into account landscape topography to provide historical and archaeological context and to identify designated heritage assets with the potential to be affected by the Scheme (refer to **PEI Report Volume 2: Figures 7-1** to **7-4**). This study has been selected with reference to the Zone of Theoretical Visibility (ZTV) submitted with the Scoping Report, which provided an indication of the likely visibility of the scheme across the surrounding landscape. For designated assets this study area was extended to 3km.
- 7.5.3 The 1km study area also includes the Grid Connection Route where it falls within the study area. Where the Grid Connection Route is located beyond the 3km study area, a separate study area has been defined (refer to paragraph 7.5.4).



500m study area

7.5.4 Where the Grid Connection Route is located beyond the 1km study area, a 500m study area has been applied from the boundary of the Grid Connection Route (refer to **PEI Report Volume 2: Figures 7-5** and **7-8**). This 500m study area is considered appropriate to the works due to the linear nature of the connector.

Wider study area

7.5.5 The settings of designated heritage assets of the highest significance (heritage value) (scheduled monuments, Grade I and Grade II* listed buildings) outside of these study areas have also been considered, up to 5km from the DCO Site. Assets beyond this distance may also be considered, where identified as necessary using professional judgement by the Consultant or consultee. This will also be guided by the Scheme's ZTV but will also consider physical and historical connectivity and relationships with other monuments and the wider landscape. Assets between 3km and 5km, where considered to identify potential effects as a result of the scheme. No effects on these assets were identified. The sites considered are listed in the heritage assets the gazetteers in **PEI Report Volume 3: Appendix 7-B.**

7.6 Assessment Methodology

Sources of Information

- 7.6.1 Sources of information that will be consulted include:
 - National Heritage List for England (NHLE) (Ref 7-23);
 - Lincolnshire Historic Environment Record (HER) and Historic Landscape Characterisation (HLC);
 - Nottinghamshire HER;
 - Various online resources including the British Geological Survey (BGS)
 Geology of Britain Viewer (Ref 7-23) and the local planning portal for the
 Local Plan and other planning information;
 - Published and unpublished literature (including a detailed review of reports for previous fieldwork carried out within the proximity to the Site boundary).
 - Existing geotechnical data:
 - Preliminary results of the LiDAR and aerial photography assessment; and
 - Documentary, cartographic and other resources as deposited within the local Archives and Local Studies Library.
- 7.6.2 The heritage assets discussed within this assessment, including designated and non-designated heritage assets, are identified by their unique identification number assigned by the NHLE for designated assets and by the HER for non-designated heritage assets. The HER numbers are prefixed *MLI* for Lincolnshire and *MNT* for Nottinghamshire. All assets are identified within the text using their unique identifier and can be cross-referenced to the gazetteers in **PEI Report Volume 3: Appendix 7-B** and located in **PEI Report Volume 2: Figures 7-1** to **7-8**.



- 7.6.3 A site walkover survey was undertaken on the 11 and 12 January and 2 March 2022 to record the survival, extent, condition, setting and significance of cultural heritage assets within the DCO site and to identify potentially affected assets including listed buildings, conservation areas and registered parks and gardens within the study areas. The setting of these heritage assets was also identified, and potential Scheme impacts were considered.
- 7.6.4 An assessment of aerial photographs and LiDAR data has been undertaken as part of the baseline research in order to identify cropmark evidence of possible archaeological remains. However, the final report was not available at the time of writing. The results will inform the Cultural Heritage Desk-Based Assessment which will form part of the ES.
- 7.6.5 Geophysical survey is currently underway to further evaluate the site. The results were not available at time of writing and consequently are not included within this report. The results of all phases of the field investigations will be included as appendices to the ES.
- 7.6.6 The results of these surveys will provide more details on the heritage interest and significance of heritage assets. When considered along with the development of the scheme design, is it considered that the likely significant effects will be reduced. The results will also assist in the development of a detailed mitigation strategy developed.

Impact Assessment Methodology

- 7.6.7 This preliminary environmental assessment has been undertaken following relevant elements of key guidance, including:
 - Historic England Good Practice Advice Note GPA3, The Setting of Heritage Assets (Ref 7-14);
 - Historic England Advice Note 12 Statements of Heritage Significance: Analysing Significance in Heritage Assets (2019) (Ref 7-15);
 - Chartered Institute for Archaeologists, Code of Conduct (Ref 7-18) and Standards and Guidance for Historic Environment Desk-based Assessment (Ref 7-17);
 - Historic England Preserving Archaeological Remains: Decision-taking for Sites under Development (Ref 7-25)); and
 - Historic England Advice Note 15 Commercial Renewable Energy Development and the Historic Environment (Ref 7-16).
- 7.6.8 This section sets out the approach to the assessment of the potential impacts of the Scheme on designated and non-designated heritage assets. The objective of this assessment is to identify any effects upon cultural heritage receptors that are likely to arise from construction, operation and maintenance, and decommissioning of the Scheme.
- 7.6.9 The principles of the impact assessment methodology rest upon independently evaluating the value (heritage significance) of the cultural heritage resources and the magnitude of impact upon that significance. By combining the value of the cultural heritage resource with the predicted magnitude of impact, the significance of the effect can be determined. The effect significance can be beneficial or adverse.



- 7.6.10 The cultural heritage assessment includes an assessment of the heritage significance of potentially affected assets, in line with NPS EN-1 (Ref 7-5). This requires the provision of information sufficient to enable adequate understanding of the potential impacts on the significance of any heritage asset (paragraph 5.8.10). This is consistent with the requirements of NPS EN-1(Ref 7-5) and in line the NPPF (Ref 7-11). Both documents also require this assessment to take account of changes to both the physical asset and its setting.
- 7.6.11 NPS EN-1 defines the value of heritage assets as "the value of a heritage asset to this and future generations because of its heritage interest," (Ref 7-5). The NPS EN-1(Ref 7-5) and the NPPF (Ref 7-7) set out criteria which should be considered when assessing the significance of cultural heritage assets, which include archaeological, architectural, artistic and historic interest. These criteria have been used in the assessment of significance for each affected asset and this information, in conjunction with professional judgement, has been used to assess the value of heritage assets.
- 7.6.12 Both documents relate to impacts affecting the value of heritage assets with harm. There is a requirement to determine whether the level of harm amounts to 'substantial harm' or 'less than substantial harm'. NPS EN-1 and NPPF make it clear that substantial harm to, or loss of, a Grade II designated asset should be exceptional and that to a Grade II* or I asset, or Scheduled Monument, should be 'wholly exceptional' (Ref 7-5). This approach is not materially altered by the draft NPS EN-1 (Ref 7-8). There is no direct correlation between the significance of effects identified through the EIA process and the level of harm caused to heritage significance. The assessment of harm arising from the impact of the Scheme have been used in the development of the PIER and will be reported within the DCO Application and determined using professional judgement.

Significance criteria

7.6.13 The value of a heritage asset (its heritage significance) is guided by its designated status but is derived also from its heritage interest which may be archaeological, architectural, artistic or historic (NPPF Annex 2, Glossary) (Ref 7-11). Each identified heritage asset can be assigned a value in accordance with the criteria set out in Table 7-1. The criteria presented in Table 7-1 have been developed using available guidance, experience on comparable schemes and professional judgement. Using professional judgement and the results of consultation, heritage assets are also assessed on an individual basis and regional variations and individual qualities are taken into account where applicable.

Table 7-1 Criteria for assessing the value of heritage assets

Asset value	Description
	World Heritage Sites
High	Scheduled Monuments
	Grade I and II* listed buildings
	Registered battlefields
	Grade I and II* registered parks and gardens



Asset value	Description
	Conservation areas of demonstrable high value Non-designated heritage assets (archaeological sites, historic buildings, monuments, parks, gardens or landscapes) that can be shown to have demonstrable national or international importance. Well preserved historic landscape character areas, exhibiting considerable coherence, time-depth or other critical factor(s).
Medium	Grade II listed buildings Conservation areas Grade II registered parks and gardens Conservation areas Non-designated heritage assets (archaeological sites, historic buildings, monuments, park, gardens or landscapes) that can be shown to have demonstrable regional importance. Averagely preserved historic landscape character areas, exhibiting reasonable coherence, time-depth or other critical factor(s). Historic townscapes with historic integrity in that the assets that constitute their make-up are clearly legible.
Low	Locally listed buildings Non-designated heritage assets (archaeological sites, historic buildings, monuments, park, gardens or landscapes) that can be shown to have demonstrable local importance. Assets whose values are compromised by poor preservation or survival of contextual associations to justify inclusion into a higher grade. Historic landscape character areas whose value is limited by poor preservation and/ or poor survival of contextual associations.
Very Low (Not significant)	Assets identified on national or regional databases, but which have no archaeological, architectural, artistic or historic value. Assets whose values are compromised by poor preservation or survival of contextual associations to justify inclusion into a higher grade. Landscape with no or little significant historical merit.

- 7.6.14 Having identified the value of the heritage asset, the next stage in the assessment will be to identify the level and degree of impact to an asset arising from the development. The impacts of a development upon heritage assets can be positive or negative; direct or indirect; long term or temporary; and/or cumulative. Impacts may arise during construction, operation and decommissioning. Impacts can occur to the physical fabric of the asset or affect its setting. Direct physical impacts are considered permanent and result in the total, or partial, loss of a heritage asset. These impacts are not reversible. Impacts as a result of changes to setting are split between those resulting from construction activities which are short-term, and those considered to last for the duration of the development. These are considered to be long-term but can be reversed upon decommissioning.
- 7.6.15 The level and degree of impact (impact rating) will be assigned with reference to a four-point scale as set out in Table 7-2. The criterial presented in Table 7-2 have been developed using available guidance, past experience on comparable schemes and professional judgement. The assessment of the level and degree of impact will be made in consideration of any scheme design mitigation (embedded mitigation). If no impact is identified, no impact rating will be given, and no resulting effect reported.



Table 7-2 Factors influencing the assessment of magnitude of impacts

Magnitude of Impact	Description of impact
	Changes such that the significance of the asset is totally altered or destroyed.
High	Comprehensive change to, or total loss of, elements of setting that would result in harm to the asset and our ability to understand and appreciate its significance.
Medium	Change such that the significance of the asset is significantly altered or modified.
	Changes such that the setting of the asset is noticeably different, affecting significance and resulting in changes in our ability to understand and appreciate the significance of the asset.
Low	Changes such that the significance of the asset is slightly affected. Changes to the setting that have a slight impact on significance resulting in changes in our ability to understand and appreciate the significance of the asset.
Very Low	Changes to the asset that hardly affect significance. Changes to the setting of an asset that have little effect on significance and no real change in our ability to understand and appreciate the significance of the asset

7.6.16 An assessment to classify the effect, having taken into consideration any embedded mitigation, is determined using the matrix at Table 7-3, which takes account of the value of the asset (Table 7-1) and the magnitude of impact (Table 7-2). Effects can be neutral, adverse or beneficial.

Table 7-3 Significance Criteria for cultural heritage

Receptor	Magnitude of Impact					
	High	Medium	Low	Very Low	No change	
High	Major	Major	Moderate	Minor	Neutral	
Medium	Major	Moderate	Minor	Negligible	Neutral	
Low	Moderate	Minor	Negligible	Negligible	Neutral	_
Very Low	Minor	Negligible	Negligible	Negligible	Neutral	

- 7.6.17 The baseline assessment has been undertaken in accordance with guidance set out by the Chartered Institute for Archaeologists (CIfA) and Historic England, in particular the Standard and Guidance for Historic Environment Desk-Based Assessment (Ref 7-17) and the Code of Conduct (Ref 7-18).
- 7.6.18 Principles of Cultural Heritage Impact Assessment in the UK (Ref 7-19) is a guide to good practice in cultural heritage impact assessment published jointly by the Institute of Environmental Management and Assessment (IEMA), the Institute of Historic Building Conservation (IHBC) and the Chartered Institute for Archaeologists (ClfA). The document provides guidance on understanding cultural heritage assets and evaluating the consequences of change and will be considered when undertaking the assessment.



7.7 Baseline Conditions

Existing Baseline

7.7.1 This section describes the baseline environmental characteristics for the Scheme and surrounding areas with specific reference to cultural heritage.

Prehistoric (up to AD 43)

- 7.7.2 There are 17 assets of prehistoric date recorded within the 1km study area, including five within the DCO Site. These comprise cropmarks of possible prehistoric enclosures and boundary ditches (MLI54017) as well as four finds of probable Bronze Age (2,500-800BC) flint at Knaith Park (MLI90353; MLI90354; MLI90355; MLI90356).
- 7.7.3 The earliest evidence from the study area comprises Mesolithic (10,000-4,000BC) flint found to the east of Lea Grange Farm (MLI51382), north of the Solar and Energy Storage Park. Further flints and stone axes were also located nearby (MLI54032) as well as a Neolithic (4,000-2,500BC) stone axe (MLI51386) to the south-east of Lea Grange Farm.
- 7.7.4 Other prehistoric remains have also been recorded to the north of the Solar and Energy Storage Park, including a prehistoric hammer stone to the north of Moor Plantation (MLI51383), prehistoric flint at Gainsborough Road (MLI125055) and flint and stone axes found to the north of Upton Road (MLI51384). In addition to these, a prehistoric Bronze bangle was found to the south-west of the Solar and Energy Storage Park in Marton (MLI50256).
- 7.7.5 Five assets are associated with the Grid Connection Route. Two are Neolithic stone axe find spots (MLI52498 and MLI52495), one complete and one partial, respectively. Evidence of Neolithic agriculture was identified at Cottam during an auger survey (MNT27156). At Rampton, a pit of Neolithic to Bronze Age date was identified (MNT11695), as well as a burial of Late Neolithic or Early Bronze Age date (MNT26008).

Roman (AD 43 - 410)

- 7.7.6 There are 33 Roman assets recorded within the 1km study area, including two scheduled monuments and 23 non-designated assets. Two of the non-designated assets are located within the Solar and Energy Storage Park consisting of an iron working site (MLI97380) and Roman pottery sherds (MLI98301), recorded in Knaith.
- 7.7.7 During the Roman period, the landscape of the study area was inhabited, as there is significant evidence of Roman occupation including a scheduled fort and town. The fort is located to the south of Littleborough Lane, is approximately 730m south-west of the Solar and Energy Storage Park (1004935). Cropmarks (MLI54200) have been recorded to the south of Littleborough Lane with a ditched enclosure recorded marking the boundary of the fort. A possible further Roman fort has also been identified at Gate Burton (MLI50544) to the north of the scheduled fort. In support of the Roman date are a number of finds recorded from the area of this feature, including pottery and coins (MLI50596).



- 7.7.8 Segelocum Roman town (1003669) is a scheduled monument located approximately 1.4km west of the DCO Site. The site is visible on aerial photographs and is thought to extend over an area of approximately 400m by 300m.
- 7.7.9 To the south of the town is Littleborough Lane, is the approximate site of the Roman Till Bridge Lane (MLI50575), a Roman road which ran from Ermine Street to the north of Lincoln to the crossing of the Trent at Marton, Evidence of the road includes a metalled surface which was uncovered during a watching brief and remains of possible paving of the Roman road have also been recorded (MLI52462). The geophysical survey (Ref 7-26) around the Roman town recorded evidence of settlement either side of this road (MLI51369). This settlement is thought to be a ribbon development, stretched along the road for approximately 2.5km and concentrated close to it. Finds of Roman pottery have also been recorded to the side of Till Bridge Lane (MLI52464). There is also evidence of Roman field systems recorded to the north of the town.
- 7.7.10 A further Roman settlement (MLI84314) was recorded in the south-east of the study area in Stow. It was identified during a watching brief and subsequently excavated. The settlement comprised a small rural farming settlement with two phases.
- 7.7.11 Evidence of industrial activity has also been recorded within the study area. Three Roman kilns were excavated at a pottery complex at Knaith (MLI51374). A further pottery kiln complex was recorded to the south-east of Lea Grange Farm (MLI51381), with between five and seven kilns identified. This pottery is thought to have been in use between the 1st and 3rd centuries, as wares of varying dates were identified.
- 7.7.12 There is further evidence of Roman activity within Marton in the south-west of the study area. These include cropmarks (MLI52472; MLI52489) and finds of Roman date, including coins (MLI52463; MLI52476; MLI52474), various copper alloy objects (MLI50257), a redeposited pottery sherd (MLI116450), and an altar fragment (MLI98578). Other Roman assets recorded within the study area include a number of possible Roman ditches and enclosures recorded in Lea (MLI125054) during a geophysical survey, with several sherds of Roman pottery recorded within the ditches during the subsequent trial trenching. The remaining Roman assets within the study area consist of the find spots of a coin in Lea (MLI98583) and a silver brooch in Stow (MLI82761).
- 7.7.13 Eight of the assets are located in close proximity to the Grid Connection Route. Three are of Iron Age to Roman date, including the settlement at Cottam (MNT15983). This comprises an incomplete asymmetric curvilinear enclosure, three probable roundhouse gullies, a linear feature identified as a trackway, and a second incomplete enclosure to the west. An Iron Age to Roman field system was identified at Rampton Quarry (MNT11696) along with a settlement of the same date (MNT15344).
- 7.7.14 There is a Roman road at Till Bridge Lane linking Ermine Street north of Lincoln to the crossing of the Trent at Marton (MLI50575). Cropmarks to the east of Marton suggest probable Roman activity, probably a settlement with



accompanying field systems (MLI52472). At Rampton there is evidence for Roman ditches and gullies associated with some metal working slag (MNT11704). At Brampton there is a probable Roman farmstead recorded through geophysical survey (MLI125068) and a find spot of ten Roman pottery sherds (MLI125072).

Early Medieval (410 - 1066)

- 7.7.15 There are five assets of early medieval date recorded within the 1km study area, comprising one scheduled monument, two listed buildings and one non-designated asset.
- 7.7.16 The Viking army is known to have camped in Torksey, to the south-east of the Solar and Energy Storage Park and within the Grid Connection Route, in the winter of 872 (MLI25067). The Viking Great Army camp has been subject to archaeological evaluation, and it is known that several thousand warriors, traders, craftworkers, women and children camped through the winter months on the higher ground to the east of the River Trent. The known extents of the camp extend to cover a large area within the Grid Connection Route although there is potential for associated deposits to extend beyond the recorded area. To date the evaluation works have been concentrated to the eastern bank of the river.
- 7.7.17 A scatter of late Anglo-Saxon and medieval pottery sherds was identified at Brampton within the Grid Connection Route (MLI125073). This comprised 37 sherds, the majority of which were medieval in date, although some were Anglo-Saxon. The scatter is thought to be derived from manuring activity.
- 7.7.18 A large number of early medieval coins have been found within Torksey, which include English and Arabic coins, as well as numerous Viking gaming pieces (Ref 7-26).
- 7.7.19 There were several churches and other religious buildings which were established in the study area during this period. One example of this is a religious college which was established in Stow. The site, a scheduled monument, is the location of a college and Benedictine Abbey at what is now St Mary's Church (1012976). The scheduled monument contains buried remains of the college as well as the subsequent abbey and the earlier Anglo-Saxon church. The site is now the location of St Mary's Church, a Grade I medieval church (1146624) (see paragraph 7.7.25).
- 7.7.20 There are also two Grade I listed churches of early medieval origins recorded within the study area. The first of these is the Church of St Nicholas (1216860), an 11th century church in Sturton Le Steeple within the 5km study area. The second listed building is the Church of St Margaret of Antioch (1359484) located in Marton 650m south of the Solar Energy and Storage Park Site. The tower is 11th century and fragments of an Anglo-Saxon sculpture survive in the south aisle. The remains consist of fragments of a cross shaft, as well as a possible wheel cross and a grave cover (MLI50631).

Medieval (1066 - 1540)

7.7.21 The medieval landscape of the study area is one of manorial sites and religious houses set within agricultural land interspersed with small villages.



There are 54 medieval assets located within the study area, including three scheduled monuments and seven listed buildings within 3km and 40 non-designated assets within 1km, 13 of which lie within the Solar and Energy Storage Park and five within the Grid Connection Route.

- 7.7.22 Within the Solar and Energy Storage Park are the sites of the former settlements at Gate Burton (MLI50512) and Knaith (MLI50529), as well as a small section of the site of Heynings Priory (MLI50244), a deer park (MLI50408), ancient woodland (MLI50651) and a warren (MLI50485). There are also several agricultural features such as ridge and furrow (MLI50914; MLI54022; MLI54012), a field system (MLI54016) and field boundary (MLI54019). Two sherds of medieval pottery were also recorded within the Solar and Energy Storage Park boundary (MLI98302; MLI98303).
- 7.7.23 Within the 5km study area there are three scheduled monuments of medieval date. The closest of the scheduled monuments to the DCO Site is the site of Heynings Priory (1008685) located at Knaith Park, directly to the west of the north-east of the Solar and Energy Storage Park. The scheduled monument comprises earthwork and buried remains of the medieval nunnery, including parts of the inner precinct and outer precincts. Around the site of the priory, an earthwork survey has been conducted (ELI586) and an excavation at the nearby Park Farm South revealed two burials aligned west-east and further burials were uncovered during the digging of foundations for nearby farm buildings (ELI150). The nunnery was founded by Raynor de Evermue including demesne land and the Grade II* listed Church of All Saints in Upton (1146810). He died before it was completed and account of the priory during the 14th century frequently refer to its impoverished state as a result of its small initial endowment. Landowners such as Master Simon of Islip, Nicholas of Buchland and Sir John Darcy spared them the payment of debts and granted the priory certain lands and the advowson of local churches. This included the advowson of the Grade I listed Church of St Mary in Knaith. By the time of the dissolution their holdings included St Mary's at Knaith, the church and rectory farm of Womersley in Yorkshire, church and rectory farm of Upton, the manors of Lerdenham Braylond and Heynings and half a knight's fee in Ingleby (Ref 7-28).
- 7.7.24 Research into the landscape setting of the priory is ongoing, including identification of the extent of its former demesne lands. The demesne lands form a key component of the asset's setting, and they are likely to include the farmland surrounding the asset in the manor of Knaith. Farming was an important aspect of Cistercian economy and religious practice; the emphasis on farming being a part of their ideal observance of the simplicity of the Rule of St Benedict. It was common for Cistercian foundations to be sited in marginal locations and undeveloped land.
- 7.7.25 Further religious features of the medieval landscape are recorded in Stow, to the south-east of the Solar and Energy Storage Park. St Mary's Church, Stow (1146624) is a Grade I listed medieval church on the site of the former Benedictine Abbey and earlier Anglo-Saxon church and college, the latter of which are discussed in paragraph 7.7.19. The remains of the Benedictine Abbey are designated as a scheduled monument (1012976). The abbey was established in 1091. It was short-lived, as the monks were moved to Eynsham



in 1109. The standing building incorporates the transepts and crossing of the early 11th century collegiate church, rebuilt in the late 11th century as part of the abbey church. The nave and chancel of the present structure are 12th century and overlie the buried parts of the 11th century churches and their Anglo-Saxon predecessor. The chancel was restored in 1850-1852 and the remainder of the church was restored in 1864-1867. Both of these restorations were undertaken by the noted Gothic revival architect John Loughborough Pearson, who is known for both restoration works and the design of new churches and cathedrals across England. The continued development and investment in the church throughout its lifespan demonstrates the continued importance of the church as a centre of worship, learning and charity as well as the centre of a network of associated assets such as parish churches, almshouses, hospitals, farming estates and tenant villages. The church had a central place in people's lives and as a place to memorialise their dead. The development of the church is reflected in the building which displays various different architectural styles and phases.

- 7.7.26 The church is located on a discernible rise within the settlement with a further rise created by the churchyard platform on which on the church sits. It contains burials and the archaeological remains of the previous phases of development of the asset. The churchyard is a grassed area, containing upstanding grave memorials and mature trees. It is enclosed by a low stone retaining wall. Around the churchyard there are buildings of 18th and 19th century appearance, as well as some modern development within the asset's setting. The character of the asset's surroundings reflects a rural village location and contributes to the asset's significance through demonstrating its central importance within the settlement. This gives the church and churchyard an enclosed and quiet character, but the church also dwarfs the surrounding buildings on account of its scale and its elevated position. Long views of the church are possible throughout the surrounding landscape and particularly on approach to the settlement from the north, south and west; less so on approach from the east. In these views the church is seen within a rural landscape of open fields which provide a level of understanding of its original siting within the medieval farming landscape.
- 7.7.27 Associated with the ecclesiastic structures in Stow was the medieval bishop's palace and deer park at Stow Park (1019229). The scheduled monument comprises the buried and earthworks remains of the medieval palace of the Bishops of Lincoln, located approximately 1.9km south of the Solar and Energy Storage Park. The palace is first referenced in the 12th century and likely originated in the 11th century when the Church of St Mary was established in Stow. The palace was situated on a moated site, parts of which survive as ponds. To the south, a deer park covering an area of approximately 275ha was associated with the palace, and remains of the park pale survive as earthwork banks. Upstanding sections of the park pale form part of the scheduled monument.
- 7.7.28 There is also a further Grade I listed church of medieval date in the study area, the Church of St Helen (1146567) in Lea, located approximately 1.3km northwest of the DCO Site. There is also a further Grade II* listed building of medieval date within the study area, the Church of All Saints in Upton



- (1146810). There are also two Grade II listed medieval buildings and structures, including the Church of St Helen in Willingham (1146826), and a medieval cross base at the Church of St Margaret of Antioch in Marton (1146582), now topped by a 20th century cross and used as a war memorial.
- 7.7.29 There is one non-designated religious feature of medieval date within 1km of the Solar Energy and Storage Park, the site of the former medieval parish church of Gate Burton (MLI51371).
- 7.7.30 The medieval landscape of the study area is also characterised by small settlements and moated complexes. Within the 3km study area is Hermit Dam moated site in Lea (1016110). A second scheduled moated site located in the surrounding landscape is the manorial complex to the north-west of Elm Tree Farm (1016920) located over 3km north-east of the Solar Energy and Storage Park in Heapham. One surviving manorial site is at Knaith Hall (1359480). The hall is a Grade II listed country house located approximately 290m north-west of the Solar Energy and Storage Park. The hall was built in the 15th century. Low Farm medieval settlement and field system of West Burton (1017741) is located to the north-west of the 3km study area. The settlement consists of earthworks and buried remains of houses as well as the former church of St Helen.
- 7.7.31 Non-designated medieval assets highlight the rural nature of the landscape as cropmark remains of medieval villages have been recorded at Marton (MLI52481), Willingham (MLI54013), Norman by Stow (MLI52445) and Lea (MLI51393). Remains of possible settlements are also highlighted by a medieval platform (MLI54021) recorded to the west of the Solar Energy and Storage Park, a trackway (MLI54011) to the south of the Gate Burton medieval settlement and remains of a former windmill mound (MLI52486) in Marton.
- 7.7.32 Evidence of the agricultural nature of the area is indicated by the remains of ridge and furrow which have been recorded throughout the study area in Marton to the south-west of the Site (MLI52492; MLI52493; MLI116360), Gate Burton to the west (MLI54010; MLI54020), Stow to the south-east (MLI80326; MLI50927; MLI52046), Knaith to the north-east (MLI80070) and Lea to the north (MLI54028; MLI125003). The medieval landscape is also visible in the study area through surviving semi-natural ancient woodlands (MLI50650; MLI50653).
- 7.7.33 Several find spots of medieval date have also been recorded within the study area. These consist of a coin weight box lid (MLI50452) and a brooch in Marton (MLI51647), building remains and pottery scatter at Dutch Cottage (MLI51378), pottery in Gate Burton (MLI52466) and a jetton at Knaith Hall (MLI51375).
- 7.7.34 There are five assets within the Grid Connection Route. A scatter of late Anglo-Saxon and medieval pottery sherds was identified at Brampton (MLI125073). This consisted of 37 sherds, the majority of which were medieval in date. A field boundary defined by a single ditch is of medieval to post-medieval date (MNT6166) and there is a rabbit warren, identified by geophysical survey, of the same date also at Brampton (MLI125069).



7.7.35 At Marton there are traces of probable medieval ridge and furrow on land off Stow Park Road (MLI116360). There is a rabbit warren of medieval to post-medieval date identified at Torksey (MLI125070).

Post-Medieval (1540 - 1900)

- 7.7.36 There are 89 post-medieval assets within the study area, including 54 listed buildings within 3km, and 30 non-designated assets within 1km, seven of which are within the Solar and Energy Park Storage Park. Five assets are within the Grid Connection Route.
- 7.7.37 Seven assets within the Solar and Energy Park Storage Park are of post-medieval date, comprising three former farm buildings (MLI118135; MLI118136; MLI118140), parkland at Gate Burton (MLI98360) and a post-medieval deer park and garden at Knaith Hall (MLI50409), as well as finds of pottery (MLI98305). Although not recorded within the HER, the line of the Great Northern and Great Eastern Joint Railway also passes through the centre of the Solar Energy and Storage Park aligned north-west to south-east and is recorded on the 19th century tithe maps of Gate Burton and Knaith of 1848. The railway remains in operation.
- 7.7.38 The post-medieval landscape of the area is characterised by manor houses and associated estates, as well as small village settlements and surrounding agricultural land, which was enclosed during the latter part of this period.
- 7.7.39 There are two Grade II* listed buildings of post-medieval date within the 3km study area, two of which are located in Gate Burton. To the north-west of Gate Burton Hall is a garden building that forms part of the Gate Burton estate, called Burton Chateau (1064085). Although the building is now a garden building, it was originally the only residence in the Gate Burton estate, constructed in the 1740s. It is located approximately 700m west of the DCO Site. Building of Gate Burton Hall (1359458) began in 1765, but it was only finished between 1774 to 1780. It is on a much grander scale than the Chateau and is a Grade II* listed country house located 220m west of the DCO Site. The hall is situated within a designed landscape. The assets reflect the development of the parkland, from its inception with the erection of the Grade II* listed Chateau (1064085) in the mid-18th century, through to its development into a country estate in the late 18th century with the addition of the Grade II* listed Gate Burton Hall (1359458) and its associated Grade II listed Walled Garden (1472727) and entrance Grade II listed Gateway (1064086). At this time the former medieval parish church of Gate Burton, that preceded the Church of St Helen, was still standing in a ruinous condition. A new church was built before 1793 and described as a 'pseudo-classical style, externally, and more like a room than a church, within'. It was presumably designed in part as a landscape feature. An associated rectory, now known as the Old Rectory (Grade II listed, 1359457), was added to its west side. This phase, together with the laying out of the parkland and clearance of the nondesignated former medieval settlement of Gate Burton (MLI50512) is associated with the Hutton family, who purchased the estate from Lord Willoughby of Parnham. The hall and grounds were the subject of picturesque art with a scene drawn by J.C. Nattes and engraved by B. Howlett in 1798. The earliest available mapping of the parkland is the Gate Burton tithe map of



1848, which shows little detail of the park's design. Nevertheless, it is possible to determine that the parkland appears to have been laid out in the later part of the 18th century associated with Gate Burton Hall, rather than with the earlier Chateau, since it appears to follow the picturesque principals of the later 18th century in terms of using the character of the natural landscape and borrowing views out of the park of the surrounding landscape without a dense shelter belt of boundary tree planting.

- 7.7.40 The 18th century church was demolished, and the new Grade II listed Church of St Helen (1064087) was built in 1866. Other 19th century buildings within the park comprise the non-designated Homestead Stackyard and former School which are shown on the Gate Burton Tithe Map of 1848, where it appears that the complex was under construction. By the time of the first edition map of 1885, it had been developed into a loose U-shaped courtyard farmstead to the north with linear north-south aligned range to the south of it joining the north side of a building that appears to be farmhouse. The complex is labelled as School on this map, and it is still known as the Old School House today.
- 7.7.41 After the mid-19th century, a building hiatus is then observable although the historic Ordnance Survey (OS) maps from the mid to late-19th century so show some new planting within the parkland, such as the addition of a horseshoe plantation to the south of The Chateau, that is still present today. The estate was sold in 1907 to the Sanders family and they employed the architects Demeter Blow and Fernand Billery to extend the hall and add/rebuild the estate buildings to the east of the hall. They also employed W. Golding to redesign the immediate formal garden next to the hall. Golding was prolific and worked on over 700 different garden landscapes in England alone. Blow and Billery are responsible for the design of Gate Burton Cottages (1166351) which were added in c.1914 in the style of a stable block, as well as substantial additions to Gate Burton Hall including the north front in the Classical style and a redesign of its interior.
- 7.7.42 Gate Burton park (MLI98360) is modestly sized. The designer of the park is not known, and neither is the date of its creation, although the design (as shown on the tithe map of 1848 some after the park's creation) suggests a date in the later part of the 18th century due to the lack of formal avenues of tree planting and dense boundary planting that would characterise parks of the earlier period (Ref 7-31). The parkland inspired works of art; being drawn by J.C. Nattes and engraved by B. Howlett in 1798. The parkland has historical interest due to its association with the Hutton family and, later, the Sanders family and their patronage of significant architects and landscape architects to redesign elements of the park and its buildings.
- 7.7.43 Gardens are recorded around the former Lea Hall (MLI51394). In 1913 it was recorded that the estate covered an area of c.2200 acres and included an area of formal gardens comprising terraces, walks and ponds to the east of the hall. The hall formed a brick country house on the site of a medieval manor and was demolished in the 1960s. Also recorded near the hall and gardens is the site of the post-medieval settlement of Lea (MLI54030).



- 7.7.44 There are a number of small settlements within the study area around the Solar and Energy Park Storage Park which contain post-medieval buildings. The nearest of these settlements to the Solar and Energy Park Storage Park include Marton, Willingham by Stow, Knaith and Knaith Park. Within Marton, the closest of the listed buildings to the Solar and Energy Park Storage Park is No 21 and attached barn (1146594), which is located approximately 400m to the south. The buildings within the village comprise 18th and 19th century red and colour washed brick houses (1359485; 1308917; 1146611; 1064060), as well as an early 19th century public house (1064057) and 19th century windmill (1064059), on the outskirts of the settlement next to the River Trent.
- 7.7.45 Park Farm South Farmhouse (1064051) in Knaith Park is located within the scheduled priory site (discussed above). The priory was dissolved in 1539 when it was granted to Sir Thomas Heneage, a key member of Henry VIII's privy chamber, knighted in 1537. As well as grants, Heanage also purchased a good deal of former monastic land, becoming a substantial landowner (Ref 7-29). The former Heynings Priory was therefore a landholding for financial gain for Heanage, rather than a base, and he retired to Hainton in East Lindsey after 1546. After his death in 1553 Heynings passed by marriage to Lord Willoughby of Parnham along with the manor of Knaith. Documents from this time suggest a small secular settlement at the former priory gates under the name of Knaith Park (Ref 7-30) and this name persists in the landscape today. South Park Farmhouse, is a Grade II listed building that now occupies part of the priory site and it was named Knaith Park on the first edition 1" OS map (Ref 7-30). It comprises an early 19th century red brick farmhouse. The farmhouse is located 120m from the Solar and Energy Park Storage Park, which surrounds the farm on three sides to the south, east and west.
- 7.7.46 The nearest listed building in Willingham by Stow is the Grade II listed Willingham House (1359509), approximately 580m east of the Solar and Energy Park Storage Park. Willingham House comprises a small country house, built c.1730, located at the western end of the village, with surrounding non-designated parkland (MLI98349). Along with this, the other listed buildings in the village comprise 18th and 19th century houses of red brick with pantile or slate roofs (1308795; 1146841; 1064030; 1064029).
- 7.7.47 In Brampton, to the south of the Solar and Energy Park Storage Park, there are a further two post-medieval Grade II listed buildings within the 3km study area located along the main road through the village. These consist of the 18th century Priory Cottage (1064082) and Manor Farmhouse (1064084), approximately 2.8km south of the Solar and Energy Park Storage Park.
- 7.7.48 There are also a number of further Grade II listed houses within the other surrounding settlements. The houses are mostly comprised of 18th and 19th century buildings of red brick with pantile or concrete tile roofs, in Stow (1064064; 1064066; 1146755), Lea (1064052; 1064056; 1359481; 1359482), Upton (1064069; 1064027; 1308810; 1359508) and Kexby (1359479). There are also several post-medieval Grade II listed houses located along Littleborough Lane to the south of the Site. These include the late 18th century Gallow's Dale Farmhouse (1146780), a 19th century former toll house (1275674) and Ferry House farmhouse (1275698).



- 7.7.49 The agricultural economy of the area continued through the post-medieval period, highlighted by a number of farmsteads. These include a number of Grade II listed farms as well as non-designated former farms. The listed buildings include the 17th century Rectory Farmhouse (1064055) in Lea, and Manor Farmhouse in Stow (1359486), with an associated 18th century threshing barn (1064063) and pigeoncote and stables (1146735), as well as 18th century Hall Farmhouse (1146805) and barn (1064028) in Upton, and Village Farmhouse in Lea (1064053). Within the 1km study area are also a number of former 19th century farms which have since been demolished or redeveloped such as Valley Farm (MLI118108), Sandy Barr (MLI118124) and an unnamed farmstead (MLI118111), all located in Willingham. Within Marton there is Rectory Farm, a partially extant 19th century farmstead (MLI50066, MLI116491), as well as associated former farm buildings (MLI98858) and the partially extant 19th century Manor Farm (MLI52139). In Lea, there are also the partially extant 19th century Moor House Farm (MLI118132) and Lea Grange Farm (MLI118131) and associated demolished cottages/outbuilding (MLI98287).
- 7.7.50 There are also a number of industrial sites of post-medieval date within the study area. These include the Grade II listed Subscription Mill (1064067), a four-storey windmill built in 1801, located approximately 2.7km south-east of the Solar and Energy Park Storage Park. It was a co-operative venture among local farmers to mill their grain produce as a rural industry and operated until the mid-1950s. As well as these are the former sites of Kexby Mill to the west of Willingham Road (MLI50907), a brickyard south of Kexby Lane (MLI50908) and a wooden post mill (MLI50923), all at the eastern end of the study area.
- 7.7.51 A railway runs north-west to south-east through the centre of the Solar and Energy Storage Park. This is the Great Northern and Great Eastern Joint Railway running from Doncaster to Lincoln. The Great Northern Railway was built in the 1840s. The line remains in use. Two listed buildings within the study area associated with this are the Stow Park Station (1064058) and a signal box (1146606), built in the mid- to late 19th century. The buildings are located at the crossing of the railway line and Littleborough Lane, approximately 1.1km south-east of the Solar and Energy Park Storage Park.
- 7.7.52 Within the settlements are several post-medieval churches, including a Grade II listed 19th century, red brick Wesleyan chapel in Stow (1146761) and a non-designated former Primitive Methodist Chapel in Marton (MLI87219). There are also two listed former rectories in Stow (1359488) and Lea (1308937), the latter with associated Grade II listed gate piers (1146557), outhouse (1064054), stables (1146553) and gazebo (1359483).
- 7.7.53 Other post-medieval assets include a Grade II listed 18th century whipping post in Stow (1064062), two non-designated duck decoy ponds at Park Plantation (MLI50392; MLI50393) and various finds, such as coins of George II and clay pipes (MLI52470), a jetton (MLI52494), a 16th century led cloth seal (MLI52473) and post-medieval pottery (MLI52467).
- 7.7.54 There are five assets within the Grid Connection Route. Two are rabbit warrens of medieval to post-medieval date (MLI125069 and MLI125070). Post-medieval flood defences were recorded at Brampton and Marton from



aerial photographs as part of the National Mapping Programme (MLI52488). Pottery Farm at Brampton is the site of a 19th century farmstead and pottery production industry (MLI52469). Also, at Brampton is the find spot of 70 sherds of unstratified post-medieval pottery (MLI118779).

Modern (1901 - present)

- 7.7.55 There are two modern assets within the study area, including one listed building within the 3km study area, and one non-designated asset located within the Site boundary. This consists of a windpump at Clay Farm (MLI53678).
- 7.7.56 The listed building is Gate Burton Cottages (1166351), two cottages within the Gate Burton estate built in 1914 of red brick with ashlar dressings, comprising two storeys and an attic. Gate Burton Hall also saw alterations in the early 20th century, and it was then used as a maternity hospital during the Second World War The hall was listed for sale in 1974 and it was subdivided into three residences by the time of its most recent designation description, written in 1985.
- 7.7.57 The landscape of the DCO Site and surrounding study area has remained predominately rural throughout the 20th century, with the earlier pattern of small villages and country houses surrounded by agricultural fields continuing.

Unknown

- 7.7.58 There are 25 assets of unknown date located within the 1km study area, including four which are located within the Solar and Energy Storage Park and ten within the Grid Connection Route. Those within the Solar and Energy Storage Park consist of cropmark features (MLI54018; MLI90939), the find spot of ceramic building material (MLI98304) and an unsubstantiated burial ground (MLI116479).
- 7.7.59 Within the study area, further undated assets include reused grave slabs in the walls of St Helen's Church (MLI50921) and industrial features such as the possible site of a watermill to the west of Knaith Hall (MLI51376) and an undated quarry (MLI116361). Finally, there are several possible archaeological features including cropmarks (MLI52482; MLI54023), possible earthworks (MLI52483; MLI52484), ditches (MLI89078; MLI125053), an enclosure (MLI50916), and a causeway (MLI50917).
- 7.7.60 The ten assets within the Grid Connection Route comprise earthwork and cropmarks of various features such as boundaries, trackways and enclosures (MNT6103, MNT6714, MNT6176, MNT6178, MNT6179, MLI52500, MLI54108). There is also evidence of quarrying of unknown date (MLI116361), a mound marked on an old OS map (MLI52497), and the place-name of Bunkers Hill, suggesting the presence of an undated rabbit warren (MLI53786).



7.8 Future Baseline

Future Baseline

- 7.8.1 The future baseline scenarios are set out in **Chapter 5: EIA Methodology**.
- 7.8.2 It is considered there will be no change to the future baseline for cultural heritage. The baseline details as presented above (including changes to settings of the assets) are not anticipated to change in the absence of the Scheme.

7.9 Potential Impacts

7.9.1 Mitigation measures being incorporated in the design and construction of the proposed Scheme are set out in Section 7.10 below. Prior to the implementation of the mitigation, the proposed Scheme has the potential to affect cultural heritage (positively or negatively), during construction, operation and decommissioning, in the following ways.

Construction Impacts

- 7.9.2 Temporary and short term construction impacts lasting for all or part of the construction phase of the Scheme potentially include the following:
 - The presence and movement of construction plant and equipment, which may impact on the significance of heritage assets caused by changes to their setting;
 - The siting of construction compounds and activities within working areas, including associated construction noise and lighting, which may impact on the significance of heritage assets caused by changes to their setting; and
 - The use of traffic management and increased volumes of traffic travelling on the local road network, which may impact on the significance of heritage assets caused by changes to their setting.
- 7.9.3 Permanent construction impacts lasting beyond the construction phase potentially include the following:
 - Physical impacts on known heritage assets arising from construction activities such as earthworks excavation, the formation of construction compounds and the installation of drainage infrastructure;
 - Physical impacts on landscapes of historical, cultural or archaeological significance as a consequence of construction, such as the loss of important elements of the landscape as a result of site clearance;
 - The disturbance, compaction or removal of previously unrecorded subsurface archaeological deposits through construction activities; and
 - Impacts on archaeological remains, historic buildings and the historic landscape associated with the introduction of the physical form and appearance of the Scheme in their setting.



Operation Impacts

- 7.9.4 Temporary operation impacts lasting for all or part of the operational phase of the Scheme potentially include the following:
 - Increase in traffic movements on and around the DCO Site (maintenance traffic), which could affect the significance of heritage assets caused by changes to their setting; and
 - Impacts on archaeological remains, historic buildings and the historic landscape associated with the introduction of the physical form and appearance of the Scheme in their setting.
- 7.9.5 The impact of the introduction of solar PV panels at construction will result in a continued effect on the setting of heritage assets through the operational phase. These effects are considered to be long-term but can be revered upon decommissioning.
- 7.9.6 No permanent effects upon Cultural Heritage as a result of the operational phase of the Scheme are envisaged.

Decommissioning Impacts

- 7.9.7 Decommissioning impacts are likely to be similar to those temporary impacts experienced during construction of the Scheme. Impacts lasting for all or part of the decommissioning phase of the Scheme potentially include the following:
 - The presence and movement of plant and equipment, which may impact on the significance of heritage assets caused by changes to their setting;
 - The siting of compounds and activities within working areas, including associated noise and lighting, which may impact on the significance of heritage assets caused by changes to their setting; and
 - The use of traffic management and increased volumes of traffic travelling on the local road network, which may impact on the significance of heritage assets caused by changes to their setting.
- 7.9.8 It is not expected that there will be any permanent impacts during decommissioning as a well-designed decommissioning scheme would not have any impact beyond the already-disturbed footprint of the Scheme; therefore, it is not anticipated that decommissioning activities would have a direct physical impact upon archaeological remains.
- 7.9.9 While there is the potential for temporary setting impacts during the removal of the solar PV panels and infrastructure, it is not anticipated that these will cause additional impacts over and above those reported in this chapter relating to the long-term presence of the proposed development within an asset's setting. Upon completion of decommissioning, the long-term adverse effects as a result of the development will cease to exist and the setting of the designated and non-designated buildings identified will be restored to the current baseline conditions.



7.10 Embedded and Additional Mitigation Measures

7.10.1 Mitigation measures in Table 7-4 have been incorporated into the Scheme design, with detailed proposals and locations to be submitted with the DCO application.

Table 7-4 Mitigation Categories

Category	Assessment	Description	Gate Burton Examples
Embedded	Factored into determining significant effects.	These form an integral, committed and deliverable part of the scheme design or standard construction practices and will be included within the DCO application.	Buried grid connection to avoid permanent impacts to the setting of heritage assets Selection of grid connection route to minimise impact to significant archaeological assets HDD for the grid connection at the River Trent Siting of transformers to minimise change to the setting of heritage assets Siting of converter stations to minimise change to the setting of heritage assets Screening and planting design Avoidance of known archaeological remains Solar panel exclusion zones (refer PEI Report Volume 1: Chapter 2: The Scheme, PEI Report Volume 2 Figure 2.2 and Section 7.11 below) to reduce impacts through change to the setting of heritage assets
Additional	Factored into determining residual significant effects.	Additional measures where standard (embedded) measures are not sufficient to avoid significant effects. Committed and deliverable as part of the Scheme and will be included within the DCO application.	of construction. While the exact

Construction and Decommissioning

- 7.10.2 The embedded mitigation and the additional mitigation developed in relation to the proposed Scheme is intended to minimise construction and decommissioning impacts.
- 7.10.3 The following are examples of embedded mitigation being considered during the development of the design:
 - Refinement of the design of the Scheme to avoid assets, where possible;
 - Use of non-intrusive solar PV panel instillation techniques where archaeological potential is identified;



- Minimising overall landtake requirements to reduce the extent to which the scheme could affect known and potential cultural heritage assets;
- Use of track matting to minimise the effect of temporary access tracks;
- The sympathetic use of landscaping to reduce visual effects on cultural heritage assets;
- Historic landscape recording in advance of scheme construction, to provide a permanent documentary record of assets in their current form and condition;
- Archaeological investigations in advance of, or during, scheme construction;
- Installation of physical protection or screening measures temporary during construction and/or decommissioning works; and
- Dissemination of the results of all surveys in an appropriate format and supporting archive.
- 7.10.4 It is anticipated that it will be possible to mitigate the Scheme's impacts upon the buried archaeological resource through a staged programme of archaeological investigation and recording undertaken as additional mitigation. The purpose of this is to ensure that surviving remains are recorded prior to their destruction by construction activities. Following a programme of geophysical survey and evaluation excavation (trial trenching), which will be reported as part of the ES, to identify the extent and survival of recorded remains, where required, further archaeological mitigation, such as excavation, will be undertaken to ensure remains are fully understood and recorded.

Operation

7.10.5 No significant effects on cultural heritage during operation are anticipated, therefore no mitigation measures are proposed during operation.

Monitoring

- 7.10.6 No archaeological monitoring is required to mitigate any effects on cultural heritage.
- 7.10.7 No monitoring is required in relation to effects arising from changes to the setting of heritage assets

7.11 Assessment of Likely Impacts and Effects

- 7.11.1 Taking into account the embedded mitigation measures as detailed in Section 7.10 above, the potential for the Scheme to generate effects was assessed using the methodology as detailed in Section 7.6 of this Chapter.
- 7.11.2 The effects have been assessed following consideration of the potential impacts outlined in Section 7.9 and the mitigation measures in Section 7.10.
- 7.11.3 The cultural heritage impact assessment is ongoing and will be reported in full in the ES, taking into account mitigation measures which are being developed. The information presented below provides a preliminary point in time of the



- current status of the assessment, and thus the assessment findings are subject to change and confirmation.
- 7.11.4 The following provides a proportionate assessment of likely significant effects on the historic environment. As such, only those assets which are considered to experience a likely significant effect from the Scheme, as informed by the desk-based research and professional judgement, are discussed. Those assets which will not experience an impact on their significance (as defined above), either physically or through changes to their setting, are omitted. Details of assets within the study area, but not impacted by the Scheme, will be provided in a desk-based assessment in a technical appendix as part of the ES.

Construction (2025 to 2027-28) and Decommissioning (2087 to 2088-89)

- 7.11.5 There are 55 heritage assets recorded that have the potential to be subject to physical impacts or impacts to the significance of assets caused by changes to their setting as a result of the construction of the Scheme. These comprise 10 designated assets and 45 non-designated assets and the effects are summarised below.
- 7.11.6 The assessment of potential impacts and effects has assumed that all individual finds recorded on the HER within the study areas were removed when found and are therefore no longer in situ. The location of find spots have been considered when assessing the significance of archaeological sites in their vicinity.

Solar and Energy Storage Park Designated Assets

- 7.11.7 Heynings Priory (1008685) is a scheduled monument of high value. Its heritage value is derived from its archaeological and historic interest as the buried and earthwork remains of a Cistercian nunnery founded after 1135. probably in the reign of Stephen or early in the reign of Henry II. It also has associative historic interest in the people and places associated with the nunnery, both whilst it was in operation and after it was dissolved. The scheduled area of the priory includes part of the inner precinct and most of the outer precinct; however, the earthwork remains are known to extend beyond the scheduled area (Ref 7-29). Earthworks have been recorded extending to the west of the scheduled area and within a narrow strip of land to the south. The extent of these remains is defined by the extent of the monument polygon recorded in the Nottinghamshire HER data (MLI150244), which is larger than the scheduled area. These additional earthwork and buried remains of the priory site are a key component of the setting of the scheduled monument as they form part of the asset and contribute to its archaeological and historic interests. They are considered to be of high value for that reason.
- 7.11.8 The farmland setting of the priory contributes to the historic interest of the asset though providing an understanding of the subsistence and devotional operation of the priory and its siting. Two areas of recorded medieval agricultural remains are present immediately adjacent to the known extent of the priory (MLI150244), comprising a medieval field system to the east of the



asset (MLI54016), and ridge and furrow cultivation to the south of the asset (MLI54022). These assets, which are immediately outside the Solar and Energy Storage Park, together with the undeveloped fields around the asset and within the Solar and Energy Storage Park contribute to its heritage value. The associative setting of the priory includes those assets that were within the ownership or financial control of the priory, which in the study area comprise of St Mary's Church in Knaith, and the Church of all Saints in Upton and its rectory farm. There is no direct visual connection between these sites, but they have a functional setting relationship that contributes to the historic interest of the asset.

- 7.11.9 The proposed Scheme includes the installation of solar panels in fields to the south, east and north-east of the Heynings Priory scheduled monument, approximately 63m from the asset at their closest extent. Whilst the Solar and Energy Storage Park avoids the full known extent of the earthwork remains of the priory (MLI150244) and the remains of known medieval agriculture adjacent (MLI54016 and MLI54022), the fields within the Solar Energy and Storage Park make a positive contribution to the heritage value of the asset as part of the surrounding farmland and siting of the priory. Current evidence suggests they do not form part of the abbey precinct. The land immediately to the west of the asset is outside the Solar Energy and Storage Park and the closest solar PV panels will be approximately 500m to the west of the asset on the opposite side of the railway line. The development of the fields surrounding three sides of the asset will, however, result in change in the ability to understand and appreciate the asset's heritage value. It is therefore assessed as a medium magnitude of impact for the lifespan of the Scheme on a high value asset, resulting in a major adverse significance of effect. This is considered to be **significant** in EIA terms.
- 7.11.10 The Church of St Mary at Stow (1146624) is a Grade I listed building of high value, that is located within, and associated with, the scheduled monument of the buried archaeological remains of a Benedictine abbey and college (1012976), also of high value. The heritage value of the asset is derived from its architectural, archaeological, artistic and historic interest as a religious institution that can be traced from its collegiate origin in the Anglo-Saxon period, through its reform as a Benedictine monastery, and then its decline to parish church status. The asset has archaeological and architectural interest in its development sequence and medieval origins, and illustrative and communal historical interest in its demonstration of the central place of the church in people's lives, and settlements.
- 7.11.11 The prominence of the church in the surrounding landscape demonstrates that its importance extended well beyond the boundary of the settlement, particularly when it is considered that the present church is much reduced in size from the 11th century abbey church that was once present on the site. Its prominence is part of the original design intention for the church, to demonstrate the importance of religion and community and to act as a landmark structure used in the surrounding rural landscape for wayfinding. The church's setting is therefore informed by its functional and visual setting relationship with its churchyard and the settlement of Stow, as well as with its surrounding rural landscape and prominence in views towards the settlement.



- 7.11.12 The Solar and Energy Storage Park is located approximately 1.5km northwest of the asset and views of the Church of St Mary are possible from various locations within the Solar and Energy Storage Park and on the roads around its perimeter. The land within the Solar and Energy Storage Park, although at distance from the asset, therefore forms part of its rural landscape setting. Views from the top of the church tower over the surrounding landscape would feature views of the Solar and Energy Storage Park and views would be possible in the surrounding landscape that feature the Solar and Energy Storage Park and the Church of St Mary in combination. The change in use of the land within the site to a Solar Energy and Storage Park would remove an element of the agricultural setting of the asset, although the farmland setting in the immediate vicinity of the asset would be retained in its current form and no identified key views of the asset would be obstructed by the Scheme. This is assessed as a very low magnitude of impact, for the lifespan of the Scheme, as it would result in little change in the ability to understand and appreciate the significance of the asset. On an asset of high value, this results in a minor adverse significance of effect. This is not considered to be significant in EIA terms.
- 7.11.13 The group of designated assets in Gate Burton non-designated parkland (MLI98360) comprise the following:
 - Gate Burton Hall Grade II* listed building (1359458) an asset of high value;
 - The Chateau Grade II* listed building (1064085) and asset of high value;
 - Gate Burton Hall Cottages Grade II listed building (1166351) an asset of high value;
 - Walled Garden at Gate Burton Hall Grade II listed building (1472727) an asset of high value;
 - Church of St Helen Grade II listed building (1064087) an asset of high value;
 - Old Rectory Grade II listed building (1359457) an asset of high value; and
 - Gateway to Gate Burton Hall Grade II listed building (1064086) an asset of high value.
- 7.11.14 The assets' heritage values are drawn from their individual intrinsic architectural and historic interest, as well as their group value with one another as a collection of assets within a designed landscape of artistic interest. It is due to this additional layer of heritage interest that the Grade II listed buildings falling within the park have been assessed as being of high value, rather than medium value. The hall became a maternity unit during the Second World War when Hull Maternity Hospital was turned over as a receiving hospital for war casualties. The hall and landscaped grounds therefore also have communal historic interest for the people who gave birth and worked there (most probably now deceased), as well as the children born there.
- 7.11.15 The setting of the buildings within the park is defined by the extent of the non-designated designed parkland garden (MLI98360) and its setting in turn. The parkland is assessed as an asset of medium value in performing this function. Its heritage value derives from its artistic and architectural interest as an example of a late 18th century designed landscape, comprising a pleasure ground and parkland. Archaeological interest is also provided by the presence



within the parkland of the former medieval settlement of Gate Burton that was cleared to make way for the parkland, as well as parts of the parkland garden that may have been lost, altered or overgrown in the course of the last two centuries. The setting of the garden includes its siting, approaches and carriage drives, as well as any designed key views of, from and within the garden. The southern access is the only formal entrance to the park and the approach to it from the south provides a key designed view of the hall's principal southern frontage set within mature trees to the other three sides. This tree planting around the hall restricts views from it on all but the south side. The planting to the west of the hall is a 20th century development and was probably introduced to screen the road as it became busier with motor vehicles. Within the parkland, historic mapping details a series of drives, including a connection to Burton Wood to the east of the park. A linear drive runs east from the north-west corner of the hall, alongside Gate Burton Cottages and the Walled Garden and out into the surrounding fields to connect with a series of drives shown through the woodland. The wood comprises 6ha classified as semi-natural and 4 ha classified as plantation. This connection has been lost in recent years, but the linear alignment through the park is still present as a tarmac drive and gravelled paths are still present within the woodland.

- 7.11.16 The park is bounded to the west by the River Trent, and on the other sides largely by agricultural land and woodland which restricts long views into and out of the park on the north side. It is bisected by Gainsborough Road from which views into the park on both sides feature parkland tree planting and grassed areas containing surviving ridge and furrow remains. The Chateau is to the west of the road and acted as a garden building after the main hall was constructed. Views into the park on the east side of the road terminate in the 20th century shelter belt of trees to the west side of the hall and no views of the hall are available from this side as a result. The park lies at the base of the Trent valley and the land rises to the east, with a gentle slope towards Burton Wood. This, and Burton Wood, restricts long views out of the park beyond the woodland. As the description of the development and fey features of the garden provided above demonstrates, the focus of views from within the garden looking out was directed predominantly to the south. Other views are inward looking within the garden and its buildings and along its drives and footpaths. The lack of a thick woodland belt of planting on the park's boundary, particularly to the east, means that the extent of garden somewhat bleeds into the surrounding farmland with a relatively open character. This is particularly true at the southern end of the park where there are open views from the Church of St Helen into the Solar and Energy Storage Park and from the Solar and Energy Storage Park into the parkland. Further north along the parkland boundary long views are more restricted by the topography and Burton Wood.
- 7.11.17 The Solar and Energy Storage Park occupies a small portion of the former extent of the park as marked on late-19th century OS maps and falls within the rural landscape setting of the park, and thus also the setting of the parkland's principal buildings. The Scheme will introduce solar panels to the east of the park, with a 100m panel-free buffer area from the present eastern boundary of the park. The buffer area assists in mitigating some of the visual impact of the proposed Scheme on the parkland. However, the Scheme will introduce a



form of development into the asset's setting that is incongruous with its picturesque naturalistic design intention and this will impact upon understanding of the park's intended design and, as an extension, the designed setting of Gate Burton Hall. This is the case despite there being no views between the Solar and Energy Storage Park and the hall. The open aspect of the parkland's eastern boundary towards the south end of the park will also mean that open views of the Solar and Energy Storage Park will be possible from the Church of Helen and from the main drive on approach to the hall from the south. The layout includes embedded mitigation comprising a panel free buffer area to the east of the parkland, and the retention of a connection between the parkland and Burton Wood. Although this connection has been lost in the modern landscape, it was a key former landscape connection forming part of the design of the park and its recreational use and land management. The panel free buffer area includes the majority of the glebe land recorded in association with the predecessor of the Church of St Helen on the Gate Burton tithe map of 1840. The magnitude of impact, for the lifespan of the Scheme, to the non-designated parkland (MLI98360) of medium value is assessed as medium, resulting in a significance of effect of moderate adverse. This is considered significant in EIA terms. The magnitude of impact, for the lifespan of the Scheme, to Gate Burton Hall (1359458) and the Church of St Helen (1064087), both of high value, is assessed as very low, resulting in minor adverse significance of effect. This is not considered significant in EIA terms.

- 7.11.18 Other assets within the parkland will experience either no impact or very low impact, for the lifespan of the Scheme, resulting **neutral** or **minor adverse effects** which are not considered significant in EIA terms.
- 7.11.19 South Park Farmhouse (1064051) is a Grade II listed building of medium value. It occupies part of the site of the former Heynings Priory scheduled monument (1008685) discussed above. Its heritage value is drawn from its architectural and historic interest as an example of a large 19th century farmhouse. 19th century OS maps show the detached farmhouse to the northwest side of a large U-shaped courtyard farmstead with a smaller U-shape courtyard adjoining its east side. A garden/orchard is depicted to the south of the farmhouse. Early 20th century OS maps detail additions to the farmstead including infilling of parts of the double U-shaped courtyard and the addition of further farm buildings to the north of the courtyard, east of the house. The majority of the historic farmstead ranges have been demolished and replaced with larger modern agricultural units that are out of scale and character with the farmhouse. Further units have been added outside the bounds of the historic farmstead on to the east and south-east. The loss of most of the historic farm ranges diminishes the contribution made by the farmyard to setting and heritage values of the farmhouse. The addition of the larger farm ranges detracts from the asset's setting, but they do maintain the farm in active use which provides valuable contextual understanding for the farmhouse.
- 7.11.20 The setting of the farmhouse is defined by its garden and the surrounding agricultural landscape which provide the aesthetic and functional setting of the farmhouse contributing to an understanding of its historic and current function and heritage value. A key view of the farmhouse is achieved from Kexby Lane



to the north of the asset. Views from the farmhouse are focused to the north, whilst views southward overlook the garden with mature trees along its southern boundary restricting long views over farmland to the south. Likewise, there are mature trees along the western boundary of the garden screening long views on that side. To the east and south-east views are largely screened by the large modern agricultural buildings.

7.11.21 The proposed development includes the installation of solar PV panels in fields to the south, east and north-east of the farmhouse, as well as at distance to the west. To the north-east, the closest extent of the Solar Energy and Storage Park is approximately 300m from the asset to the east is its approximately 170m from the asset at its closest extent, and to the south the Solar Energy and Storage Park is approximately 190m from the asset. The land immediately to the west of the asset is outside the Solar Energy and Storage Park and closest solar panels would be approximately 600m to the west of the asset on the opposite side of the railway line. Development of the farmland around the asset, whether visible from the asset of not, has the capacity to impact upon the understanding of the historic interest of the farm, however, there is considered to be a sufficient green buffer retained around the asset comprising its garden and the fields immediately outside to reduce the degree of the impact such that it does not affect the ability to understanding the asset's heritage value. This is assessed as a very low magnitude of impact, for the lifespan of the Scheme, on an asset of **medium** value, resulting in a **negligible** significance of effect. This is not considered to be significant in EIA terms.

Solar and Energy Storage Park Non-designated Assets

- 7.11.22 Three areas of undated cropmark enclosures and boundary ditches (MLI54017, MLI90939 and MLI54018), possibly of prehistoric date, are recorded from aerial photographs within the Solar and Energy Storage Park. Their exact nature and date are unknown at this stage. These features have not been previously investigated and as such are of archaeological, and possibly historic, interest in their ability to inform on past human activity. Given the scarcity of information available, this asset is considered to be of medium heritage value. The full extent of the impact is not known at this stage but there is potential for partial or full loss of the features as a results of ground works. The magnitude of impact of intrusive groundworks upon these cropmarks has been assessed as **medium**, as the heritage value of the asset has the potential to be significantly altered or modified. Therefore, the construction of the scheme would result in a **moderate adverse effect** on this asset of **medium** value. This is considered to be **significant** in EIA terms.
- 7.11.23 An area of iron working (MLI97380) dating from the Iron Age or Romano-British period has been recorded in the north of the Site close to Knaith Park. The areas of iron working were identified through a programme of archaeological evaluation undertaken in connection with a natural gas pipeline proposed between Grayling and West Burton. Geophysical survey identified a localised area of anomalies interpreted as industrial features such as kilns. These anomalies were investigated through six evaluation trenches which located two broad hollows containing slag and other iron working residues.



Romano-British pottery was also recorded. The works concluded that the slags indicated an earlier pit furnace(s) rather than a clag-tapping furnace. The site holds archaeological interest for the information it would provide on iron working in the Iron Age period. The site is considered to be of medium heritage value. The site is in an area identified for solar PV panels. As such the Scheme would have a **low** magnitude of impact. The resulting significance of effect on an asset of medium value would be **minor adverse**. This is not considered to be significant in EIA terms.

- 7.11.24 A medieval rabbit warren (MLI50485) was recorded in 1536 as being located within part of the deer park of Knaith Hall. The tithe map of 1850 recorded the field in which it is located as 'Conney Green' and earthworks have been located at this location on aerial photographs. The asset is not designated and it is considered to have low heritage value. It holds historic interest due to the contribution it makes to the understanding of the layout and function of the park and the wider historic landscape. The warren lies in an area of the Scheme where solar PV panels will be excluded and used for ecological mitigation. The full extent of this mitigation is not known at this stage but should ground works or tree planning be required it could result in an impact on the buried archaeological deposits. As such the Scheme would have a low magnitude of impact to the rabbit warren of low value, resulting in a significance of effect of negligible. This is not considered to be significant in EIA terms.
- 7.11.25 The historic boundary of the medieval deer park at Knaith (MLI50408, MLI50409) extends in some locations into the boundary of the Solar and Energy Storage Park. The medieval park is thought to have been created in 1344 when John Darcy was licensed to empark woodland, though this evidence is not confirmed. Certainly by 1536 historic records record there was a deer park stocked with 38 deer as well as a 'warren of conies'. The park is not designated and is considered to be of medium heritage value for its archaeological and historic interest. The archaeological interest is derived from the earthwork features and surviving landscape features, while the historic interest relates to the park's 14th century origins and its connections to Knaith Hall which was constructed in the 15th century. At this time the deer park developed into a parkland garden associated with the hall, and located predominantly to its south side. The park is located to the north and north-west of the Solar and Energy Storage Park and the full extent of its boundary is being researched. It is anticipated that it extends into the north-west of the site. A section of the park lies in an area where solar PV panels will be excluded. As such the Scheme would have a temporary low magnitude of impact to the park as a result of construction activities resulting. On an asset of **medium** value, this results in a temporary significance of effect of **minor** adverse. This is not considered to be significant in EIA terms.
- 7.11.26 Two areas of medieval ridge and furrow agricultural features (MLI50914, MLI54012) are recorded within the DCO Site. They are of local archaeological and historic interest based on their ability to inform on past activities relating to agricultural processes and land management. Such features are very common throughout the region, and across England as a whole, and are therefore of no more than low heritage value. Although intrusive groundworks



will result in the physical impacts on these assets within some areas of the Scheme's footprint, there is potential that areas of ridge and furrow within ecological compensation areas and solar PV panel areas could largely be preserved *in situ*. Where the Grid Connection Route crosses these areas, the impact will be limited to the cable trench and adjacent working area. When considering the worst case, the construction phase of the Scheme will therefore result in a **medium** magnitude of impact on an asset of **low** value, resulting in a **minor adverse** significance effect. This is not considered to be significant in EIA terms.

- 7.11.27 Thurlby Farm (MLI118135) was a post-medieval farm demolished in the mid19th century, the site of which lies just within the northern boundary of the Solar
 and Energy Storage Park. The asset is not designated, and any surviving
 remains would be of very low heritage value. It holds limited archaeological
 interest due to the contribution that any surviving buried remains may provide
 to the understanding of post-medieval farmsteads. The asset is located on the
 edge of the Solar and Energy Storage Park in an area identified for the
 installation of solar PV panels. Assuming that the remains are limited the effect
 would be a **very low** magnitude of impact on an asset of **very low** value. The
 resulting significance of effect would be **negligible**. This is not considered to
 be significant in EIA terms.
- 7.11.28 A section of the remains of settlement earthworks, formerly part of the village of Knaith (MLI50529), lies within the north-west of the Solar and Energy Storage Park. The documentary evidence for Knaith from 1086 onwards indicates a settlement in this location which utilised the prominent bend in the River Trent. It is believed that the ancient village was removed after the estate passed to Willoughby of Parham who made Knaith his permanent home and removed the village to create a landscape garden and park, with a new settlement created to the south-east along the Gainsborough Road. While some earthworks of the village are extant, the full extent of the settlement is not known but it is believed to extend into the north-west of the Site. The remains of the village are of local archaeological and historical interest based on their ability to inform on the history of the expansion and shrinkage of the village, as well as past influence on the landscape. The asset is not designated and is considered to be of medium heritage value for its archaeological and historic interest. The recorded extent of the asset extends into an area of the Scheme where solar PV panels will be excluded and used for ecological mitigation. The full extent of this mitigation is not known at this stage but should ground works or tree planning be required it could result in an impact on the buried archaeological deposits. As such the Scheme would have a low magnitude of impact to this asset of **medium** value, resulting in a significance of effect of minor adverse. This is not considered to be significant in EIA terms.
- 7.11.29 The medieval settlement of Gate Burton (MLI50512) was dispersed when the area was emparked in the 18th century. The remains of the settlement are largely located in the fields around the Church of St Helen, the most prominent of which are two hollow-ways marking the line of former roads. To the north and east of the church is a series of ditched earthworks which once continued into the now ploughed land within the Solar and Energy Storage Park. The site



has archaeological interest for the information it contains regarding settlement activity, as well as historic interest for information on both settlement development in the medieval period, and the later park landscape. The setting of the assets includes the church and the surrounding agricultural landscape, which contributes to its heritage value. Given the scarcity of information available, this asset is considered of medium heritage value. The magnitude of impact of intrusive groundworks upon the remains of the settlement will be limited to where it extends into the site boundary. There will also be an impact on its setting so that its significance will be altered. As such the Scheme would have a **medium** magnitude of impact on an asset of **medium** value. Therefore, the construction of the scheme would result in a **moderate adverse** significance of effect. This is considered to be **significant** in EIA terms.

- 7.11.30 The line of a medieval field boundary (MLI54019) is recorded as a cropmark within the Solar and Energy Storage Park. The asset has historic interest for the contribution it makes to understanding the medieval landscape. It is considered to be of low value. The asset is located on the edge of the Solar and Energy Storage Park in an area identified for the installation of solar PV panels. Assuming that the remains would be limited, the effect would be a **very low** magnitude of impact on an asset of **low value**, resulting in a significance of effect of **negligible**. This is not considered to be significant in EIA terms.
- 7.11.31 The site of Burton Windmill (MLI90076) is recorded on the OS map dating to 1891, and only the associated mound is shown on the 1905 edition. This asset is of archaeological and historic interest due to its ability to inform on the development of late post-medieval industries in rural contexts. It is considered to be of low heritage value. The site of the windmill lies within a wooded area within the Solar and Energy Storage Park and any effect on this asset of low value would result in a very low magnitude of impact for the lifespan of the Scheme. The resulting significance of effect would be negligible. This is not considered to be significant in EIA terms.
- 7.11.32 Siding Farm (MLI118136) is a non-designated farmhouse of very low value. Its limited heritage value is gained from its historic and architectural interest as an example of a small 19th century farmhouse. The house is shown on the Knaith Tithe Map of 1848 as a farmhouse with an attached linear farmstead range to the north, forming a small yard to the south. The first edition OS map of 1885 shows the same arrangement with a double yard to the south of the linear farmstead. The farmhouse and farmstead are within the same land parcel with some tree-planting shown to the east side. The farmstead range has been demolished and only the farmhouse now remains in isolation. The fields surrounding the asset contribute to its understanding as a farmhouse. However, this has been much diminished by the loss of the farmstead ranges. The setting of the asset therefore makes a limited contribution to its heritage value by providing an understanding of its historic function. The proposed development will introduce solar PV panels around the asset on all four sides, at a distance of approximately 95m from the asset. This is assessed as a medium magnitude of impact, for the lifespan of the Scheme, on an asset of very low value, resulting in a negligible significance of effect. This is not considered to be significant in EIA terms.



- 7.11.33 Clay Farm (AEC001) is considered to be a non-designated heritage asset of low value. Its heritage value is drawn from its architectural and historic interest as a 19th century farmhouse and farmstead that survives largely intact, although with modern additions. It is shown on the Gate Burton Tithe Map of 1848 as a farmhouse with a separate L-shaped courtyard farmstead to the east, with a yard on its north side. By the time of the first edition OS map in 1885 the farmstead had been extended with a long linear range to the west of the original L-shaped range and yard, and joining on the north-east corner of the farmhouse. Garden plots are shown to the north and south of the house with farmyards to the east of the linear farm range. The farmhouse and farmstead survive but large modern agricultural units have been added, one enclosing the foldyard and two to the north and east. The setting of the asset includes its gardens to the north and south of the house, both of which are bounded by mature tree planting. The railway runs immediately to the west of the asset which visually severs it from the farmland on the opposite side of the line, so the farmland setting of the asset, which provides an understanding of its historic function, is limited to the fields to the north, east and south. The Scheme will introduce solar panels around the asset on all sides, at a distance of approximately 40m to 60m from the asset. This will substantially alter the asset's farmland context affecting the ability to understand its heritage interest. This is assessed as making a **medium** magnitude of impact, for the lifespan of the Scheme, on an asset of low value, resulting in a minor adverse significance of effect. This is not considered to be significant in EIA terms.
- 7.11.34 A wind pump was built at Clay Farm in the 1930s to supply water to the farm (MLI53678). The original pump measured 32ft high with sails and 11ft in diameter. The pump was recorded on the HER as having been out of use since 1955 and derelict in the 1990s. The remains of the pump were not noted during the walkover survey of the area. The asset is not designated, and any surviving remains would have very low heritage value. It holds limited historic interest due to the contribution it makes to the understanding of the industrial development of farming practices. The pump is located on the edge of the farm in an area identified for the installation of solar PV panels. The effect would be a very low magnitude of impact, resulting in a significance of effect of negligible on an asset of very low value. This is not considered to be significant in EIA terms.
- 7.11.35 The HER notes that a burial ground (MLI116479) is recorded on the OS landline data file for 2002 and current OS Mastermap. There is, however, no earlier record of a burial ground in this location or any evidence of it when the location was visited. The HER record speculates that the addition to the reference to the burial ground is an error. As a result, despite the location referenced in the HER record falling within the Solar and Energy Storage Park, no asset exists to be affected.

Grid Connection Route Non-designated Assets

- 7.11.36 There are 32 non-designated heritage assets affected by the Grid Connection Route. No designated heritage assets are affected.
- 7.11.37 The line of a Roman Road at Till Bridge Lane (MLI50575) passes through the Grid Connection Route. This linked Ermine Street north of Lincoln to the



crossing point of the River Trent at Marton and formed a key over land route to Roman York to avoid the wide ferry crossing of the River Humber. The road is of archaeological and historic interest, as it is indicative of the network of routes established by the Roman armies which enabled them to maintain control of their territories. The heritage value of this asset is deemed to be low. As only a small section of the line of the road passes through the Grid Connection Route, magnitude of impact would be **low** on an asset of **low** value. The resulting significance of effect would be **negligible**. This is not considered to be significant in EIA terms.

- 7.11.38 Cropmarks of Romano-British settlement activity have been identified to the east of Marton (MLI52472). These depict the likely remains of a series of enclosures and an accompanying series of field systems. The area is adjacent to the line of the Roman road at Till Bridge Lane. The remains possess archaeological and historical interest for the knowledge they provide regarding settlement and agricultural land use. The heritage value of this asset is deemed to be medium. Given the limited width of the scheme it is unlikely that total loss of this asset will occur. Therefore, the magnitude of impact would be low on an asset of medium value. The resulting significance of effect would be minor adverse. This is not considered to be significant in EIA terms.
- 7.11.39 There are traces of probable medieval ridge and furrow off Stow Park Road, Marton (MLI116360). This was recorded during a magnetometry survey in 2016. They are of local archaeological and historic interest based on their ability to inform on past activities relating to agricultural processes and land management. Such features are very common throughout the region, and across England as a whole, and are therefore of no more than very low heritage value. Given the limited width of the scheme it is unlikely that total loss of this asset will occur. Therefore, the magnitude of impact would be low on an asset of very low value. The resulting significance of effect would be negligible. This is not considered to be significant in EIA terms.
- 7.11.40 An area of probable quarrying of unknown date (MLI116361) is recorded adjacent to the traces of medieval ridge and furrow. This is of limited historic interest for the information it contains about industrial activity. The heritage value of this asset is deemed to be very low. Given the limited width of the Scheme it is unlikely that total loss of this asset will occur. Therefore, the magnitude of impact would be very low on an asset of very low value. The resulting significance of effect would be negligible. This is not considered to be significant in EIA terms.
- 7.11.41 The partially extant remains of the 19th century Rectory Farm are recorded at Marton (MLI50066). This has been subjected to previous historic building recording in 2013 prior to the proposed demolition of some of the farm buildings. Its heritage value is drawn from its architectural and historic interest as a 19th century farmhouse. The heritage value of this asset is deemed to be low. Given that the scheme could be adjusted to avoid this asset or that the Scheme is unlikely to result in total loss of the asset, there be a **low** magnitude of impact on an asset of **low** value. The resulting significance of effect would be **negligible**. This is not considered to be significant in EIA terms.



- 7.11.42 Earthworks of unknown date have been identified at East End Farm, Rampton (MNT6103). The earthworks are the remains of a bank, hollow way, mound and ridge and furrow, which are likely to be of medieval or post-medieval date. The earthworks are described as substantial and some are thought to be the remains of former buildings. The site has archaeological interest for the information it contains regarding settlement activity, as well as historic interest for information on settlement development in the medieval or post-medieval period. The heritage value of this asset is deemed to be low. Given the limited width of the Scheme, it is unlikely that total loss of this asset will occur. Therefore, the magnitude of impact would be low on an asset of low value. The resulting significance of effect would be negligible. This is not considered to be significant in EIA terms.
- 7.11.43 Adjacent to these earthworks is a field boundary at Rampton of medieval to post-medieval date defined by a single ditch, which is 450m long (MNT6166). It has limited historic interest related to likely agricultural activity. The heritage value of this asset is deemed to be very low. Given the limited width of the Scheme, it is unlikely that total loss of this asset will occur. Therefore, the magnitude of impact would be low. The resulting significance of effect on an asset of very low value would be negligible. This is not considered to be significant in EIA terms.
- 7.11.44 Further earthworks at Rampton are recorded in the grounds of Manor House (MNT6714). The HER record does not provide any further detail as to the nature of these earthworks and they are undated. The site has archaeological interest for the information it contains regarding settlement activity, as well as historic interest for information on past activity. The heritage value of this asset is deemed to be low. Given the limited width of the Scheme, it is unlikely that total loss of this asset will occur. Therefore, the magnitude of impact would be low. On an asset of low value, the resulting significance of effect would be negligible. This is not considered to be significant in EIA terms.
- 7.11.45 A settlement of Iron Age and Roman date is recorded at Cottam (MNT15983; MNT6178; MNT6179). This consists of substantial enclosures with possible internal features such as roundhouses, as well as sections of trackways, further enclosures, and linear features. The remains possess archaeological and historical interest for the knowledge they provide regarding settlement and agricultural land use. The heritage value of these assets is deemed to be medium. Given the limited width of the Scheme, it is unlikely that total loss of these assets will occur. Therefore, the magnitude of impact would be low on an asset of medium value. The resulting significance of effect would be minor adverse. This is not considered to be significant in EIA terms.
- 7.11.46 A late Neolithic to early Bronze Age pit was recorded at Rampton (MNT11695). This contained a highly decorated beaker pottery vessel and was cut by a Roman enclosure ditch. The asset has archaeological significance related to the information it contains about Bronze Age activity, as well as the distribution of settlement. The heritage value of this asset is deemed to be medium. Further similar and related features could be located in the area. Given the limited width of the Scheme, it is unlikely to result in their total loss, and the magnitude of impact is considered to be **low**. On an asset of **medium** value,



the resulting significance of effect would be **negligible**. This is not considered to be significant in EIA terms.

- 7.11.47 Evidence of Late Iron Age and Roman settlement activity had been identified at Rampton (MNT11696; MNT11704; MNT15344). These consist of field systems, roundhouses, traces of wattle and daub buildings and artefacts such as pottery and brooches. These remains are extensive and reasonably well preserved. The remains possess archaeological and historical interest for the knowledge they provide regarding settlement and agricultural land use. The heritage value of these assets is deemed to be medium. Given the limited width of the Scheme, it is unlikely that total loss of these assets will occur. Therefore, the magnitude of impact would be **low**. On an asset of **medium** value the resulting significance of effect would be **minor adverse**. This is not considered to be significant in EIA terms.
- 7.11.48 A likely late Neolithic or Early Bronze Age burial has been recorded at Rampton (MNT26008). This consisted of an intact ceramic vessel placed upright in the bottom of a small pit. This is thought to have been a burial but the human remains unlikely to have survived due to the acidic soil conditions. The same record notes the recovery of a thin scatter of Mesolithic to Bronze Age lithics and a Roman enclosure ditch. The asset has archaeological interest related to the information it contains about Neolithic or Bronze Age funerary practices, as well as the distribution of these features, as well as about prehistoric activity. The heritage value of this asset is deemed to be medium. Given the limited width of the scheme, it is unlikely that total loss of this asset will occur. Therefore, there would be a **low** magnitude of impact on an asset of **medium** value. The resulting significance of effect would be **minor adverse**. This is not considered to be significant in EIA terms.
- 7.11.49 Evidence of Neolithic agriculture was recorded near Cottam during an auger survey (MNT27156). This produced environmental evidence suggestive of localised woodland clearance and agriculture. It has archaeological interest related to both Neolithic activity and past environmental change. The asset is of medium value. Given the limited width of the scheme, it is unlikely to result in total loss of this asset. Therefore, the magnitude of impact would be low. On an asset of medium value, the resulting significance of effect would be minor adverse. This is not considered to be significant in EIA terms.
- 7.11.50 A large area of cropmarks has been identified from aerial images (MNT4983) including circular enclosures, linear features and trackways. Analysis of the available images suggests a group of enclosures, trackways and field systems likely to be of Iron Age or Roman date. There are also a number of features that potentially date to the medieval and post-medieval date. This complex of features hold archaeological interest relating to the information the site would provide on late prehistoric and Iron Age settlement and farming practices and how these practices developed into the medieval period and beyond. Due to the potential complexity of the site and the contribution the information from the site could make to the regional research agenda the value of this asset is deemed to be medium. Given the limited width of the Scheme, it is unlikely that total loss of this asset will occur. However, the Grid Connection Route could potentially cut through the complex. Therefore, the magnitude of impact would be **medium**. On an asset of **medium** value, the resulting significance



of effect would be **moderate adverse**. This is considered to be **significant** in EIA terms.

- 7.11.51 A subcircular enclosure of unknown date is recorded at South Leverton (MNT6176). It has a possible entrance facing north-west. It has archaeological interest related to details of past activity. The heritage value of this asset is deemed to be low. Given the limited width of the Scheme, it is unlikely to result in total loss of this asset. Therefore, there would be a low magnitude of impact. The resulting significance of effect on an asset of low value would be negligible. This is not considered to be significant in EIA terms.
- 7.11.52 An earthwork mound of unknown date is recorded on the 1956 OS map at Brampton (MLI52497). Given the nature of this asset it is likely to be of prehistoric date and could be the remains of a burial mound. It would therefore have an archaeological interest related to the information it contains about funerary practices, and it has a medium value. Given the limited width of the Scheme, and the relatively small nature of this asset, it may even be avoided by the final design. However, if it is affected, the magnitude of impact would be medium. The resulting significance of effect on an asset of medium value would be moderate adverse. This is considered to be significant in EIA terms.
- 7.11.53 Cropmarks of a boundary and trackway have been recorded (MLI52500). These are undated and the HER record does not note any further information regarding them. They would have some archaeological interest about past activity. The heritage value of this asset is deemed to be low. Given the limited width of the Scheme, it is unlikely to result in total loss of the asset. Therefore, the magnitude of impact would be low. The resulting significance of effect on an asset of low value would be negligible. This is not considered to be significant in EIA terms.
- 7.11.54 Further undated cropmarks of an enclosure and ring ditch are recorded (MLI54108) suggestive of some kind of occupation. However, a watching brief at this site only located a spread of Roman and post-medieval pottery, an no archaeological features were identified. Although the pottery has been removed, the potential archaeological significance of this site means that it is of low value given the limited remains located. The site has limited archaeological significance for the information it contains relating to past activity. As the site has been removed, it is unlikely to result in further impact, although further artefacts could survive. Therefore, the magnitude of impact on this **low** value asset is considered to be **low**. The resulting significance of effect would be **negligible**. This is not considered to be significant in EIA terms.
- 7.11.55 Post-medieval flood defences are recorded at Brampton and Marton existing as earthworks (MLI52488). The site is of limited archaeological and historic interest, and the heritage value of this asset is considered to be low. Given the limited width of the Scheme, it is unlikely to result in total loss of the asset. Therefore, there would be a low magnitude of impact. On an asset of low value, the resulting significance of effect would be negligible. This is not considered to be significant in EIA terms.



- 7.11.56 The demolished remains of a 19th century farmhouse at Rectory Farm, Marton are recorded (MLI116491). These were subjected to a programme of historical building recording prior to their demolition in 2013. Its heritage value is drawn from its architectural and historic interest as a 19th century farmhouse. As it has been demolished, only limited sub-surface remains may survive, and consequently its value of is considered to be very low. Given the limited width of the Scheme and the fact the building has been demolished, the magnitude of impact would be no more than very low. The resulting significance of effect on an asset of very low value would be negligible. This is not considered to be significant in EIA terms.
- 7.11.57 The location and remains of the Viking Winter Camp are recorded at Torksey (MLI125067). This consists of substantial area of temporary settlement, evidenced by archaeological features and early medieval metal working, along with a large number of artefacts. It is of archaeological interest for the information it contains about the temporary camp and settlement and industrial activity related to metal working, and historic interest related to the Viking incursions in the region. It is of high heritage value due to its likely national significance. Although the Grid Connection Route will cross through the area, this will only be within a narrow corridor. As a consequence, the magnitude of impact is not considered to be more than **low**. On an asset of **high** value, this results in a significance of effect of **moderate adverse**. This is considered to be **significant** in EIA terms.
- 7.11.58 A probable Roman farmstead and associated pottery scatter is recorded at Brampton (MLI125068; MLI125072). The farmstead consists of a possible enclosure, trackway and pitting recorded through geophysical survey. The remains possess archaeological and historical interest for the knowledge they provide regarding settlement and agricultural land use. The heritage value of these assets is deemed to be medium. Given the limited width of the Scheme, it is unlikely to result in total loss of these assets. Therefore, the magnitude of impact would be low on an asset of medium value. The resulting significance of effect would be minor adverse. This is not considered to be significant in EIA terms.
- 7.11.59 Two rabbit warrens of medieval to post-medieval date were identified by geophysical survey at Brampton (MLI125069) and Torksey (MLI125070). It holds historic interest due to the contribution it makes to the understanding of the use of the historic landscape in the medieval and post-medieval periods. The heritage value of these assets is deemed to be low. Given the limited width of the Scheme, it is unlikely to result in total loss of the asset. Therefore, there would be a **low** magnitude of impact on an asset of **low** value. The resulting significance of effect would be **negligible**. This is not considered to be significant in EIA terms.
- 7.11.60 A scatter of late Anglo-Saxon and medieval pottery was identified at Brampton (MLI125073). The site has limited archaeological significance for the information it contains relating to past activity. The heritage value of this asset is considered to be very low as the remains have been removed. Given the limited width of the Scheme, it is unlikely to result in total loss of the scatter and any related buried archaeological remains associated. Therefore, there would be a very low magnitude of impact on this asset of very low value. The



- resulting significance of effect would be **negligible**. This is not considered to be significant.
- 7.11.61 An unstratified scatter of 70 sherds of post-medieval pottery was recorded at Brampton (MLI118779). The site has limited archaeological significance for the information it contains relating to past activity. The heritage value of this asset is deemed to be very low as the remains have been removed. Given the limited width of the Scheme, it is unlikely to result in total loss of this asset and any buried associated archaeological remains. The magnitude of impact would be very low. On an asset of very low value, the resulting significance of effect would be negligible. This is not considered to be significant in EIA terms.
- 7.11.62 A possible rabbit warren is recorded in the place-name of Bunkers Hill Warren, Brampton (MLI53786). It holds historic interest due to the contribution it makes to the understanding of the use of the historic landscape in the medieval and post-medieval periods. The heritage value of this asset is deemed to be very low. If the warren is indeed present, then the limited width of the Scheme is unlikely to result in its total loss. Therefore, the magnitude of effect would be very low on an asset of very low value. The resulting significance of effect would be negligible. This is not considered to be significant in EIA terms.
- 7.11.63 Pottery Farm, Brampton is a demolished 19th century farmstead and the site of pottery production works of the same date. Its heritage value is drawn from its architectural and historic interest as a 19th century farmhouse. As it has been demolished, only limited sub-surface remains may survive, and consequently its value of is considered to be very low. Given the limited width of the Scheme and the fact the building has been demolished, the magnitude of impact would be no more than **very low**. The resulting significance of effect on an asset of **very low** value would be **negligible**. This is not considered to be significant in EIA terms.

Operation (2027 to 2087)

- 7.11.1 Impacts during the operation of the Scheme include those associated with the ongoing operation of the development. This potentially includes impacts from security lighting, operational noise; associated traffic and glint and glare. The effect of the Scheme within an asset's setting, identified during the construction phase, will remain in place throughout the lifespan of the Scheme. No additional, or increase of, significant effects are considered likely through the operational phase. Confirmation of this will be made in the ES once details of the scheme design and confirmed embedded mitigation are available.
- 7.11.2 It is not expected that the operation of the Scheme will result in any further intrusive activities and as such no impact to the archaeological resource is anticipated during this phase.

Decommissioning (2087 to 2089)

7.11.3 Likely decommissioning activities are described in **Chapter 2: The Scheme**.



- 7.11.4 Following the decommissioning of the Scheme, it is considered that the Scheme, including the solar panels and associated infrastructure will be removed in accordance with the relevant statutory process at that time. It is expected that the selected method of decommissioning would have due regard to health and safety, environmental impact and benefits, and economic aspects which will be set out in a Decommissioning Environmental Management Plan, which will be secured through a DCO Requirement. Any future maintenance, decommissioning and / or reinstatement works would be subject to prevailing legislation, guidance and permitting regimes. Landscape restoration and remediation to suitable surfaces would be undertaken. This will result in the restoration of the rural landscape. A well-designed decommissioning scheme would not have any impact beyond the alreadydisturbed footprint of the Scheme and will take into account areas of archaeological deposits that have been preserved in situ; therefore, it is not anticipated that decommissioning activities would have a direct physical impact upon archaeological remains.
- 7.11.5 There would be temporary impacts to the setting of designated assets in the study area during decommissioning, resulting from the use of machinery to dismantle the Scheme. Decommissioning is likely to affect the setting of those heritage assets described for the construction phase above. However, impacts would be no greater than those assessed during construction. Impacts arising from decommissioning activities would be temporary and the duration would be shorter than the impacts during construction. The impacts therefore would not be greater than those reported during construction. It is also anticipated that the effects on the setting of heritage assets as a result of the additional of the solar PV panels and supporting infrastructure to the landscape would be limited to the lifespan of the proposed Scheme. When removed during the decommissioning phase the impact will be reversed and the significance of effect significantly lowered or removed completely.

Summary of Effects

7.11.6 A summary of significant effects is provided in Table 7-5. Please see **PEI Report Volume 3: Appendix 7-C** for a summary of non-significant effects.

Table 7-5 Summary of Significant Effects

Receptor	Sensitivity (Value)	Description of Impact	Magnitude of Impact	Effect Category
Heynings Priory Scheduled Monument (1008685)	High	Change to setting through introduction of panels and infrastructure in the fields surrounding the asset	Medium	Major adverse
Gate Burton non-designated parkland (MLI98360)	Medium	Change to setting through introduction of panels and infrastructure in	Medium	Moderate adverse



Receptor	Sensitivity (Value)	Description of Impact	Magnitude of Impact	Effect Category
		the fields surrounding the asset. Severance of historic connection with Burton Wood		
Cropmarks of possible prehistoric date (MLI54017, MLI90939 and MLI54018)	Medium	Potential for complete loss	Medium	Moderate adverse
Medieval settlement of Gate Burton	Medium	Potential of loss of a section of the asset.	Medium	Moderate adverse
Area of cropmark (MNT4983)	Medium	Potential of loss of a section of the asset.	Medium	Moderate adverse
Earthwork mound (MLI52497)	Medium	Potential for complete loss	Medium	Moderate adverse
Viking Winter Camp (MLI125067)	High	Potential of loss of a section of the asset.	Low	Moderate adverse

7.12 Enhancement Measures

- 7.12.1 Aspirational enhancement measures, which would have an additional beneficial outcome will be put in place as part of the decommissioning strategy. For cultural heritage this would include the retention of field boundaries, planted during the construction phase, as they would enhance and reinstate elements of the historic landscape character.
- 7.12.2 These enhancement measures are not factored into determination of residual significant effects. However, the potential additional benefits can still be identified.

7.13 Residual Effects and Conclusions

- 7.13.1 This section summarises the residual significant effects of the Scheme on cultural heritage following the implementation of embedded and additional mitigation.
- 7.13.2 Significant residual effects are defined as moderate or major. These are listed in Table 7-6 (construction and decommissioning).



Table 7-6 Summary of Significant Residual Effects (Construction)

Receptor	Sensitivity (value)	Description of impact	Embedded and additional mitigation measure	Magnitude of Impact after Mitigation	Residual effect after mitigation
Heynings Priory Scheduled Monument (1008685)	High	Change to setting through introduction of panels and infrastructure in the fields surrounding the asset	Panel free buffer area around the asset	Medium	Major adverse
Gate Burton non-designated parkland (MLI98360)	Medium	Change to setting through introduction of panels and infrastructure in the fields surrounding the asset.	Screening planting where appropriate Panel free buffer area to the east of the parkland, and the retention of a connection between the parkland and Burton Wood	Medium	Moderate adverse
Cropmarks of possible prehistoric date (MLI54017, MLI90939 and MLI54018)	Medium	Potential for complete loss	Design and construction options to limit any physical effect. Appropriate archaeological mitigation will be used where required	Medium	Moderate adverse
Medieval settlement of Gate Burton (MLI50512)	Medium	Potential for loss of a section of the asset.	Design and construction options to limit any physical effect. Appropriate archaeological mitigation will be used where required.	Medium	Moderate adverse
Area of cropmark (MNT4983)	Medium	Potential for loss of a section of the asset.	Design and construction options to limit any physical effect. Appropriate archaeological mitigation will be used where required.	ect. Appropriate mitigation will be used	
Earthwork mound (MLI52497)	Medium	Potential for complete loss	Design and construction options to limit any physical effect. Appropriate archaeological mitigation will be used where required.	Medium	Moderate adverse



Torksey Viking High Potential for loss of part of Camp (MLI125067)

High Potential for loss of part of the asset.

Design and construction options to limit Low Moderate adverse any physical effect. Appropriate archaeological mitigation will be used where required. Design and construction options to limit any physical effect. Appropriate archaeological mitigation will be used where required.

Table 7-7 Summary of Significant Residual Effects (Operational)

Receptor	Sensitivity (value)	Description of impact	Embedded and additional measure	Magnitude of Impact after Mitigation	Residual effect after mitigation
Heynings Priory Scheduled Monument (1008685)	High	Change to setting through introduction of panels and infrastructure in the fields surrounding the asset	Panel free buffer area around the asset	Medium	Major adverse
Gate Burton non-designated parkland (MLI98360)	Medium	Change to setting through introduction of panels and infrastructure in the fields surrounding the asset.	Screening planting where appropriate Panel free buffer area to the east of the parkland, and the retention of a connection between the parkland and Burton Wood	Medium	Moderate adverse



7.14 Cumulative Assessment

- 7.14.1 The cumulative schemes are currently being agreed in consultation with Lincolnshire and Nottinghamshire County Council, and as such the cumulative effects will be reviewed following statutory consultation and fully addressed in the ES.
- 7.14.2 At this stage of the PEI Report, developments that may give rise to cumulative cultural heritage effects with the Scheme have not yet been fully assessed. A list of relevant developments is presented in Chapter 16: Cumulative Effects and Interactions. The cumulative assessment methodology is presented within Chapter 5: EIA Methodology. Cumulative heritage effects will be assessed in the ES.
- 7.14.3 It is therefore not possible to definitely state the significance of cumulative impacts. However, based on an initial review of the list and their nature and distance from the DCO Site, it is not expected that cumulative schemes would elevate any of the residual effects identified in this assessment. At worst, the cumulative effect is expected to be moderate adverse, for example if any construction phases of any cumulative schemes overlap with the Scheme or if they include setting effects within 500m of the Solar and Energy Storage Park .This will be reviewed as part of the ES.



7.15 References

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8. Ecology and Nature Conservation

8.1 Introduction

8.1.1 This chapter of the Preliminary Environmental Information (PEI) Report provides presents the findings of an assessment of the likely significant effects on ecology and nature conservation (collectively referred to as biodiversity within this chapter) as a result of the Scheme. For more details about the Scheme, refer to **Chapter 2: The Scheme**.

8.1.2 This chapter:

- Identifies and proposes measures to address the potential impacts and likely significant effects of the Scheme on biodiversity, during the construction, operation and decommissioning phases;
- Provides a preliminary evaluation of relevant important ecological receptors (including nature conservation designations, priority habitats, protected species and invasive non-native species (INNS) associated with the Scheme, with each being assigned a nature conservation value (sensitivity value);
- Identifies the Scheme's potential direct and indirect impacts and effects on ecological receptors and their conservation status, inter-relationships, and their contribution to local (and if appropriate county, regional and national) biodiversity;
- Takes into account impact avoidance design measures and management activities when determining the significance of potential effects; and
- Describes the requirement for any further mitigation measures which are then described and mitigation and monitoring measures are also considered in the assessment of potential residual effects.
- 8.1.3 The assessment within this chapter reports on the biodiversity baseline and Scheme design information available at the time of writing this chapter (April 2022). A final assessment of the potential impacts of the Scheme on biodiversity, including any updates to the baseline, will be undertaken as part of the Environmental Impact Assessment (EIA) and will be reported in the Environmental Statement (ES) that will be submitted with the Development Consent Order (DCO) Application.
- 8.1.4 This chapter is supported by the following technical appendices (**PEI Report Volume 3**):
 - Appendix 8-A: Relevant Legislation and Policy;
 - Appendix 8-B: Preliminary Ecological Appraisal Report;
 - Appendix 8-C: Wintering Bird Survey Report;
 - Appendix 8-D: Badger Survey Methods; and
 - Appendix 8-E: Habitat Regulations Assessment (HRA).
- 8.1.5 Full details of the study areas, survey methods, survey dates and guidance used for each survey are available in the reports as detailed above and



- included as technical appendices in **PEI Report Volume 3: Appendices 8-B** to **8-D**. A summary of survey findings is provided further on in this chapter.
- 8.1.6 Effects on ecological resources from infrastructure projects can arise from direct and indirect impacts upon designated sites, habitats or species, and be of a temporary or permanent nature. Indirect effects can occur through pollution of air and water and via changes in lighting, noise or hydrology. This biodiversity chapter is therefore supported by information contained within the following chapters:
 - Chapter 6: Climate Change;
 - Chapter 9: Water Environment (including hydrology and water pollution);
 - Chapter 10: Landscape and Visual Amenity (including lighting);
 - Chapter 11: Noise and Vibration; and
 - Chapter 15: Other Environmental Topics (including changes in air quality).
- 8.1.7 This chapter is supported by the following figures in **PEI Report Volume 2:**
 - Figure 8-1: Sites statutorily designated for nature conservation value;
 - Figure 8-2: Non-statutory sites designated for nature conservation; and
 - Figure 8-3: Phase 1 Habitat Map.
- 8.1.8 This chapter should also be read in conjunction with **Chapters 1** to **5** of this PEI Report as these chapters provide introduction to the Scheme, its evolution, consultation and the EIA methods.
- 8.1.9 As part of the Environmental Statement that will be submitted with the DCO application, a Framework Construction Environmental Management Plan (CEMP)) and Framework Operational Environmental Management Plan (OEMP) will be prepared, to describe management of environmental effects of the Scheme and to demonstrate compliance with environmental legislation.

8.2 Consultation

- 8.2.1 A request for an EIA Scoping Opinion was sought from the Secretary of State through the Planning Inspectorate in 2021 as part of the EIA Scoping Process. Relevant stakeholders (such as statutory consultees) were also consulted as part of this process and are detailed in **Chapter 4: Consultation**.
- 8.2.2 In addition to the statutory consultation process, there will be ongoing engagement with other consultees to steer the development of the Scheme. This section will be updated based on further consultation on the Scheme and matters raised by stakeholders will be considered and addressed and any main matters raised will be addressed within the final DCO submission.
- 8.2.3 Consultation responses in relation to biodiversity, to date, are presented in **PEI Report Volume 3: Appendix 1-C**.

8.3 Legislation and Planning Policy

8.3.1 A summary of applicable legislation, planning policy and other guidance documents relating to protected nature conservation sites, significant habitats



- and protected and, or notable species and invasive non-native species pertinent to the Scheme is provided below.
- 8.3.2 Full details of the legislation, policy, and guidance of relevance to the assessment of significant biodiversity effects of the Scheme is provided in full in **PEI Report Volume 3: Appendix 8-A**.

Legislation

- 8.3.3 Applicable legislation to inform the biodiversity assessment includes:
 - Directive 2009/147/EC on the conservation of wild birds (Birds Directive) (Ref 8-1);
 - Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) (Ref 8-2);
 - Regulation (EU) 1143/2014 on the prevention and management of the introduction and spread of invasive alien species (IAS) (Ref 8-3);
 - Wildlife and Countryside Act (WCA) 1981(Ref 8-4);
 - Countryside and Rights of Way Act 2000 (Ref 8-5):
 - Conservation of Habitats and Species Regulations 2017 (as amended) (Ref 8-6);
 - Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (Ref 8-7);
 - The Environment Act 2021 (Ref 8-8);
 - Natural Environment and Rural Communities (NERC) Act 2006 (Ref 8-9);
 - Protection of Badgers Act 1992 (Ref 8-10):
 - Hedgerows Regulations 1997 (Ref 8-11);
 - Animal Welfare Act 2006 (Ref 8-12);
 - Salmon and Freshwater Fisheries Act 1975 (Ref 8-13);
 - Eels (England and Wales) Regulations 2009 (Ref 8-14);
 - Invasive Alien Species (Enforcement and Permitting) Order 2019 (Ref 8-15); and
 - Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (Ref 8-16).
- 8.3.4 European Union (EU) legislation as it applied to the UK on 31st December 2020 is now a part of UK domestic legislation as 'retained EU legislation'. Changes have been made to parts of the Habitats Regulations 2017 (Ref 8-6) so that they effectively continue the legislation which implemented the EU Habitats and Species Directive (Ref 8-2) and parts of the Wild Birds Directive (Ref 8-1) through the provisions of the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (Ref 8-7). Most of these changes involve transferring functions from the European Commission to the appropriate authorities in England. All other processes or terms of the 2017 Regulations (Ref 8-6) remain substantively unchanged and the network of protected European sites in the UK is now referred to as the "national site network" (previously the "Natura 2000 network").
- 8.3.5 As part of the assessment of a development, it is necessary to determine whether the Scheme is likely to have a significant effect on areas that have been internationally designated for nature conservation purposes (*i.e.*



European sites). European sites are protected under the Conservation of Habitats and Species Regulations 2017 (as amended; relevant to England and Wales) (Ref 8-6). The UK left the EU on 31 January 2020 under the terms set out in the European Union (Withdrawal Agreement) Act 2020 ("the Withdrawal Act"). However, the most recent amendments to the Habitats Regulations the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (Ref 8-7) - make it clear that the need for Habitats Regulations Assessment (HRA) continues to apply. Likely significant effects have been considered further, with relation to international sites in PEI Report Volume 3: Appendix 8-E. Whilst the HRA decisions must be taken by the competent authority (the Secretary of State, informed by the recommendations of the appointed Examining Authority), the information needed to undertake the necessary assessments must be provided by the Applicant. The information needed for the competent authority to establish whether there are any Likely Significant Effects (LSEs) from the Scheme and to assist in carrying out its Appropriate Assessment, is provided in PEI Report Volume 3: Appendix 8-

National Planning Policy

- 8.3.6 This chapter takes into account relevant National Policy Statements (NPS) for solar, including relevant sections of the draft updated versions of these NPSs. The following NPSs are considered important and relevant to the Scheme and biodiversity:
 - Overarching National Policy Statement for Energy (EN-1) (2011) (Ref 8-18);
 - Draft Overarching National Policy Statement for Energy (EN-1) (2021) (Ref 8-19):
 - Draft National Policy Statement for Renewable Energy EN-3 (2021) (Ref 8-20);
 - National Policy Statement for Electricity Networks Infrastructure (EN-5) (2011) (Ref 8-21); and
 - Draft National Policy Statement for Renewable Energy EN-5 (2021) (Ref 8-22).
- 8.3.7 The National Planning Policy Framework (NPPF) (Ref 8-23), with particular reference to Section 15 and paragraphs 174, 180 and 181, which state that the planning system should contribute to and enhance the natural and local environment by minimising impacts on biodiversity and providing net gains in biodiversity. The NPPF (Ref 8-23) is clear that pursuing sustainable development includes moving from a net loss of biodiversity to achieving net gains for nature, and that a core principle for planning is that it should contribute to conserving and enhancing the natural environment and reducing pollution. The NPPF also specifies the obligations that the Local Authorities and the UK Government have regarding statutory designated sites and protected species under UK and international legislation and how this is to be delivered in the planning system. Protected or notable habitats and species can be a material consideration in planning decisions and may therefore make some sites unsuitable for particular types of development, or if development is permitted, mitigation measures may be required to avoid or minimise



- impacts on certain habitats and species, or where impact is unavoidable, compensation may be required.
- 8.3.8 Planning Practice Guidance (Ref 8-24) was also reviewed for further guidance and interpretation on the NPPF.

Local Planning Policy

- 8.3.9 Local planning policies that are relevant to the Scheme and biodiversity are:
 - Central Lincolnshire Local Plan 2012-2036, adopted 24 April 2017, specifically Policies LP20: Green Infrastructure Network and Policy LP21: Biodiversity and Geodiversity (Ref 8-25); and
 - Bassetlaw District Council Core Strategy and Development Management Policies DPD, adopted 22 December 2011, specifically Policy DM9: Green Infrastructure, Biodiversity & Geodiversity, Landscape; Open Space & Sports Facilities (Ref 8-26).

Other Guidance

- 8.3.10 Other guidance documents relevant to the assessment of the impacts of the Scheme on biodiversity include:
 - Biodiversity 2020: A strategy for England's Wildlife and Ecosystem Services with regards to marine habitats, ecosystems, and fisheries (Ref 8-27);
 - 25-year Environment Plan (Ref 8-28);
 - UK Post 2010 Biodiversity Framework (Ref 8-29);
 - Biodiversity Guidance for Solar Developments (Ref 8-30);
 - Mitigating biodiversity impacts associated with solar and wind energy development: Guidelines for project developers (Ref 8-31); and
 - Natural England and Department for Environment, Food and Rural Affairs (DEFRA) Standing Advice (protected species) (Ref 8-32).

8.4 Assessment Assumptions and Limitations

- 8.4.1 The assessment presented in this chapter reflects that obtained and evaluated at the time of reporting, and has referenced published data, records and webbased information obtained to date.
- 8.4.2 The assessment of all the phases (construction, operation and decommissioning) of the Scheme is based upon the preliminary design for the Scheme (refer to **Chapter 2: The Scheme**).
- 8.4.3 As noted in **Chapter 2: The Scheme**, the construction period is expected to be 24 to 36 months. This is a realistic worst-case assumption for this assessment, as it represents the expected maximum build time. The impact on flora is not affected by the duration of activity but rather the change or loss of any habitats. The impact on fauna is likely to be the same or less than has been assumed if the construction period is extended.



- 8.4.4 Habitat and species information referenced in the assessment has been collected from site surveys undertaken on land within and around the DCO Site between August 2021 and April 2022, where permission to access the land was obtained from landowners. Where any survey data are currently incomplete or limited, and further work is required to inform the assessment, this is presented within Table 8-1, which contains a summary of work that will be completed for the ES.
- 8.4.5 Since the scoping process, the design of the Scheme has evolved. The current site layout, the DCO Site (see **Chapter 2: The Scheme**) was fixed in March 2022 for the purposes of statutory consultation in summer 2022 and therefore where surveys are not yet complete (e.g. within the Cable Corridor Route), these will continue in 2022 and within appropriate seasonal windows for the purposes of the Environmental Statement that will accompany the DCO.
- 8.4.6 Existing and forthcoming surveys will be used to inform the Biodiversity Net Gain (BNG) report, which will be prepared with the ES and submitted as part of the DCO application. However, this report is not available at this stage as the design for the Scheme continues to evolve. The BNG assessment will be undertaken using Defra's Metric 3.1 and a summary of BNG will be presented within the ES chapter as part of the DCO submission.
- 8.4.7 Existing and forthcoming biodiversity surveys will inform the development of a Landscape and Biodiversity Management Plan (LBMP). The LBMP will include a description of the Scheme, along with targeted landscape and biodiversity mitigation that will be incorporated into the Scheme design. This will be an ongoing iterative process, with environmental specialists actively involved in its development, using the mitigation hierarchy to avoid impacts, incorporating mitigation for those that cannot be avoided and incorporating opportunities for enhancement at the earliest possible stage.

8.5 Study Area

- 8.5.1 The DCO Site, referred to within this chapter, includes the Solar and Energy Storage Park Site and the Grid Connection Route (as defined in **Chapter 2: The Scheme**). Where ecological receptors are identified relevant to a Scheme area (such as the Solar and Energy Storage Park Site only), then this is referred to throughout.
- 8.5.2 The study area was defined to include biodiversity features likely to be at risk from possible direct and indirect impacts that might arise from the Scheme, termed the Zone of Influence (ZoI). The Chartered Institute of Ecology and Environmental Management (CIEEM) (Ref 8-33) define the ZoI as: "...the area over which biodiversity features may be affected by biophysical changes as a result of the proposed project and associated activities".
- 8.5.3 The study area captured all designated sites, sensitive habitats and species of importance that occur within the relevant ecological Zol of the Scheme. This then enabled the identification of specific areas which required ecological survey (Survey Areas) (see Table 8-1). The boundaries and zones for the ecology study area reflect standard industry good practice and were informed



- by published guidance and professional judgement. The study areas defined are the maximum distances that statutory consultees would typically expect to be considered and these study areas were presented within the Scoping Report (Ref 8-34) and acknowledged by consultees, to be appropriate.
- 8.5.4 The extent of the ZoI varies according to the ecological receptor in question and with regards to the precautionary principle. Accordingly, the study areas used in this assessment ensure sufficient data were gathered to meet any design iterations which may change the likely ZoI used to undertake the impact assessment.
- 8.5.5 Accordingly, the desk study areas included:
 - Sites of international nature conservation value (Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar sites) within 10km of the DCO Site as well as any SACs within 30km of the DCO Site where bats are noted as the, or one of the, qualifying features;
 - Statutorily designated sites of national nature conservation value, e.g. Sites of Special Scientific Interest (SSSIs) and Local Nature Reserves (LNRs) within 2km of the DCO Site;
 - Non-statutorily designated sites of nature conservation value, e.g. Local Wildlife Sites (LWSs), within 2km of the DCO Site;
 - Ancient Woodland, veteran trees and other notable habitats within 2km of the DCO Site: and
 - Records of protected or notable species and scheduled invasive nonnative species within 2km of the DCO Site.
- 8.5.6 The desk study enabled determination of an appropriate study area, within which all ecological receptors requiring assessment were subject to field survey (see Table 8-1). Habitat and species surveys were confined to within the DCO Site and its immediate vicinity and were extended to outside of the DCO Site as appropriate (such as identifying ponds up to 500m from the DCO Site for Great Crested Newt *Triturus cristatus*) (see Table 8-1).
- 8.5.7 In defining individual study areas, consideration was given to the geographic location, nature and scale of the Scheme (refer to **Chapter 2: The Scheme**).

8.6 Assessment Method

Establishment of the Baseline Conditions

8.6.1 Establishment of the baseline environment, within the ZoI, involved reference to existing data sources, consultation with statutory bodies and other organisations, and field surveys.

Sources of Information - Desk Study

8.6.2 A desk study was undertaken to identify sites designated for their biodiversity value and records of protected and, or notable habitats and species (biodiversity features) and invasive non-native species that are relevant to the Scheme.



- 8.6.3 The desk study will also identify Water Framework Directive (WFD) water body status in order to identify water bodies that are likely to be impacted. However, as water pollution may propagate downstream or there could be downstream flood risk effects, it is also necessary to consider a wider study area along watercourses to identify all the relevant attributes that may be impacted and that contribute to the water bodies overall importance. Consideration thus will also be given to any surface water or groundwater bodies or water dependent ecological sites outside of the study area and up to 2km from the DCO Site boundary, if it is considered that they might be hydrologically linked.
- 8.6.4 The study area used for the desk study is defined in Section 8.5.5 of this chapter.
- 8.6.5 Lincolnshire Environmental Records Centre (LERC) and Nottinghamshire Biological and Geological Records Centre (NBGRC) were contacted in October 2021 to gain information on pre-existing ecological information (*i.e.*: location and citations of Local Wildlife Sites (LWSs), records of protected, notable and invasive non-native species within 2km of the DCO Site).
- 8.6.6 A review of ecology reports for surveys undertaken for the Scheme (surveys of bat activity (Ref 8-35) and surveys of breeding birds (Ref 8-36)) was also undertaken to identify previous baseline conditions within the DCO Site and identify which surveys either require updating or completing to inform the current baseline.
- 8.6.7 Online data resources that were reviewed included:
 - Multi-Agency Geographic Information Centre (MAGIC) (Ref 8-37), to identify the location (and details) of statutorily designated sites, ancient woodland, notable habitats and for any granted European Protected Species Licence applications within 2km of the DCO Site;
 - Joint Nature Conservation Committee (JNCC) website (Ref 8-38), for site information and designation details of SACs, SPAs and Ramsar Sites identified within the relevant study areas (refer to Section 8.5.5);
 - National Biodiversity Network (NBN) Gateway (Ref 8-39) for details on any protected and/or notable species recorded within 2km of the DCO Site; and
 - Environment Agency (EA) Ecology and Fish Data for species records of fish, macroinvertebrate and macrophytes (Ref 8-40).
- 8.6.8 Protected and notable habitats and species include those listed under Schedules 1, 5 and 8 of the Wildlife and Countryside Act 1981 (as amended) (Ref 8-4); Schedules 2, 4 and 5 of the Habitat Regulations (Ref 8-2); and species and habitats of principal importance (SPI or HaPI) for nature conservation in England listed pursuant to Section 41 of the NERC Act (Ref 8-9). Other habitats and species are also considered and have been assessed on a case-by-case basis, e.g. those included in national, regional or local Red Data Books and Lists but not protected by legislation. This is consistent with the requirements of relevant planning policy.
- 8.6.9 Records of invasive non-native species, as listed under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) (Ref 8-4) and the Invasive Alien Species (Enforcement and Permitting) Order 2019 (Ref 8-15) have been



taken into account when assessing the potential ecological effects of the Scheme.

Field Surveys

- 8.6.10 The requirement for ecological field surveys was determined following the Preliminary Ecological Appraisal (PEA) (included as **PEI Report Volume 3: Appendix 8-B**).
- 8.6.11 The PEA consisted of three components: the desktop study data review; a Phase 1 Habitat survey; and a scoping survey for protected species and other species of conservation concern.
- 8.6.12 The Phase 1 Habitat survey followed the standard JNCC method 'Handbook for Phase 1 habitat survey: A technique for environmental audit' (Ref 8-40). In summary, this comprised walking over the habitat within the DCO Site and recording the habitat types and boundary features present.
- 8.6.13 A protected species scoping survey was carried out in conjunction with the Phase 1 Habitat survey. This survey, in combination with the desk study, led to the recommendation of detailed field surveys for certain protected or notable habitats and species, as presented in **PEI Report Volume 3: Appendix 8-B**.
- 8.6.14 Field surveys are ongoing, having commenced in October 2021 and continuing throughout 2022, to characterise the ecological baseline within the relevant study areas (termed Survey Areas hereafter where referring to areas within which ecological surveys were undertaken) as presented in Table 8-1. Further details regarding the definition of these Survey Areas and any limitations are presented in the associated survey reports within **PEI Report Volume 3: Appendices 8-B** to **8-D**.
- 8.6.15 Formal surveys for Hedgehog *Erinaceus europaeus* and Brown Hare *Lepus europaeus* were not and will not be undertaken as part of the assessment as observations of both species will be recorded through the desk study and other ecological surveys of the DCO Site. Both species are assumed to be present within the DCO Site and consideration for any mitigation required for either species is included further in this chapter and will also be included in the ES chapter, submitted as part of the DCO application.
- 8.6.16 Where surveys have been completed and data available to inform the characterisation of the baseline in this chapter, this is identified in Table 8-1. The remaining surveys are still in progress or are planned during 2022 with data gathered used to inform the assessment presented in the ES.
- 8.6.17 Table 8-1 presents details of the coverage, methods and survey periods (either undertaken where completed, or proposed) within the relevant Survey Areas
- 8.6.18 Full details of the Survey Areas, survey methods, survey dates and guidance used for each survey undertaken as of April 2022 are available in the reports as detailed above (and included as technical appendices (PEI Report Volume 3: Appendices 8-B to 8-D)). A summary of survey findings is provided further in this chapter.



- 8.6.19 The survey report for Badgers is not included in full with this PEI Report, owing to the sensitivities of detailing information on the location of Badger setts. Therefore, the results, evaluation and conclusions section of **PEI Report Volume 3: Appendix 8-D** will be provided confidentially to key stakeholders.
- 8.6.20 Field surveys that will be undertaken throughout 2022, together with details of the survey areas, methods, survey periods and guidance that will be used for each survey are presented in Table 8-1. Full details of these surveys will be included with the ecology chapter of the ES and included with the final DCO submission.



Table 8-1 Ecological surveys to characterise baseline conditions.

Survey (and relevant technical appendix)	Survey Area	Survey Method	Survey Period	Justification for the Survey Areas	Information Available for Inclusion in this PEI Report Chapter
Terrestrial Invertebrate scoping survey	The survey area will be the Solar and Energy Storage Park Site and the scoping survey will identify habitats suitable to support notable terrestrial invertebrates. Areas subject to any further detailed surveys, if required, will be those which have the potential to be affected by the Scheme.	Desk-based study using satellite imagery and the Phase 1 Habitat map, followed by a walkover survey by a specialist entomologist.	May to September 2022	Habitat within the Solar and Energy Storage Park Site is an appropriate Survey Area, acknowledging that habitats that have the potential to be permanently impacted (i.e. lost) by the Scheme and potentially supporting notable terrestrial invertebrates or assemblages are within this area. The surveys will identify any areas likely to be important for terrestrial invertebrates and inform avoidance, mitigation and enhancement.	No
Phase 1 Habitat (PEI Report Volume 3: Appendix 8-B)	The DCO Site and to a maximum of 50m from the DCO Site, where viewable or access is permitted.	3	Commenced in August and September 2021 with subsequent surveys as a result of changes to the DCO Site undertaken in April 2022, which informed the requirement for further detailed botanical surveys, where necessary.	50m is an appropriate Survey Area, acknowledging that habitats that are likely to be impacted by the Scheme are within the DCO Site.	Yes, but walkover survey required for the Grid Connection Route to validate habitats.



Survey (and relevant technical appendix)	Survey Area	Survey Method	Survey Period	Justification for the Survey Areas	Information Available for Inclusion in this PEI Report Chapter
Terrestrial Habitats and Flora (including invasive non-native species)	The survey area will be the DCO Site and areas of terrestrial habitat to be surveyed in further detail are those with the potential to be affected by the Scheme and potential priority habitats, as identified from the initial Phase 1 Habitat survey and desk study information.	Surveys for arable flora will involve walking arable field boundaries to record notable species as listed in Great Britain (Ref 8-50)) and England (Ref 8-51)) Red Data Lists or rated as locally, regionally or nationally scarce in 'A vascular plant red list for England' (Ref 8-52). Grasslands (including setaside and verges) will be surveyed in more detail (i.e.: species lists with abundance ratings) for notable species and species composition to help inform mitigation, habitat compensation and enhancement proposals, with the rarity of higher plants given based on 'New Flora of the British Isles' (Ref 8-53).	Between June and September 2022	Habitat within the DCO Site is an appropriate Survey Area, acknowledging that habitats that are likely to be impacted by the Scheme are within the DCO Site.	No
Hedgerows	Hedgerows potentially affected by the Scheme within the DCO Site.	Selected hedgerows, where likely to be impacted, will be surveyed and assessed for their 'importance' against the Wildlife and Landscape	Between June and July 2022	The DCO Site is an appropriate Survey Area, acknowledging that the majority of hedgerows will be retained and, or avoided.	No



Survey (and relevant technical appendix)	Survey Area	Survey Method	Survey Period	Justification for the Survey Areas	Information Available for Inclusion in this PEI Report Chapter
		Criteria, detailed in the Hedgerow Regulations (Ref 8-11).			
Aquatic scoping survey	All water bodies identified within 250m of the DCO Site, where access allows.	Walking accessible and safe stretches of water body banks, noting physical habitat features such as riparian cover, channel substrate, habitat type, modifications and instream vegetation to assess the potential for waterbodies to support protected or notable species and inform further survey work.	Between May and June 2022	250m from the DCO Site is an appropriate Survey Area to determine any potential impacts arising from the Scheme both upstream and downstream, including connectivity with other water bodies for transient species (the desk study will assess a wider 1km area).	No
Aquatic macrophyte and macro-invertebrate surveys, including the presence of any invasive non-native species and River Habitat Surveys (if required pending response to consultation with Natural England).	Water bodies identified during the aquatic scoping survey and desk study for further survey within the DCO Site and up to 250m from the DCO Site where access allows.	Surveys of ponds will be based on the Predictive System for Multimetrics (PSYM) methods used for ponds (Ref 8-54). Survey method for streams and ditches will follow the aquatic macroinvertebrate sampling procedures standardised by the EA in 2017 (Ref 8-55).	Aquatic macrophytes and aquatic macroinvertebrates will be surveyed, as required, between May and September 2022	250m from the DCO Site is an appropriate Survey Area to determine any potential impacts arising from the Scheme both upstream and downstream (the desk study will assess a wider 1km area).	No



Survey (and relevant technical appendix)	Survey Area	Survey Method	Survey Period	Justification for the Survey Areas	Information Available for Inclusion in this PEI Report Chapter
Amphibians, including Great Crested Newt	Ponds within 500m of the DCO Site were identified during the desk study. Further surveys, such as Habitat Suitability Index (HSI) will be undertaken on all water bodies within 250m of the DCO Site and, where further survey is identified as being required, using eDNA methods, will be undertaken on all water bodies within 250m of the DCO Site that are most likely to support Great Crested Newt and potentially impacted upon by the Scheme.	HSI evaluates suitability of ponds for Great Crested Newt following the standard method (Ref 8-42). eDNA method will strictly adhere to the standard survey technique for eDNA (Ref 8-57).	HSI surveys commenced in April 2022 eDNA surveys will be undertaken between April and June 2022	Habitats within the DCO Site could constitute significant foraging areas, hibernation or resting sites for Great Crested Newts, which typically utilise terrestrial habitat up to 500m from their breeding ponds (Ref 8-43). However, 250m is an appropriate Survey Area from the DCO Site acknowledging that there is a notable decrease in abundance of Great Crested Newt beyond a distance of 250m from a breeding pond (Ref 8-72).	No. However, waterbody locations are provided in Figure 5 in PEI Report Volume 3: Appendix 8-B.
Reptiles	Suitable habitat for reptiles (such as grassland) within the Solar and Energy Storage Park Site.	Reptile surveys will involve recording reptile species presence, or absence, using artificial refugia in accordance with Froglife's Advice Sheet 10 (Ref 8-58) and Natural England's Standing Advice Sheet for Reptiles (Ref 8-59).	August to September 2022	The Survey Area will provide sufficient information on reptile presence or absence within the Solar and Energy Storage Park Site, acknowledging that habitats that have the potential to be permanently impacted (i.e. lost) by the Scheme and potentially supporting reptiles are within this area.	No



Survey (and relevant technical appendix)	Survey Area	Survey Method	Survey Period	Justification for the Survey Areas	Information Available for Inclusion in this PEI Report Chapter
Wintering (non-breeding) birds (including farmland birds) (PEI Report Volume 3: Appendix 8-C)	The DCO Site and to a maximum of 50m from the DCO Site.	Wintering bird surveys utilised transect-based walkovers following methods detailed in 'Bird Monitoring Methods' (Ref 8-44) and 'Bird Census Techniques' (Ref 8-45).	October 2021 to March 2022	Standardised survey buffers for assessing the impacts of development on bird populations do not exist, however, the Survey Area used provides information on the wintering (non-breeding) birds within the area immediately surrounding the DCO Site and includes areas contiguous with the DCO Site boundary, where birds may potentially be adversely affected and is sufficient to determine the likely impacts of the Scheme on the majority of wintering bird species occurring or likely to occur in the area.	Yes
Breeding birds (including farmland birds)	The DCO Site and to a maximum of 50m from the DCO Site for the general breeding bird assemblage. Appropriate Scheme buffer will be extended out from the DCO Site for species specific surveys, e.g.: Hobby Falco subbuteo and Barn Owl Tyto alba.	Surveys for breeding birds will be based on a standard territory mapping method for surveying breeding birds as detailed in 'Bird Monitoring Methods' (Ref 8-44) and 'Bird Census Techniques' (Ref 8-45); and will be adapted where necessary to include species-specific	April to September 2022	Standardised survey buffers for assessing the impacts of development on bird populations do not exist, however, the Survey Area will provide information on the breeding birds within the area immediately surrounding the DCO Site and includes areas contiguous with the DCO Site, where birds may potentially be adversely	No



Survey (and relevant technical appendix)	Survey Area	Survey Method	Survey Period	Justification for the Survey Areas	Information Available for Inclusion in this PEI Report Chapter
		methods for other species, as required. Species-specific methods for Barn Owl will also utilise 'Barn Owl Tyto alba Survey Methodology and Techniques for use in Ecological Assessment' (Ref 8-60), as appropriate.		affected. Depending on the sensitivity of the species, birds occurring outside of the survey area may also be adversely affected (such as those listed on Schedule 1 of the WCA) and therefore where any such species are recorded beyond the 50 m survey buffer (up to 200 m from the DCO Site), these will also be recorded. However, the 50 m survey buffer is sufficient to determine the likely impacts of the Scheme on the majority of breeding bird species occurring or likely to occur in the area.	
Bats	Bat activity -Solar and Energy Storage Park Site Bat roosts – DCO Site and to a maximum of 50m	Surveys for bat activity will be undertaken within the Solar and Energy Storage Park Site and will based on standard methods for bat activity transect surveys as described in the BCT guidelines (Ref 8-46). Following a PRA survey of trees and buildings within the DCO Site, any trees or buildings with potential to	year Activity surveys: May to September 2022 Roost characterisation surveys (if required): May to September 2022	The Survey Area will provide sufficient information on bat usage of the DCO Site and where impacts are predicted, assessing commuting and foraging habitat and nearby roosts and enabling determination of impacts on bat populations occurring within, or adjacent to, the DCO Site.	No



Survey (and relevant technical appendix)	Survey Area	Survey Method	Survey Period	Justification for the Survey Areas	Information Available for Inclusion in this PEI Report Chapter
		support roosting bats and only those that may be impacted upon by the Scheme, will be surveyed following standard method for bat emergence/ reentry surveys as described in the BCT guidelines (Ref 8-46).			
Riparian mammals (including invasive non- native species, such as Mink <i>Mustela vison</i>)	All waterbodies and watercourses within the DCO Site (and to a maximum of 100m from the DCO Site where access is permitted), identified during the desk study and Phase 1 Habitat survey as being potentially suitable for Water Vole Arvicola amphibius and Otter Lutra lutra.	Water Vole surveys will involve searching watercourses for signs of Water Vole activity as described in the 'Water Vole Conservation Handbook' (Ref 8-61) and 'The Water Vole Mitigation Handbook' (Ref 8-62). Otter surveys will involve searching watercourses for signs of Otter activity, following guidance in the 'New Rivers and Wildlife Handbook' (Ref 8-63); the 'Fifth Otter Survey of England 2009-2010' (Ref 8-64) and the 'Ecology of European Otter' (Ref 8-65).	Water Vole – between May and September 2022 Otter – between May and September 2022	Surveying riparian habitats up to 100m from the DCO Site is sufficient to determine presence or absence of riparian mammals within, or adjacent to, the DCO Site.	No



Survey (and relevant technical appendix)	Survey Area	Survey Method	Survey Period	Justification for the Survey Areas	Information Available for Inclusion in this PEI Report Chapter
Badger Meles meles (PEI Report Volume 3: Appendix 8-D)	The DCO Site and to a maximum of 50m from the DCO Site.	Surveys for Badger involved a walkover survey searching for signs of Badger activity as described in the Mammal Society publication 'Surveying Badgers' (Ref 8-47) and in the National Badger Survey method (Ref 8-48) withadditional reference to 'Surveying for Badgers: Good Practice Guidelines' (Ref 8-49).	December 2021, with any evidence of Badger also recorded during other ecological surveys between August 2021 and April 2022 (and ongoing).	50m is an appropriate Survey Area acknowledging that the majority of habitats of importance to Badger, such as woodland and hedgerows, will be retained.	Yes, but surveys ongoing within the Grid Connection Route.



Impact Assessment Method

- 8.6.21 The impact assessment, detailed in this chapter, has been undertaken in accordance with best practice guidance for Ecological Impact Assessment (EcIA), issued by the CIEEM (the CIEEM guidelines) entitled 'Guidelines for Ecological Impact Assessment in the UK and Ireland Terrestrial, Freshwater, Costal and Marine' (Ref 8-33) as summarised below. The aims of the ecological assessment are to:
 - Identify important ecological features (IEFs) (*i.e.* designated sites, habitats, species or ecosystems) which may be impacted by the Scheme;
 - Provide a scientifically rigorous and transparent assessment of the likely ecological impacts and resultant effects of the Scheme. Impacts and effects may be positive or negative;
 - Facilitate scientifically rigorous and transparent determination of the consequences of the Scheme in terms of national, regional and local policies relevant to nature conservation and biodiversity, where the level of detail provided is proportionate to the scale of the development and the complexity of its potential impacts; and
 - Set out what steps will be taken to adhere to legal requirements relating to the relevant ecological features concerned.
- 8.6.22 The principal steps involved in the CIEEM approach can be summarised as:
 - Ecological features that are both present and might be affected by the Scheme are identified (both those likely to be present at the time works begin and those predicted to be present at a set time in the future) through a combination of targeted desk-based study and field survey work to determine the relevant baseline conditions;
 - The importance of the identified ecological features is evaluated, placing their relative nature conservation importance into geographic context, which is then used to define the relevant biodiversity features that need to be considered further:
 - The changes or perturbations predicted to result as a consequence of the Scheme (i.e. the potential impacts) and which could potentially affect relevant ecological features are identified and their nature described. Established best-practice, legislative requirements or other incorporated design measures to minimise or avoid impacts are also described and are taken into account;
 - The likely effects (positive or negative) on relevant ecological features are then assessed, and where possible quantified;
 - Measures to avoid or reduce any predicted significant effects, if possible, are then developed in conjunction with other elements of the design (including mitigation for other environmental disciplines) and if necessary, measures to compensate for effects on features of nature conservation importance are also included;
 - Any residual effects of the Scheme are reported; and
 - Scope for ecological enhancement is considered.
- 8.6.23 It is not necessary in the assessment to address all habitats and species with potential to occur in the relevant study area and instead the focus is on those



that are "relevant" i.e. ecological features that are considered to be important and potentially affected by the Scheme. The CIEEM guidelines (Ref 8-33) makes clear that there is no need to "carry out detailed assessment of ecological features that are sufficiently widespread, unthreatened and resilient to project impacts and will remain viable and sustainable". This does not mean that efforts should not be made to safeguard wider biodiversity and requirements for this have been considered. National and local planning policy documents emphasise the need to achieve net gains for nature and that a core principle for planning is that it should contribute to conserving and enhancing the natural environment and reducing pollution. These considerations have been applied to the assessment method in this chapter.

Determining Importance

- 8.6.24 To support a focussed assessment, there is a need to determine the scale at which the relevant ecological features identified through the desk studies and field surveys undertaken for the Scheme are of value. The value of each relevant ecological feature has been defined with reference to the geographical level at which it matters.
- 8.6.25 Relevant planning policy and legislation (see **PEI Report Volume 3: Appendix 8-A**) were used to inform on designated sites, habitats and species of nature conservation importance within each geographical level. Such features provide the starting point for identification of IEFs to consider within the EcIA. This is important in demonstrating how the Scheme will comply with statutory requirements and policy objectives for biodiversity, in accordance with Section 4.3 of the CIEEM guidelines (Ref 8-33).
- 8.6.26 Species populations are valued on the basis of their size, recognised status (such as through published lists of species of conservation concern and designation of Biodiversity Action Plan (BAP) status) and legal protection. For example, bird populations exceeding 1% of published information on biogeographic populations are considered to be of international importance, those exceeding 1% of published data for national populations are considered to be of national importance, and so on.
- 8.6.27 In assigning values to species populations, it is important to take into account the status of the species in terms of any legal protection. However, it is also important to consider other factors such as its distribution, rarity, population trends and the size of the population which would be affected. For example, whilst the Great Crested Newt is protected as a European protected species under the relevant legislation and therefore conservation of the species is of significance at an international level, this does not mean that every population of Great Crested Newt is internationally important. It is important to consider the particular population in its context. Therefore, in assigning values to species, the geographic scale at which they are important has been considered. The assessments of value rely on the professional opinion and judgment of experienced ecologists.
- 8.6.28 Plant communities are assessed both in terms of their intrinsic value and as habitat for protected species whose habitat is also specifically protected and



for species of nature conservation concern which are particularly associated with them.

- 8.6.29 Due regard will also be paid to the legal protection afforded to species during the development of mitigation and compensation measures to be implemented for the Scheme. For European protected species there is a requirement that the Scheme should not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range.
- 8.6.30 For the purposes of the assessment within this chapter, only ecological features of at least Local importance are considered as IEFs that require assessment for potential significant effects.
- 8.6.31 Assessing the value of features requires consideration of both existing and future predicted baseline conditions. Therefore, the description and valuation of ecological features takes account of any likely changes, such as trends in the population size or distribution of species, likely changes to the extent of habitats and the effects of other proposed developments or land use changes; as explained in the 'Future Baseline' section of this chapter.
- 8.6.32 A summary of the sensitivity of ecological receptors and the geographical frames of reference used for this assessment, based on Section 4.7 in the CIEEM guidelines (Ref 8-33) is presented in Table 8-2.

Table 8-2 Summary of sensitivity of ecological receptors, according to geographic context

Sensitivity (Value)	Geographic Frame of Reference	Examples
Very High	International	Statutorily designated sites, such as Ramsar Sites, SACs (including candidate SACs), SPAs, normally within the geographic area of Europe Species occurring in numbers approaching that of international importance (<i>i.e.</i> , >1% of a biogeographic population) Qualifying species connected to an SAC (such as bats)
High	UK or National (Great Britain), but considering the potential for certain ecological features to be more notable (of higher value) in England, with context relative to Great Britain as a whole)	Statutorily designated site, such as a SSSI or NNR Species occurring in numbers approaching that of national importance (<i>i.e.</i> , >1% of the UK population) Priority habitats included on Annex I of the Habitats Directive (Ref 8-2) or S41 of the NERC Act 2006 (Ref 8-9)
Medium	County (Lincolnshire or Nottinghamshire) and, or, District (Bassetlaw and West Lindsey)	Non-statutorily designated sites, such as LWSs Species occurring in numbers approaching that of county or district importance (<i>i.e.</i> , >1% of the county or district (if known) population)
Low	Local	Species of conservation interest, <i>e.g.</i> : UK Biodiversity Action Plan (UKBAP) / Local Biodiversity Action Plan (LBAP) species that contribute to the local community.



Sensitivity (Value)	Geographic Frame of Reference	Examples
		Areas of habitat that do not meet criteria for selection as LWS in Lincolnshire or Nottinghamshire
		Areas of habitat or species that are considered to enrich local area
Negligible	Site	Species that are common and widespread and are not legally protected or included within local planning policy Areas of habitat that are widespread and of no local value (such as a fence-line or hard-standing)

8.6.33 A geographical area for Regional importance (the East Midlands) has not been defined. A feature is of Regional importance when it is of greater geographical importance than within the county of Lincolnshire or Nottinghamshire but does not reach the threshold to be of National importance.

Characterising Ecological Effects

- 8.6.34 In accordance with Section 1.21 in the CIEEM guidelines (Ref 8-33), the terminology used within the assessment draws a clear distinction between the terms 'impact' and 'effect'. For the purposes of this chapter these terms are defined as follows:
 - Impact actions resulting in changes to an ecological feature. For example, construction activities of a development removing a hedgerow; and
 - Effect outcome resulting from an impact acting upon the conservation status or structure and function of an ecological feature, *e.g.* the effects on a population of bats as a result of the loss of a bat roost.
- 8.6.35 When describing potential impacts (and where relevant the resultant effects) consideration is given to the following characteristics likely to influence this:
 - Positive or negative i.e. is the change likely to be in accordance with nature conservation objectives and policy and is that change:
 - Positive a change that improves the quality of the environment, or halts or slows an existing decline in quality e.g. increasing the extent of a habitat of conservation value; or
 - Negative a change that reduces the quality of the environment *e.g.* destruction of habitat.
 - Spatial extent the spatial or geographical area or distance over which the impact or effect may occur under a suitably representative range of conditions;
 - Magnitude the 'size', 'amount' or 'intensity' and 'volume' of an impact this is described on a quantitative basis where possible;
 - Duration the time over which an impact is expected to last prior to recovery or replacement of the resource or feature. Consideration has been given to how this duration relates to relevant ecological characteristics such as a species' lifecycle. However, it is not always appropriate to report the duration of impacts in these terms. The duration of an effect may be longer than the duration of an activity or impact;



- Timing and frequency *i.e.* consideration of the point at which the impact occurs in relation to critical life-stages or seasons; and
- Reversibility *i.e.* is the impact temporary or permanent. A temporary impact is one from which recovery is possible or for which effective mitigation is both possible and enforceable. A permanent effect is one from which recovery is either not possible or cannot be achieved within a reasonable timescale, *i.e.* the 60-year lifespan of the Scheme (in the context of the feature being assessed).
- 8.6.36 Combined, these characteristics form the magnitude criteria for effects of the Scheme on IEFs as summarised in Table 8-3.

Table 8-3 Magnitude Criteria for Effects

Magnitude	Magnitude criteria	
High	Changes to an ecological feature that almost always have an adverse effect on its integrity or conservation status. Such changes are usually long-term and often permanent and, or, irreversible	
Medium	Adverse changes on an ecological feature that, in some circumstances, may effect its integrity or conservation status. Although such changes may be long-term, they are potentially reversible	
Low Adverse changes on an ecological feature that do not usually change integrity or conservation status. Such changes are often short-term at reversible		
Very low	There is no noticeable change on the ecological feature	

Significance Criteria

- 8.6.37 For each ecological feature, only those characteristics relevant to understanding the ecological effect of the Scheme and determining the significance are described. The determination of the significance of effects has been made based on the predicted effect on the structure and function, or conservation status, of relevant ecological features, as follows:
 - Not significant no effect on structure and function, or conservation status;
 and
 - Significant structure and function, or conservation status is affected.
- 8.6.38 Sections 5.24 to 5.28 in the CIEEM guidelines (Ref 8-33) state that effects should be determined as being significant (a 'significant effect') when "an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general. Conservation objectives may be specific (e.g. for a designated site) or broad (e.g. national / local nature conservation policy) or more wide-ranging (enhancement of biodiversity). Effects can be considered significant at a wide range of scales from international to local. A significant effect is an effect that is sufficiently important to require assessment and reporting so that the decision maker is adequately informed of the environmental consequences of permitting a project. In broad terms, significant effects encompass impacts on structure and function of defined sites, habitats or ecosystems and the conservation status of habitats and species (including extent, abundance and distribution)".



- 8.6.39 Using this information and judgement, it is determined whether the effects will be 'significant' or 'not significant' on the structure and integrity of site or ecosystems or conservation status of habitats and, or species of each ecological feature and the impact significance is determined at the appropriate geographical scale, as presented in Table 8-2.
- 8.6.40 There are a number of approaches for determining the significance of effects on ecological features. Whilst the CIEEM guidelines (Ref 8-33) recommend the avoidance of the use of the matrix approach for categorisation (major, moderate and minor), in order to provide consistency of terminology within this chapter, the terminology used in the CIEEM guidelines for impact assessment have been translated into the classification of effects scale, as outlined in Table 8-4.

Table 8-4 Significance Criteria for Effects

Effect classification terminology	Equivalent CIEEM terminology
Major beneficial (positive)	1) Beneficial effect on structure / function or conservation status at a regional, national or international level; and 2) The extent, magnitude, frequency, and/or timing of an impact positively affects the integrity or key characteristics of the resource.
Moderate beneficial (positive)	1) Beneficial effect on structure/ function or conservation status at a county level; and 2) The extent, magnitude, frequency, and/or timing of an impact positively affects the integrity or key characteristics of the resource.
Minor beneficial (positive)	 Beneficial effect on structure / function or conservation status at a local level; and The extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource.
Negligible beneficial	No effect on structure / function or conservation status
Minor adverse (negative)	 Adverse effect on structure / function or conservation status at a local level; and The extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource.
Moderate adverse (negative)	 Adverse effect on structure / function or conservation status at a county level; and The extent, magnitude, frequency, and/or timing of an impact negatively affects the integrity or key characteristics of the resource.
Major adverse (negative)	1) Adverse effect on structure / function or conservation status at a regional, national or international level; and 2) The extent, magnitude, frequency, and/or timing of an impact negatively affects the integrity or key characteristics of the resource.



Biodiversity Net Gain

- 8.6.41 When the relevant provisions come into force, the Environment Act 2021 (Ref 8-8) will include a mandate for at least 10% biodiversity net gain for projects, including for Nationally Significant Infrastructure Projects (NSIPs).
- 8.6.42 BNG is a quantitative process applied to development and can be defined as "development that leaves biodiversity in a better state than before and involves an approach where developers work with local governments, wildlife groups, land owners and other stakeholders in order to support their priorities for nature conservation" (Ref 8-66).
- 8.6.43 The principle behind BNG is to ensure that any impacts on biodiversity, arising from any development, are taken into consideration and compensated with equivalent or additional gains.
- 8.6.44 For a development to achieve BNG, it is important that the principles of the mitigation hierarchy are followed.
- 8.6.45 There are four sequential steps that must be taken throughout the lifecycle of a project:
 - Avoidance actions taken to avoid causing impacts to the environment prior to beginning development (e.g. moving the development to a different location);
 - Minimisation measures taken to reduce the duration, intensity, extent and/ or likelihood of the unavoidable environmental impacts caused by development (e.g. adapting the development design to minimise impacts);
 - Restoration or rehabilitation actions taken to repair environmental degradation or damage following unavoidable impacts caused by development; and
 - Offsets measures taken to compensate for any adverse environmental impacts caused by development which cannot be avoided, minimised and/ or restored (e.g. including habitat creation to offset losses).
- 8.6.46 Biodiversity metrics provide a measure of overall biodiversity value based on habitat type, area, condition and distinctiveness. The current approved metric is Defra's Metric 3.1 and this metric is a tool that allows a value to be measured, in this case biodiversity, which is calculated pre- and post-development for three habitat components: Habitat, Rivers and streams and Hedgerows. The change in biodiversity units are calculated for each component and indicates either a net loss, a net gain or no change in biodiversity.
- 8.6.47 As detailed in Section 8.4.5 of this chapter, a BNG report will be prepared with the ES, submitted as part of the DCO application, but is not available at this stage as the design for the Scheme continues to evolve.

8.7 Baseline Conditions

8.7.1 This section describes the baseline environmental characteristics for the DCO Site and surrounding areas with specific reference to ecological features.



Existing Baseline

Sites statutorily designated for biodiversity importance

- 8.7.2 There are two statutory sites for nature conservation within the Zone of Influence (ZoI) set out in Section 8.5.5 of this chapter. These sites, of national importance, are designated for biodiversity reasons and are presented in Table 8-5. The locations of these statutory sites, relevant to the Scheme, are shown in **PEI Report Volume 2: Figure 8-1**. There are no statutory sites of international importance within the ZoI set out in Section 8.5.5 of this chapter.
- 8.7.3 Site designation details are summarised in Table 8-5 and are taken from citation documents published online by Joint Nature Conservation Committee (JNCC) for the individual sites. Statutory sites detailed in Table 8-5 are listed in ascending order, with those closest to the DCO Site listed first.
- 8.7.4 There are no international statutory site designations for bats within 30km of the DCO Site.

Table 8-5 Sites statutorily designated for biodiversity importance within 10km (international) and 2km (national) of the DCO Site

Statutory site name and designation	Area - hectares (ha)	Description	Distance (km) and direction from the DCO Site	Importance	
Ashton's Meadow Site of Special Scientific Interest (SSSI)	3.6	The reserve is an ancient meadow supporting a variety of flowers and grasses, including Cowslips <i>Primula veris</i> , Green-winged Orchid <i>Anacamptis morio</i> , Oxeye Daisy <i>Leucanthemum vulgare</i> and Yellow Rattle <i>Rhinanthus minor</i> . The grassland also offers a home for moths and ground-based species of butterfly like the Meadow Brown <i>Maniola jurtina</i> , Ringlet <i>Aphantopus hyperantus</i> and Gatekeeper <i>Pyronia tithonus</i> . The hedgerows around the site are another important habitat, supporting bird species such as Yellowhammer <i>Emberiza citrinella</i> .	1.5km to the west of the DCO Site	National	
Lea Marsh SSSI	27.24	Lea Marsh is an important area of unimproved floodplain meadow and wet pasture adjacent to the River Trent in north-west Lincolnshire. The site lies on seasonally inundated alluvial soils and includes an unusually large area of a nationally rare grassland type. Populations of two nationally scarce plants with a restricted distribution in the East Midlands are particularly notable, whilst breeding waders provide additional interest.	1.7km to the north-west of the DCO Site	National	



Sites non-statutorily designated for biodiversity importance

- 8.7.5 There are 14 non-statutory sites designated for nature conservation within 2km of the DCO Site (as per the study area in Section 8.5.5 of this chapter) and these are presented in Table 8-6. These sites have been designated as Local Wildlife Sites (LWS) for their biodiversity value at a county level and are known to have supporting value to a wide variety of protected and ecologically important species and/ or habitats. The locations of these non-statutory sites, relevant to the Scheme, are shown in **PEI Report Volume 2: Figure 8-2.**
- 8.7.6 Non-statutory sites detailed in Table 8-6 are listed in ascending order, with those closest to the DCO Site listed first.



Table 8-6 Sites non-statutorily designated for biodiversity importance within 2km of the DCO Site

Non-statutory site name and designation	Area (ha)	Description	Distance (km / m) and direction from the DCO Site	Importance
Cow Pasture Lane Drains LWS	0.446	This LWS comprises a drain which runs alongside Broad Lane and southwards beside a track, Cow Pasture Lane. Meadowsweet <i>Filipendula ulmaria</i> grows abundantly in the ditch while a defunct rich hedgerow behind supports mature Ash <i>Fraxinus excelsior</i> trees and species including Dogwood <i>Cornus sanguinea</i> and Field Maple <i>Acer campestre</i> . The drain is deeper and wider along Cow Pasture Lane containing a variety of plants. These include Branched Bur-reed <i>Sparganium erectum</i> , Amphibious Bistort <i>Persicaria amphibia</i> , Blunt-fruited Water-starwort <i>Callitriche obtusangula</i> and stands of Reed Sweet-grass. The lower reaches of the bank support Wild Angelica, False Fox-sedge <i>Carex otrubae</i> and Meadowsweet.	Within the DCO Site	County
Coates Wetland LWS	18.948	The River Trent meanders around this LWS, comprising a mosaic of habitats including wetland, developing woodland and grassland enclosed within a flood bank. The eastern half of the LWS is dominated by grassland and tall ruderal vegetation with abundant False Oat-grass Arrhenatherum elatius and stands of Creeping Thistle Cirsium arvense interspersed with patches of Wild Angelica Angelica sylvestris and Purple Loosestrife Lythrum salicaria on damper soils. To the north a developing woodland is dominated by a variety of Willow Salix sp. species. Damper areas on the western side of the LWS include a seasonally wet area but supporting a number of plant species typical of a Trentside inundation community. These include Marsh Yellow-cress Rorippa palustris, Pink Water-speedwell Veronica catenata and Marsh Dock Rumex palustris. To the south a small, deeper pond is edged by species such as Greater Pond-sedge Carex riparia, Reed Sweetgrass Glyceria maxima and Yellow Iris Iris pseudacorus. The LWS is bounded to the west by a flood bank with an area of marshy grassland/tall ruderal vegetation and a drainage channel containing locally dominant Branched Bur-reed Sparganium erectum, Gypsywort Lycopus europaeus and Water-plantain Alisma plantago-aquatica.	Immediately adjacent to the DCO Site	County



Non-statutory site name and designation	Area (ha)	Description	Distance (km / m) and direction from the DCO Site	Importance	
Knaith Park Wood LWS	6.4	Approximately 15m from the DCO Site	County		
Cottam Wetlands 88.557 LWS		This large wetland mosaic, adjacent to and including a stretch of the River Trent, comprises a number of lakes and lagoons, ditches, damp cattle-grazed grassland, swamp and marshland. It is botanically very rich supporting a diverse flora. The Local Wildlife Site boundary encompasses part of the Cottam Power Station site and a connected disused mineral railway, which is now wooded.	Approximately 30m from the DCO Site	County	
		The wetlands support an interesting and varied selection of plants including Purple Loosestrife, Fine-leaved Water-dropwort <i>Oenanthe aquatica</i> , Water Horsetail <i>Equisetum fluviatile</i> , Yellow Iris, Pink Water-speedwell, Slender Tufted-sedge <i>Carex acuta</i> , Water Mint <i>Mentha aquatica</i> and Skullcap <i>Scutellaria galericulata</i> . They provide breeding habitat for amphibians, <i>Odonata</i> and many other insect species and are an important site for birds providing nesting sites and habitat for both breeding birds and wintering wildfowl and feeding opportunities for passage migrants in spring and autumn.			
5/2324 (Cottam Ponds) LWS	5.038	Lagoons to the east of the Cottam Power Station, supporting Great Crested Newt.	Approximately 60m from the DCO Site	County	
Littleborough Lagoons LWS			Approximately 370m from the DCO Site	County	



Non-statutory site Area (ha) name and designation		Description	Distance (km / m) and direction from the DCO Site	Importance	
Out Ings LWS	12.477	Adjacent to the River Trent, Out Ings LWS is a floristically rich site comprising a diverse mosaic of grassland, willow carr, open water and wetland. Stands of Common Reed <i>Phragmites australis</i> and Reed Sweet-grass grow around the wetland margins with Willow <i>Salix</i> sp. carr dominating the central area.	Approximately 400m from the DCO Site	County	
Thurlby Wood LWS	38	This LWS, to the south-east of Gainsborough, is contiguous with Caistor's Wood to the north. Most is semi-natural ancient woodland, and all parts are of significant botanical interest.	Approximately 420m from the DCO Site	County	
Torksey Ferry Road Ditch LWS	0.138	Trackside ditch with waterlogged decomposing grasses including Reed Canary-grass <i>Phalaris arundinacea</i> and rush (a species of <i>Juncus</i>), supporting the near threatened water beetle <i>Agabus uliginosus</i> . Three Local B water beetle species <i>Cercyon convexiusculus</i> , <i>Cymbiodyta marginellus</i> and <i>Ilybius montanus</i> have also been recorded.	Approximately 620m from the DCO Site	County	
Broad Lane Grassland, North Leverton LWS	0.831	This small neutral grassland is bordered by Hawthorn <i>Crataegus monogyna</i> and Blackthorn <i>Prunus spinosa</i> hedgerows and a linear broadleaved woodland, separating it from a railway line. The sward contains a good selection of grasses with Yellow Oat-grass <i>Trisetum flavescens</i> , Yorkshire-fog <i>Holcus lanatus</i> , Sweet Vernal Grass <i>Anthoxanthum odoratum</i> , Meadow Barley <i>Hordeum secalinum</i> and Meadow Fescue <i>Schedonorus pratensis</i> with locally dominant Common Bent <i>Agrostis capillaris</i> and False Oatgrass. Among the forbs Meadow Buttercup <i>Ranunculus acris</i> is scattered across the site with numerous patches of Great Burnet <i>Sanguisorba officinalis</i> , Lady's Bedstraw <i>Galium verum</i> and Meadow Vetchling <i>Lathyrus pratensis</i> . Other species include Pepper-saxifrage <i>Silaum silaus</i> , Red Clover <i>Trifolium pratense</i> , Lesser Stitchwort <i>Stellaria graminea</i> and Common Bird's-foot-trefoil <i>Lotus corniculatus</i> .	Approximately 800m from the DCO Site	County	
Mother Drain, Upper Ings LWS	2.123	A long length of drainage ditch/channel with Spiked Milfoil <i>Myriophyllum spicatum</i> and marginal Reed Sweet-grass, Reed canary-grass, Creeping Bent <i>Agrostis stolonifera</i> and Duckweed <i>Lemna</i> species. Fourty-six Water Beetle species and 11 water bug species have been recorded. The nationally near threatened <i>Hydrochus</i> elongates at it's only Nottinghamshire	Approximately 810m from the DCO Site	County	



Non-statutory site name and designation	Area (ha)	Description	Distance (km / m) and direction from the DCO Site	Importance
		location and Nationally scarce <i>Hygrotus quinquelineatus</i> are recorded from the site. The drain also supports an assemblage of local species, some of which have a high local conservation interest including a Local A water beetle <i>Limnebius nitidus</i> together with 15 Local B species. Notably Local B <i>Notonecta maculate</i> and <i>Notonecta viridis</i> water bugs are also recorded from the drain.		
Priory Farm LWS	12.9	This area is predominantly wooded, but with a partially open southern fringe. At the northern end there is an east-west track bisecting a strip of pasture that has a shallow ditch on its northern edge	Approximately 985m from the DCO Site	County
Ashton's Meadow LWS	3.566	See also Ashton's Meadow SSSI in Table 8-5. This meadow, bordered by hedgerows and trees, is a SSSI, owned and managed by the Nottinghamshire Wildlife Trust. The sward is unimproved and species-rich with a range of characteristic grasses and forbs. Among the grasses Upright Brome <i>Bromopsis erecta</i> and Quaking-grass <i>Briza media</i> grow abundantly with other species including Meadow Barley <i>Hordeum secalinum</i> and Yellow Oat-grass <i>Trisetum flavescens</i> . Forbs include abundant Meadow Vetchling <i>Lathyrus pratensis</i> , Common Knapweed <i>Centaurea nigra</i> , Rough Hawkbit <i>Leontodon hispidus</i> and Yellow-rattle <i>Rhinanthus minor</i> . Fairy Flax <i>Linum catharticum</i> , Pyramidal Orchid <i>Anacamptis pyramidalis</i> , Bee Orchid <i>Ophrys apifera</i> and Ox-eye Daisy <i>Leucanthemum vulgare</i> are among the many other species found.	Approximately 1.5km to the west of the DCO Site	County
Thornhill Lane Drain, Littleborough LWS	0.135	This stretch of drain meanders through intensively farmed arable land. It supports a variety of aquatic plants including Blunt-fruited Water-starwort <i>Callitriche obtusangula</i> and the county-rare Opposite-leaved Pondweed <i>Groenlandia densa</i> . Among the marginal species are Branched Bur-reed <i>Sparganium erectum</i> , Reed Sweet-grass and Reed Canary-grass. The drain supports a number of rushes <i>Juncus</i> sp., along with Pink Water-speedwell, Water-cress <i>Nasturtium officinale</i> and Amphibious Bistort.	Approximately 1.6km to the north of the DCO Site	County



- 8.7.7 Five areas of ancient woodland were identified within 2km of the DCO Site. These are:
 - Burton Wood within DCO Site;
 - Stag Wood approximately 190m to the north of the DCO Site;
 - Thurlby/Castors Wood approximately 825m to the north of the DCO Site;
 - An unnamed ancient woodland, approximately 1.9km to the north of the DCO Site; and
 - Lea Wood approximately 1.9km to the north of the DCO Site.
- 8.7.8 The locations of these ancient woodland sites are presented in **PEI Report Volume 2: Figure 8-2**.

Habitats

- 8.7.9 The DCO Site (as defined in **Chapter 2: The Scheme**) is approximately 1,436 ha and the land use dominated by arable fields (940ha / 65.5%), intersected by a network of drainage ditches. Other habitat includes improved and semi-improved grassland fields, mature trees and hedges, small wooded copses and ponds. The surrounding habitat is mainly arable and mature broadleaved woodland (plantation, semi-natural and ancient). There are individual and clusters of residential properties located adjacent to the DCO Site.
- 8.7.10 The terrestrial habitats present within the DCO Site were identified during the Phase 1 Habitat survey, undertaken in August and September 2021; and April 2022 (and reported in **PEI Report Volume 3: Appendix 8-B**). These habitats are the broad habitat types found within the DCO Site and will be further defined by detailed habitat surveys that will be undertaken between May and September 2022 (see Table 8-1). The broad habitats are summarised in Table 8-7, alongside area calculations (taken from digitised maps of the Phase 1 Habitats) and their biodiversity importance. The locations of these habitats are presented in **PEI Report Volume 2: Figure 8-3** and included in **PEI Report Volume 3: Appendix 8-B**.
- 8.7.11 Habitat data, required to calculate the biodiversity net gain or net loss have been collected in the Phase 1 Habitat survey and will be updated, as necessary, through subsequent surveys (such as arable flora and hedgerow surveys, see Table 8-1) to ensure a comprehensive baseline of data for the BNG assessment. This will be prepared and submitted with the ES for the DCO submission.



Table 8-7 Broad habitat types within the DCO Site

Habitat	Area (ha) / length (km)	% of Site area	Notable Habitat?	Biodiversity Importance	Rationale
A1.1.1 - Broadleaved woodland - semi- natural (including ancient woodland)	21.65ha	1.51%	Habitat of Principal Importance – Lowland Mixed Deciduous Woodland and Wet Woodland. LBAP habitat in Lincolnshire	County	Four woodlands adjacent to the DCO Site are listed as ancient woodland (see Section 8.7.7). Burton Wood, within the DCO Site, is an ancient woodland (see Section 8.7.7). One other small broadleaved woodland within the DCO Site. A data search for veteran or ancient trees (see section 8.5.4) did not identify any such trees within 2km of the DCO Site. However, many trees within the DCO Site are potentially veteran and/ or ancient trees occurring within hedges and along lanes within or immediately adjacent to the DCO Site.
A1.1.2 - Broadleaved woodland - plantation	0.79ha	0.05%	No	Site	Not a habitat of principal importance.
A1.3.2 - Mixed woodland - plantation	1.17ha	0.08%	No	Site	Not a habitat of principal importance.
A2.1 - Scrub - dense/continuous	10.65ha	0.74%	No	Site	Not a habitat of principal importance.
A2.2 - Scrub - scattered	4.11ha / 1.13km	0.28%	No	Site	Not a habitat of principal importance.



Habitat	Area (ha) / length (km)	% of Site area	Notable Habitat?	Biodiversity Importance	Rationale
B1.2 - Acid grassland - semi-improved	0.36ha	0.02%	Habitat of Principal Importance LBAP habitat in Lincolnshire	Possibly up to County	Habitat of Principal Importance. Small area of this habitat present within the DCO Site and exceeds LWS selection criteria (Ref 8-67) for this habitat in Lincolnshire (0.1ha). Further survey required to confirm the importance of this habitat type.
B2.2 - Neutral grassland - semi-improved	78.41ha	5.46%	Coastal and Floodplain Grazing Marsh is a Priority Habitat Grazing Marsh is an LBAP habitat in Lincolnshire	Possibly up to County	Whilst the majority of neutral semi- improved grassland is not a habitat of principal importance, grassland either side of the River Trent is a priority habitat as identified on MAGIC (Ref 8-37). This habitat, within the Grid Connection Route, does not fulfil the LWS selection criteria for this habitat in Lincolnshire (Ref 8-67), but is considered to be of higher than local importance due to this being a priority habitat in the UK and the lack of this habitat within the wider area and within the DCO Site. Further survey required to confirm the importance of this habitat type.
B4 - Improved grassland	100.06ha	6.96%	No	Site	Not a habitat of principal importance.
B5 - Marsh/marshy grassland	0.37ha	0.03%	Habitat of Principal Importance Fens, marsh and swamp is an LBAP habitat in Nottinghamshire	District / Local	Very small extent of this habitat within the DCO Site and considered of District / Local value as it adds to the wider resource. Further survey required to



Habitat	Area (ha) / length (km)	% of Site area	Notable Habitat?	Biodiversity Importance	Rationale
					confirm the importance of this habitat type.
B6 - Poor semi-improved grassland	40.50ha	2.82%	No	Site	Not a habitat of principal importance.
C1.1 - Bracken - continuous	0.13ha	<0.01%	No	Site	Not a habitat of principal importance.
C1.2 - Bracken - scattered	0.08ha	<0.01%	No	Site	Not a habitat of principal importance.
C3.1 - Other tall herb and fern - ruderal	5.81ha	0.41%	No	Site	Not a habitat of principal importance.
F1 - Swamp	0.29ha	0.02%	Habitat of Principal Importance Reedbed is an LBAP habitat in Lincolnshire; Fens, Marshes and Swamps is an LBAP habitat in Nottinghamshire	Local	Very small extents of this habitat found within the DCO Site, with this habitat surrounding ponds and along fringes of ditches. Due to small extent, does not meet LWS selection criteria for this habitat in Lincolnshire (Ref 8-67) or Nottinghamshire (Ref 8-68).
G1 - Standing water	0.09ha	<0.01%	Ponds of certain criteria are a Habitat of Principal Importance	Local	Ponds can be defined as permanent (or seasonal) waterbodies up to 2ha in extent and qualify as being a priority habitat if they meet one or more criteria for UKBAP classification, including supporting species of high conservation



Habitat	Area (ha) / length (km)	% of Site area	Notable Habitat?	Biodiversity Importance	Rationale
					importance. The majority of ponds within the DCO Site contained little to no macrophytes or aquatic vegetation and had little other ecological value. Furthermore, these ponds are not a stand-alone habitat within the wider area, as similar habitat can be found in the surrounding area. Therefore, the ponds within the DCO Site are unlikely to reach the required level to fulfil the criteria of a priority habitat and are considered as being of no more than Local importance. Further survey is required to confirm the importance of this habitat type.
G2 - Running water (including the River Trent)	14.43ha / 14.19km	1.01%	Rivers are a Habitat of Principal Importance	Up to County	The River Trent is within the Grid Connection Route.
Hardstanding	13.04ha	0.91%	No	Site	Not a habitat of principal importance.
J1.1 - Cultivated/disturbed land - arable	940.00ha	65.5%	No	Site	Excluding arable field margins, not a habitat of principal importance.
J1.2 - Cultivated/disturbed land - amenity grassland	0.44ha	0.03%	No	Site	Not a habitat of principal importance.
Hedgerows (intact and defunct)	47.46km	-	Habitat of Principal Importance	Up to County	Habitat of principal importance, legally protected under the Hedgerow Regulations (Ref 8-11).



Area (ha) / length (km)	% of Site area	Notable Habitat?	Biodiversity Importance	Rationale
		LBAP habitat in Lincolnshire and Nottinghamshire		
13.60km	-	Habitat of Principal Importance LBAP habitat in Lincolnshire and Nottinghamshire	Up to County	Habitat of principal importance, legally protected under the Hedgerow Regulations (Ref 8-11). Some hedgerows may contain veteran trees.
3.04km	-	No	Site	Not a habitat of principal importance.
12.82km	-	No	Site	Not a habitat of principal importance.
0.41ha	0.03%	No	Site	Not a habitat of principal importance.
2.12ha	0.15%	No	Site	Not a habitat of principal importance.
16.21ha	0.08%	No	Site	Not a habitat of principal importance.
181.64ha	12.6%	Not yet surveyed		
	13.60km 13.60km 12.82km 0.41ha 2.12ha 16.21ha	13.60km - 3.04km - 12.82km - 0.41ha 0.03% 2.12ha 0.15%	/ length (km)area (km)LBAP habitat in Lincolnshire and Nottinghamshire13.60km-Habitat of Principal Importance LBAP habitat in Lincolnshire and Nottinghamshire3.04km-No12.82km-0.41ha0.03%No2.12ha0.15%No	/ length (km)areaImportanceLBAP habitat in Lincolnshire and NottinghamshireUp to County13.60km-Habitat of Principal Importance LBAP habitat in Lincolnshire and NottinghamshireUp to County3.04km-NoSite12.82km-NoSite0.41ha0.03%NoSite2.12ha0.15%NoSite16.21ha0.08%NoSite



Legally protected and notable species

- 8.7.12 The data search, obtained in October 2021 from LERC and NBGRC, returned records of protected and notable species within the 2km search radius from the DCO Site and from the preceding ten years. These protected and notable species, including species of conservation importance, can be reviewed in **PEI Report Volume 3: Appendix 8-B**.
- 8.7.13 Table 8-8 presents a summary of protected or notable animal species that have been identified, as of April 2022, during ecological surveys as present, or potentially present, within the DCO Site and survey areas (see Table 8-1) and an evaluation including importance / value (sensitivity) and rationale of the ecological features for each species. Full descriptions of the baseline conditions, as of April 2022, are presented in **PEI Report Volume 3:**Appendices 8-B to 8-D.
- 8.7.14 The assessment of biodiversity importance of species has been made for the entirety of the DCO Site, where surveys have been undertaken between August 2021 and April 2022. This assessment will be further updated by ongoing surveys throughout 2022. Where the biodiversity importance of a receptor is specific to a particular area of the DCO Site (e.g. occurring within the main site only), then this is specified with population size or specific species in Table 8-8.

Table 8-8 Summary of Baseline Details for Legally Protected and Notable Species, recorded as of April 2022, alongside assessment of Biodiversity Importance of Ecological Features

Ecological feature and technical appendix	Baseline Detail	Nature Conservation Receptor	Biodiversity Importance	Rationale
Non- breeding (wintering and passage) birds	67 bird species recorded during the wintering bird surveys.	Assemblage of wintering birds within the DCO Site.	Species Diversity is up to County importance. Peak count of Starling (Sturnus vulgaris) is likely to be of County Importance	No wintering bird population approaches the 1% level of the national population, which would constitute a nationally significant wintering bird population. Three species, listed on Annex I of the EC Birds Directive (Ref 8-1) were recorded within the survey area: Little Egret (Egretta garzetta), Golden Plover (Pluviallis apricaria) and Kingfisher (Alcedo atthis). Thirteen SPI (Ref 8-9) were recorded within the survey area. Twelve species, included on the Birds of Conservation Concern (BoCC) Red List (Ref 8-69) and 23 species, included on the BoCC Amber list (Ref 8-69), were recorded within the survey area. The remaining species are all included on the Green list and

Ecological Baseline Detail Nature



Biodiversity Rationale

feature and technical appendix	Dascillo Detail	Conservation Receptor	Importance	Rationale
				are of least conservation concern.
Roosting bats	Preliminary Roost Assessment survey, although ongoing, has (as of April 2022) identified four trees within the DCO Site as being of 'high' potential to support roosting bats and 11 trees with medium potential to support roosting bats.	Potential for roosts within the DCO Site.	Up to County Importance	All bat species and their roosts are legally protected in the UK under the Wildlife and Countryside Act (1981, as amended) (Ref 8-4) and Conservation of Habitats and Species Regulations (as amended) (Ref 8-6), which implemented the EC Directive 92/43/EEC (the Habitats Directive) (Ref 8-2). Seven bat species are also included as SPI under Section 410 of the NERC Act (Ref 8-9). Biodiversity importance of roosting bats based on likely presence of nearby roosts. All potential roosts currently to be retained and not disturbed.
Badger	At least three Badger setts recorded within the DCO Site.	At least one Badger social group present within or in the vicinity of the DCO Site.	Local Importance	Badgers are protected under The Protection of Badgers Act 1992 (Ref 8-10), however, they remain common and widespread throughout Lincolnshire and Nottinghamshire.
Brown Hare	The data search returned records of Brown Hare and this species has been recorded within the DCO Site during other ecological surveys.	Presence of this species within the DCO Site.	Local Importance	SPI in England (Ref 8-9) and Local BAP species in Lincolnshire (Ref 8-70). No surveys have or will be undertaken for Brown Hare (see Section 8.6.15). However, Brown Hare has been recorded in arable land during other ecological surveys undertaken to date and when considering the amount of arable habitat within the DCO Site, an assumption has been made that this species is located throughout the DCO Site.
Hedgehog	The data search returned records of Hedgehog within the study area (see Section 8.5).	Assumed presence within DCO Site.	Local Importance	SPI in England (Ref 8-9) and Local BAP species in Lincolnshire (Ref 8-70) and Nottinghamshire (Ref 8-71). No surveys have or will be undertaken for Hedgehog (see Section 8.6.15). However, an assumption has been made this



Ecological feature and technical appendix	Baseline Detail	Nature Conservation Receptor	Biodiversity Importance	Rationale
	The species has the potential to			species is likely to be present across the DCO Site.
	occur across the DCO Site.			Hedgehog is widespread and abundant in the UK and in Lincolnshire and Nottinghamshire, but declining.

8.7.15 A summary of desk study data, used to determine the further surveys required within the DCO Site (as detailed in Section 8.5.5 of this chapter) is presented in Table 8-9.

Table 8-9 Summary of desk study data for legally protected and notable species

Ecological feature	Desk study results
Flora/plants	The desk study identified records of scarce and 'near threatened' plants, occurring within the study area, including Juncus Compressus, Persicaria mitis, Callitriche truncata and Bluebell Hyacinthoides nonscripta as well as arable plants including Venus's-looking-glass Legousia hybrida, Cornflower Centaurea cyanus, Dwarf Spurge Euphorbia exigua, Common Fumitory Fumaria officinalis, Prickly Poppy Papaver dubium, Shepherd's Needle Scandix pecten-veneris, Night-flowered Catchfly Silene noctiflora and Narrow-fruited Cornsalad Valerianella dentata. Furthermore, the Phase 1 Habitat survey did not record any notable or
	protected plant species.
Terrestrial Invertebrates	The data search returned records of several invertebrate species, including two species of beetle: three butterfly species (Small Heath Coenonympha pamphilus, Wall Lasiommata megera and White-Letter Hairstreak Satyrium w-album), three molluscs and 35 moth species, all occurring within the study area. There are grassland margins and scrub habitats present across the Site that may support protected and notable invertebrate species.
Aquatic Invertebrates	The data search returned no records of aquatic invertebrates, however, there are aquatic habitats present with the Site (<i>e.g.</i> ponds and watercourses) with potential to support notable aquatic invertebrate species and assemblages.
Amphibians	The desk study identified four amphibian species (Great Crested Newt, Smooth Newt <i>Lissotriton vulgaris</i> , Common Frog <i>Rana temporaria</i> , and Common Toad <i>Bufo bufo</i>) occurring within the study area. There are ponds within the DCO Site with the potential to support amphibians.
Reptiles	The data search returned seven records of Grass Snake <i>Natrix helvetica</i> within 2km of the DCO Site. Reptile habitat is limited across the DCO Site, but small pockets of habitat suitable for reptiles do exist comprising uncropped field margins, hedgerows, woodland edge habitats and ditches.



Ecological feature	Desk study results
Breeding birds	The desk study identified at least 66 bird species within the study area, including Peregrine, Hobby, Golden Plover, Barn Owl, Cetti's Warbler <i>Cettia cetti</i> , Kingfisher <i>Alcedo atthis</i> and Red Kite. Surveys of breeding birds, undertaken between April and June 2021 within the DCO Site by the Landscape and Science Consultancy (Ref 8-36) recorded breeding species including Lapwing <i>Vanellus vanellus</i> and Skylark <i>Alauda arvensis</i> . During the Phase 1 Habitat survey, Barn Owl and Hobby were observed within the DCO Site.
Bat activity	The data search returned records of at least six bat species (Brown Long-eared <i>Plecotus auritus</i> , Common Pipistrelle <i>Pipistrellus pipistrellus</i> , Noctule <i>Nyctalus noctule</i> , Natterer's bat <i>Myotis nattereri</i> , Soprano Pipistrelle <i>Pipistrellus pygmaeus</i> , Daubenton's bat <i>Myotis daubentonii</i> , and Myotis sp). Surveys of bat activity, undertaken in May and August/September 2021 within the DCO Site by the Landscape and Science Consultancy (Ref 8-35), recorded six bat species using the DCO Site: Common Pipistrelle, Soprano Pipistrelle, Noctule, Brown Long-eared, Leisler's <i>Nyctalus leisleri</i> and <i>Myotis</i> sp.
Otter	The data search returned records of Otter within the study area and the watercourses and water bodies occurring within the DCO Site and the ZoI has the potential to support Otter.
Water Vole	The data search returned records of Water Vole within 2km of the DCO Site. Evidence of Water Vole was found within the DCO Site during the Phase 1 Habitat survey, in one location.
Invasive Non-native Species (INNS)	The data search returned records of five invasive species, including Mitten Crab <i>Eriocheir sinensis</i> , American Mink, New-Zealand Pigmyweed <i>Crassula helmsii</i> , Himalayan Balsam <i>Impatiens glandulifera</i> and Japanese Knotweed <i>Reynoutria japonica</i> . No invasive non-native species were recorded within the DCO Site during the Phase 1 Habitat survey.

Future Baseline

- 8.7.16 The future baseline scenarios are set out in **Chapter 5: EIA Methodology** of this PEI Report.
- 8.7.17 This section considers those changes to the baseline conditions, described above, that might occur in the absence of the Scheme and during the time period over which the Scheme would be in place.
- 8.7.18 The habitat within the DCO Site and up to 50m from the DCO Site is dominated by arable fields (cropped on rotation) with a few fields of semi- improved grassland, bordered by mature trees and hedges, woodlands (including ancient woodland) and ponds. The River Trent is to the west of the village of Gate Burton. There are individual and clusters of residential properties located within and adjacent to the DCO Site.
- 8.7.19 In the short to medium term, in the absence of the Scheme, these habitats have and will continue to provide a number of species with potential habitat



such as arable farmland for ground-nesting breeding birds. In the long term, in the absence of the Scheme, habitats on site will be under agricultural management and therefore the distribution of some species will change in response to cropping, whilst the assemblages may remain broadly the same. Any changes to the baseline between now and the future scenario have been taken into account in the assessment and when determining mitigation measures.

8.7.20 Irrespective of whether the Scheme were to proceed or not, the current national and local trend is for a decline in species diversity and abundance, e.g. farmland birds, and these declines are likely to continue throughout the duration of the Scheme.

Construction Period (2025-2027/2028)

- 8.7.21 Based on current trends, species abundance and diversity are likely to remain similar to the existing baseline conditions during the construction period, although the trajectory for the majority of species is continued decline.
- 8.7.22 If the Scheme did not proceed, the majority of existing habitats are likely to continue being present, although some changes in habitat extent, composition and structure will occur as a result of ecological succession *e.g.* the gradual establishment of tree and shrub seedlings within woodland areas and along hedgerows. These resultant gradual changes in habitat composition are unlikely to materially alter the ecological baseline and therefore the habitats and species present are very unlikely to undergo significant change prior to 2025 and up to 2027.

Opening and Operation (2028-2088)

- 8.7.23 Based on current projections the long-term, *i.e.* the next 60 years, will continue to see a decline in biodiversity, including species associated with the baseline conditions present within the DCO Site. This will have implications for the species assemblages present during opening and operation of the Scheme.
- 8.7.24 Local planning policy targeted at halting and reversing these declines is set out in **PEI Report Volume 3: Appendix 8-A**.
- 8.7.25 If the Scheme did not progress, based on available information, whilst there is likely to be an overall decline in biodiversity, there are no reasons to expect that there would be any marked change in the broad habitat types associated with the Scheme between opening in 2028 and 2088 (based on an estimated 60-year operation). It is noted however, that changing climatic conditions resulting from climate change may influence the resilience of certain habitats and species, such as grasslands and their associated faunal communities. Habitats such as broad-leaved trees and scrub will be more mature but are likely to support a broadly similar species assemblage and arable farmland will also be managed accordingly, maintaining broadly similar species assemblages.

Decommissioning (2088-2089/2090)

8.7.26 The future baseline conditions in 2088 are currently unknown and more difficult to predict given the time period that would need to lapse between now



and then. They are likely to be similar to those at the start of construction (2025), although habitats such as plantation woodland would have matured further, though some may have been felled or partially cropped. Species assemblages are also likely to have changed in accordance with the site conditions, with changes in biodiversity likely to occur if climate change continues at its current pace. Effects could include changes in species habitats and compositions and consequently changes in species assemblages and distribution. A Framework Decommissioning Environmental Management Plan will be prepared to support the DCO submission and will be finalised prior to decommissioning.

8.8 Potential Impacts

8.8.1 Prior to the implementation of any mitigation, the Scheme has the potential to affect biodiversity (positively or negatively), during construction, operation and decommissioning, in the following ways.

Construction (2025-2027/2028)

- 8.8.2 Impacts on biodiversity features during construction of the Scheme are likely to include:
 - Habitat loss or gain direct impacts associated with changes in land use resulting from the Scheme, for example temporary works associated with site clearance, and permanent land-take (mainly arable land) associated with the installation of the Scheme.
 - Fragmentation of populations or habitats indirect impacts due to the Scheme dividing a habitat, group of related habitats, site or ecological network, or the creation of partial or complete barriers to the movement of species, with a consequent impairment of ecological function.
 - Disturbance indirect impacts resulting from a change in normal conditions (light, noise, vibration, human activity) that result in individuals or populations of species changing behaviour or range.
 - Habitat degradation direct or indirect impacts resulting in the reduction in the condition of a habitat and its suitability for some or all of the species it supports, for example changes in chemical water quality or changes in surface flow or groundwater.
 - Species mortality direct impacts on species populations associated with mortalities due to construction activities, for example site clearance.
 - Introduction of invasive species, due to the movement of personnel, equipment and plant machinery, potentially facilitating the introduction of invasive species.

Operation (2028-2088)

8.8.3 Impacts on biodiversity features during the operational phase of the Scheme are likely to include:



Negative impacts:

- Potential attraction of aquatic invertebrates to solar panels, causing displacement and mortality;
- Potential avoidance of species using the DCO Site, such as bats and birds, due to indirect impacts through operational lighting;
- Disturbance of sensitive species during operational maintenance activities; and
- Fragmentation of habitats causing a barrier effect, e.g. due to fencing.

Beneficial impacts

- Increases in permanent habitat of greater floristic diversity than arable farmland, increasing invertebrate assemblages and abundance;
- Potential attraction and increases in species foraging around the DCO Site, such as bats and birds, from increases in prey items (i.e. flying insects);
- Potential increases in abundance and distribution of species, due to lack of human disturbance and changes in habitat (such as agricultural practices) within the DCO Site; and
- Indirect beneficial impacts through a possible reduction of agricultural chemical inputs to watercourses /reduction in pesticide use on crops within the local area resulting in an increase in invertebrate abundance and diversity.

Decommissioning (2088-2089/2090)

8.8.4 Impacts on biodiversity features during decommissioning of the Scheme are likely to be the same as construction. However, field surveys would be required in advance of decommissioning to define the ecological baseline at the time of decommissioning and to ensure that impacts on ecological features are identified. Upon decommissioning, the above- ground physical infrastructure will be removed and the DCO Site returned to landowners in the condition as at the end of operation, including the established habitats.

8.9 Important Ecological Features

8.9.1 Table 8-10 summarises the known Important Ecological Features (IEF) that are relevant to the Scheme, based on survey data collected between August 2021 and April 2022. Based on CIEEM guidelines (Ref 8-33) and using professional judgement, features of Site importance, *i.e.* less than Local importance, are not considered further in the assessment process, unless legislation requires their consideration. Therefore, in recognition of the protected status of species occurring at a local level (*e.g.* the general wintering bird assemblage), the Scheme will embed appropriate mitigation (see Section 8.10) to minimise impacts in line with the relevant legislation.



Table 8-10 Summary of known IEFs as of April 2022

IEF	Importance / Sensitivity (see Table 8-2)	Reason for valuation
Ashton's Meadow SSSI	National	Statutory site of nature conservation importance and therefore qualifies as High Importance (see Table 8-2).
Lea Marsh SSSI	National	Statutory site of nature conservation importance and therefore qualifies as High Importance (see Table 8-2).
14 sites of county importance (LWSs – see Table 8-7)	County	Non-statutory sites of nature conservation importance, qualifying as Medium Importance (see Table 8-2).
Habitat – broadleaved woodland (including ancient woodland)	County	Habitat of ecological importance included as a Priority Habitat or LBAP habitat. Therefore, this habitat qualifies as being of Medium Importance (see Table 8-2).
Habitat – acid grassland (semi- improved)	County	Habitat of ecological importance included as a Priority Habitat or LBAP habitat. Therefore, this habitat qualifies as being of Medium Importance (see Table 8-2).
Habitat – semi- improved neutral grassland (Coastal and Floodplain Grazing Marsh)	·	Coastal and Floodplain Grazing Marsh either side of the River Trent qualifies as a habitat of ecological importance included as a Priority Habitat and LBAP habitat. Therefore, this habitat qualifies as being of Medium Importance (see Table 8-2).
Habitat - Marsh / marshy grassland	Local	Habitat of ecological importance included as a Priority Habitat or LBAP habitat. Currently considered as being of Low importance due to small extent of this habitat within the DCO Site, but to be further determined by detailed surveys in 2022 (see Table 8-2).
Habitat - Swamp	Local	Habitat of ecological importance included as a Priority Habitat or LBAP habitat. Currently considered as being of Low importance due to small extent of this habitat within the DCO Site, but to be further determined by detailed surveys in 2022 (see Table 8-1).
Habitat – Standing Water	Local	Habitat of ecological importance included as a Priority Habitat or LBAP habitat. Currently considered as being of Low importance and this will be assessed during ongoing surveys to inform the ES.
Habitat – Running Water	Up to County	The River Trent is within the DCO Site and qualifies as being of Medium Importance (see Table 8-2). Furthermore, the network of ditches with running water are likely to support protected species, such as bats and Water Vole, therefore these would also



IEF	Importance / Sensitivity (see Table 8-2)	Reason for valuation
		qualify as being of Medium Importance (see Table 8-2).
Habitat – hedgerows	Up to County	The network of hedgerows across the DCO Site will be of value to birds, bats and other fauna, therefore hedgerows qualify as being of Medium Importance (see Table 8-2).
Wintering birds	Up to County	Species Diversity and peak count of wintering Starling qualify as being of Medium Importance.
Bats - roosting	Up to County	Potential for roosts within the DCO Site and would qualify as being of Medium Importance.
Badger	Local	Badgers occurring within the DCO Site are of Low importance, due to the presence of two outlier setts (one in active use) within the DCO Site and no main setts.
Other mammals (Brown Hare and Hedgehog)	Local	Presence likely across the DCO Site and both species would qualify as being of Low Importance.

8.9.2 Identification of further IEFs, will be determined by the ongoing field surveys during 2022 and, if appropriate, following the criteria set out in Section 8.6, presented in the ES.

8.10 Embedded and Additional Mitigation Measures

8.10.1 The following embedded mitigation and additional measures have been incorporated into the Scheme design, with detailed proposals and locations to be submitted with the DCO application. These measures are provided on the basis of baseline conditions known at the time of reporting. It is anticipated that further measures may be required as the baseline conditions are fully established. If required, the scheme design will be further refined to embed mitigation, as appropriate.

Table 8-11 Mitigation Categories

Category	Assessment	Description	Gate Burton Examples
Embedded	Factored into determining residual significant effects.	These form an integral, committed and deliverable part of the scheme design or standard construction practices and will be included within the DCO application.	HDD for sections of the grid connection route to avoid disturbance to priority or sensitive habitats such as rivers A Framework Construction Environmental Management plan (CEMP) will be implemented during construction to protect retained vegetation, designated sites, protected species and other areas of biodiversity value from disturbance, damage and accidental pollution.



Category	Assessment	Description	Gate Burton Examples
			Avoidance of protected species, such as 30m from Badger setts.
			Undeveloped buffers will be included with the Scheme design to protect all hedgerows, individual trees, ponds and ancient woodland during construction (refer to PEI Report Volume 2: Figure 2-2).
Additional	Factored into determining residual significant effects.	Additional measures where standard (embedded) measures are not sufficient to avoid significant effects. Committed and deliverable as part of the Scheme and will be included within the DCO application.	If appropriate, where a significant effect is identified following completion of baseline surveys and detailed assessment, additional mitigation measures to avoid or minimise the significant effect will be presented in the ES.

Construction

- 8.10.2 Primary mitigation measures will be embedded into the Scheme to minimise construction impacts and these will be formalised through the implementation of the Framework CEMP that will detail the measures required to mitigate any construction related effects on biodiversity, including those associated with dust deposition, air pollution, pollution incidents, water quality, light, noise and vibration.
- 8.10.3 This embedded mitigation is needed to successfully integrate the Scheme within the context of the existing landscape and prevent or reduce any adverse effects on ecological features.
- 8.10.4 The Framework CEMP will include measures to manage the environmental effects of the Scheme and to demonstrate compliance with environmental legislation. The following standard mitigation measures secured through the Framework CEMP will be implemented during construction to protect retained vegetation, designated sites, protected species and other areas of biodiversity value from disturbance, damage and accidental pollution:
 - The design of the Scheme will comply with industry good practice and environmental protection legislation during construction e.g. prevention of surface and ground water pollution, fugitive dust management, noise prevention or amelioration.
 - Where lighting is required, it will conform to best practice guidelines with respect to minimising light spill into adjacent habitats and prevent disturbance to bats and other species. With reference to Chapter 2: The Scheme, temporary construction site lighting, in the form of mobile lighting towers with a power output of 8 kilo volt-amperes (kVAs), will be required in areas where natural lighting is unable to reach (sheltered/confined areas) and during core working hours within winter months. All construction lighting will be deployed in accordance with the following recommendations to prevent or reduce the impact on human and ecological receptors:



- The use of lighting will be minimised to that required for safe site operations and security;
- Lighting will be controlled by infrared settings;
- Lighting will utilise directional fittings to minimise outward light spill and glare (e.g. via the use of light hoods/cowls which direct light below the horizontal plane, preferably at an angle greater than 20° from horizontal); and
- Lighting will be directed towards the middle of the DCO Site rather than towards the boundaries.
- The crossing of the River Trent will be undertaken using HDD methods to avoid impacts to the river, with setbacks of at least 10m from the top of the river bank (see below). The Framework CEMP will also specify requirements for the safe storage of chemicals and other hazardous materials (e.g. fuel) reaching the River Trent during flood events during construction.
- 8.10.5 A Scheme drainage strategy will be developed to manage surface water runoff and will reduce the likelihood and severity of potential pollution incidents and flooding affecting watercourses and the local ditch network to reduce or eliminate adverse effects for aquatic and riparian species and habitats.
- 8.10.6 The following Scheme design, impact avoidance and embedded mitigation measures have been incorporated to avoid, reduce or minimise effects on biodiversity:
 - A perimeter deer fence around the Scheme will be implemented early in the construction phase to secure the DCO Site. The fence design will include gaps to allow mammals, including Badger, to pass underneath at strategic locations. This fence will also prevent construction activity in proximity to designated sites (such as Burton Wood) and to retained habitats within and adjacent to the DCO Site.
 - The Scheme has been designed so that impacts upon important habitats (including woodland, acid grassland, hedgerows, running water and ponds) are avoided (refer Chapter 2: The Scheme).
 - Throughout the DCO Site, undeveloped buffers will be included with the Scheme to protect all hedgerows, individual trees, ponds and ancient woodland during construction. These buffers will include:
 - 10m from watercourses to protect riparian habitats and to mitigate for potential hazards such as chemical and soils spills into watercourses and avoid potential direct impacts to water courses and any protected species (such as Water Vole) that use them.
 - Specific tree protection measures will be implemented, including fencing and construction exclusion zones. Tree Root Protection fencing will be erected around retained trees, in line with British Standard BS 5837: Trees in relation to design, demolition and construction Recommendations and these undeveloped buffers will be of at least 15m from woodlands, individual trees and hedgerows with trees and at least 5m from hedgerows without trees.
 - Reasonable avoidance measures, including appropriate buffers (of up to 30m) around any identified Badger setts, or trees with bat roost



potential (a buffer of 15m) throughout the DCO Site (refer to **PEI Report Volume 2: Figure 2-2**).

- Within some of these buffers, particularly around the ancient woodland, natural regeneration of woodland will create additional scrub and woodland habitat. Other areas will be managed as grassland.
- Pre-construction surveys will be undertaken to validate and, where necessary, update the baseline survey findings. The purpose of these preconstruction surveys is to ensure mitigation during the construction phase is based on the latest protected species information. This will also be required for any protected species licensing that may be identified as being necessary at detailed design stage.
- Mitigation strategies will be prepared for protected species and where required, application for species licences from Natural England for any relocation of animals away from construction areas (sufficiently in advance of the works to meet with the optimum time for mitigation and to minimise any changes to the construction programme).
- Vegetation clearance will avoid the nesting bird period, where practicable i.e., March to August (inclusive), however, should any vegetation clearance be required within the nesting bird period this will be checked, prior to vegetation removal, for the presence of nesting birds, by a suitably qualified ornithologist. If active nests are found, then these will be avoided with appropriate buffer zones put in place and the area monitored until the young birds have fledged and, or the nesting attempt has ceased.
- Vegetation clearance will be undertaken in advance of construction and at an appropriate time of year so as to avoid incidental injuring or killing of reptiles and amphibians (if present), concordant with the requirements for other species, such as nesting birds and Brown Hare.
- Implementation of measures to avoid animals being injured or killed within
 construction working areas, through excluding them from such areas and
 preventing them from falling into and becoming trapped in excavations. No
 excavations will remain open overnight and if excavations are required to
 be left open, ramps will be provided to allow animals a means of escape.
- Throughout the DCO Site, new habitats will be provided to increase the biodiversity of the Scheme and will include bare ground, grassland, 'cover crops', hedgerows, tree and scrub planting. These habitats will provide landscape scale benefits for wildlife through increased habitat provision and connectivity and will be of value to a wide range of fauna, including farmland birds such as Skylark and Yellowhammer. Habitat creation will include:
 - Grassland to be provided adjacent to and beneath the Solar PV Arrays, including in larger open fields within the DCO Site, to increase the diversity of flora in comparison to existing intensive agriculture and provide new habitat niches to encourage other fauna such as invertebrates and birds, such as Skylark.
 - Vegetation would be established through natural regeneration or from seed collection from the grasslands identified within the DCO Site and through a suitable long-term habitat management regime. Consideration will be paid to microclimatic conditions when identifying appropriate species.



- Gaps in currently defunct hedges will be planted with suitable native species to improve the connectivity of habitats (such as between ancient and other broad-leaved woodland) within and adjacent to the DCO Site.
- New areas of tree planting will be provided to create screening from Scheme infrastructure, improve habitat connectivity and increase the area of hedgerow (and woodland habitat) within the DCO Site. Tree planting will be avoided in any areas where there may be ecological features which require open landscapes.
- Hedgerows and trees will be allowed to grow tall and wide to provide maximum benefits for biodiversity and this natural regeneration will encourage a mosaic of successional habitats, forming broad habitat corridors throughout the Scheme.
- For the purposes of BNG, the habitat creation for the Scheme will seek to achieve overall net gains in habitat units for biodiversity and for river and hedgerow habitats. Whilst the majority of habitat potentially to be lost is of low ecological value and of no more than Local importance, e.g. arable farmland, embedded design measures described above will be used in the final assessment to ensure no net loss in important habitat types.
- Pre-construction and pre-decommissioning surveys will be undertaken to provide an update on the presence and location of any invasive species, the findings of which will inform the implementation of measures to prevent their spread into the wild. These surveys will inform the production of a Biosecurity Management Plan which will set out procedures to ensure that no invasive species are brought onto the DCO Site (e.g. Wildlife and Countryside Act 1981 (as amended) (Ref 8-4) Schedule 9 species) and will secured through the Framework CEMP and Decommissioning Environmental Management Plan In the event that any future infestations of invasive non-native species are identified prior to and or during the development process, exclusion zones will be established around them and an Ecological Clerk of Works (ECoW) contacted for advice as required
- 8.10.7 The ongoing baseline surveys are likely to record further important ecological features which will need consideration in the final scheme design. For example, the desk study has identified the likely presence of breeding farmland bird species, such as Skylark and Lapwing, both ground nesting species of open arable farmland. The Scheme has integrated areas for such species, at an early stage, including undeveloped plots of land approximately 50x50m within arrays provide nesting habitat for Skylark and undeveloped zones at the western and southern edges of the DCO Site where management can be targeted at Lapwing. However, the specifics and quantity of any such mitigation will be informed by the baseline surveys and appropriate mitigation incorporated into the Scheme design submitted with the DCO application.

Operation

8.10.8 A Framework Operational Environmental Management Plan (OEMP) will detail the measures required to minimise operational impacts, including:



- No part of the Scheme will be continuously lit. Manually operated and motion-detection lighting will be utilised for operational and security purposes around electrical infrastructure such as inverters, transformers and switchgear across the Solar PV Array Areas, and within the compounds and substations. Lighting will be directed downward and away from boundaries. No visible lighting will be utilised at the site perimeter fence, aside from the site entrance points.
- The Scheme drainage strategy will include measures to manage surface water runoff during operation and will reduce the likelihood and severity of potential pollution incidents and flooding affecting watercourses and the local ditch network to reduce or eliminate adverse effects for aquatic and riparian species and habitats
- The creation and subsequent management of habitats will be determined by the characterisation of the existing baseline. However, management will seek to maximise floristic diversity, which will require low density and short frequency, sheep grazing (conservation grazing) or an appropriate, sensitive moving regime.

Decommissioning

8.10.9 A Framework Decommissioning Environmental Management Plan (DEMP) will be required to set out measures to mitigate any decommissioning related effects on biodiversity. Whilst the majority of mitigation measures will be similar to those during construction (as above), pre-decommissioning surveys are likely to be required to inform on any mitigation and protected species licensing, as required at the time of decommissioning.

8.11 Assessment of Likely Impacts and Effects on Relevant Ecological Features

- 8.11.1 This section assesses the likely impacts and potential effects of the Scheme (see Section 8.8 of this chapter) on the IEFs identified in Table 8-10 and based on the characterisation of the baseline conditions to date, in the absence of any mitigation over and above that which is embedded in the design (as described in Section 8.10). It should be stressed that the further surveys identified in Table 8-1 may identify additional IEFs to those presented in Table 8-10. An assessment of the likely impacts and potential effects of the Scheme on any additional IEFs identified following submission of the PEI Report will be presented in the ES. As such, it provides a 'worst case' assessment based on the information that is available in support the PEI Report.
- 8.11.2 An initial consideration of potential impacts and effects arising from the construction, operation and decommissioning phases of the Scheme on the IEFs identified in Table 8-10 is provided in Table 8-12 to Table 8-13, to set the requirements for the more detailed assessment that follows.



Sites statutorily and non-statutorily designated for their biodiversity value

8.11.3 The statutory and non-statutory designated sites that have been considered are presented in Table 8-10. Where there is the potential for significant effects on known IEFs then this is stated and the relevant receptors assessed in Section 8.12 of this chapter.



Table 8-12 Determination of relevant ecological features – Designated Sites

IEF	Importance (see section 8.6 and Table 8-2)	Potential Impacts (see section 8.8)	Potential for an effect to occur?
Ashton's Meadow SSSI (located 1.5km from the DCO Site)	High	Construction : This SSSI (primary designation being grassland habitats) is 1.5km to the west of the DCO Site and there are no ecological or hydrological connections between this SSSI and the Scheme.	No
·		The construction of the Scheme will not directly impact on habitat within Ashton's Meadow SSSI.	
		There will be no fragmentation of habitats, or of populations of species using habitats, within Ashton's Meadow SSSI during construction.	
		Preparation of the DCO Site and the construction of the Scheme will result in dust generation, along with noise and visual disturbance. However, these will not impact on the integrity or the functioning of Ashton's Meadow SSSI, owing to the distance between this SSSI site and the Scheme.	
		The implementation of standard environmental protection measures during construction, such as dust suppression and pollution prevention, will be adopted and these measures will be formalised into the Framework CEMP and secured through the DCO. Consequently, construction related pollution will be mitigated and will not affect the integrity of this SSSI site.	
		There will be no species mortality of any species associated with Ashton's Meadow SSSI, during construction of the Scheme.	
		Therefore, there are no impact pathways, either directly or indirectly, that would impact upon the integrity or functioning of Ashton's Meadow SSSI.	
		Operation : The distance between the SSSI and the DCO Site is 1.5km and there are no pathways (<i>e.g.</i> habitat loss or disturbance to designated site features occurring during operation of the Scheme (such as through noise, water quality changes, lighting or visual)), during operation of the Scheme which could affect Ashton's Meadow SSSI.	No
		Decommissioning : Decommissioning impacts will be similar to those occurring during construction. The decommissioning of the Scheme will not directly impact on habitat within Ashton's Meadow SSSI, owing to the distance between this SSSI site and the DCO Site.	No



IEF	Importance (see section 8.6 and Table 8-2)	Potential Impacts (see section 8.8)	Potential for an effect to occur?
		There will be no fragmentation of habitats, or of populations of species using habitats, within Ashton's Meadow SSSI during decommissioning.	
		There will be no disturbance to this SSSI site, habitat degradation or species mortality and any impacts at the time of decommissioning would be mitigated fully in line with relevant legislative and policy requirements. These measures will be included within the Framework DEMP, submitted with the ES as part of the DCO submission.	
Lea Marsh SSSI (located 1.7km from the DCO Site)	High	Construction : This SSSI (primary designation being an unimproved floodplain meadow) is 1.7km to the north-west of the DCO Site and there are no ecological or hydrological connections between this SSSI and the Scheme.	No
		The construction of the Scheme will not directly impact on habitat within Lea Marsh SSSI.	
		There will be no fragmentation of habitats, or of populations of species using habitats, within Lea Marsh SSSI during construction.	
		Preparation of the DCO Site and the construction of the Scheme will result in dust	
		generation, along with noise and visual disturbance. However, these will not impact on the integrity or the functioning of Lea Marsh SSSI, owing to the distance between this SSSI site and the Scheme.	
		The implementation of standard environmental protection measures during construction, such as dust suppression and pollution prevention, will be adopted and these measures will be formalised into the Framework CEMP and secured through the DCO. Consequently, construction related pollution will be mitigated and will not affect the integrity of this SSSI site.	
		There will be no species mortality of any species associated with Lea Marsh SSSI, during construction of the Scheme.	
		Therefore, there are no impact pathways, either directly or indirectly, that would impact upon the integrity or functioning of Lea Marsh SSSI.	
		Operation : The distance between the SSSI and the DCO Site is 1.7km and there are no pathways (e.g. habitat loss or disturbance to designated site features occurring during operation of the Scheme (such as through noise, water quality changes, lighting or visual)), during operation of the Scheme which could affect Lea Marsh SSSI.	No



IEF Potential for Importance (see section Potential Impacts (see section 8.8) 8.6 and Table 8-2) an effect to occur? **Decommissioning**: Decommissioning impacts will be similar to those occurring during No construction. The decommissioning of the Scheme will not directly impact on habitat within Lea Marsh SSSI, owing to the distance between this SSSI site and the DCO Site. There will be no fragmentation of habitats, or of populations of species using habitats, within Lea Marsh SSSI during decommissioning. There will be no disturbance to this SSSI site, habitat degradation or species mortality and any impacts at the time of decommissioning would be mitigated fully in line with relevant legislative and policy requirements. These measures will be included within the Framework DEMP, submitted with the ES as part of the DCO submission. Cow Pasture Lane Drains Medium Construction: Cow Pasture Lane Drain LWS is within the footprint of the Grid Connection Yes LWS (within the DCO Site) Route and this LWS is designated for its habitat. The majority of this LWS and its habitat will be avoided during construction, with setbacks of 10m to protect riparian habitats (see Section 8.10) outside of the construction area. The exact habitat composition within the footprint of the Scheme has not been determined and will be surveyed in detail in 2022. Dependent on the construction methods used to install the grid connection route, there is potential to directly impact on habitat within Cow Pasture Lane Drain LWS along a working right of way of 30 to 40m (see Chapter 2: The Scheme). Methods such as boring, microtunnelling or impact moling methods would not directly impact upon habitats within the LWS, although the exact route and construction methods to be used are yet to be defined. Once defined, measures to remove or reduce impacts on the LWS will be included within the Framework CEMP submitted with the ES as part of the DCO submission. Construction of the grid connection route will lead to temporary fragmentation of habitats within the LWS. Boundary vegetation will be retained and protected, as much as is practicable, which will maintain connectivity for any species using the LWS. Any construction within the vicinity of this LWS may require temporary lighting, which has the potential to spill into adjacent habitats. With reference to Chapter 2: The Scheme, construction working hours during summer months will be 7am until 7pm Monday to Friday and during construction in the winter months (where working hours will be 8am until 6pm, Monday to Friday), mobile lighting towers with a power output of 8 kilo volt-amperes (kVAs) will be used. Any lighting that is required for the construction of the Scheme will be directed away from existing retained and sensitive habitats to minimise light disturbance to species



IEF Potential for Importance (see section Potential Impacts (see section 8.8) 8.6 and Table 8-2) an effect to occur? associated with these habitats (see also section 8.10). Any requirements for task-specific lighting during construction will be designed to be downward directional and will only be used for the duration of the task. All temporary lighting will need to satisfy health and safety requirements, as well as minimising potential effects on the surrounding areas by minimising sky glow, glare and light spillage. The direction of required construction lighting (facing away from Cow Pasture Lane Drains LWS and into the Scheme and existing boundary features (woodland/hedgerows)) will also reduce the potential for light spill on sensitive habitats from construction activities. During construction, there is potential for pollutant spills and surface runoff into watercourses hydrologically connected to these sites, which have the potential to adversely affect habitats within the LWS and, consequently, species associated with such habitats. The implementation of standard environmental protection measures (such as dust suppression and pollution prevention) will be adopted during construction, formalised into the Framework CEMP. With the implementation of standard environmental protection measures, there will be no indirect impacts to Cow Pasture Lane Drains LWS which will affect the integrity of the LWS. There will be no species mortality of any species associated with Cow Pasture Lane Drains LWS, as a result of construction of the Scheme. **Operation**: Cow Pasture Lane Drains LWS is within the Grid Connection Route and, during No operation of the Scheme, there are no pathways (e.g. habitat loss or disturbance to designated site features such as through noise, water quality, air quality, lighting or visual) which could affect this LWS. **Decommissioning**: Medium voltage buried cables will remain *in situ* and therefore there are No no pathways (e.g. habitat loss or disturbance to designated site features such as through noise, water quality, air quality, lighting or visual) which could affect this LWS during decommissionina. Coates Wetland LWS Medium Construction: Coates Wetland LWS is designated for its habitat (including wetland) and is No

directly adjacent to the Grid Connection Route of the Scheme, with ecological and

hydrological connections between this LWS and the Scheme.

(immediately adjacent to

the DCO Site)



8.6 and Table 8-2)

Importance (see section Potential Impacts (see section 8.8)

Potential for an effect to occur?

The construction of the Scheme will not directly impact on habitat within Coates Wetland LWS and measures to ensure incursion into this LWS does not occur will be put in place, e.g. security fencing (see also Section 8.10). These measures will be included within the Framework CEMP submitted with the ES as part of the DCO submission.

There will be no fragmentation of habitats, or of populations of species using habitats within Coates Wetland LWS during construction. Boundary vegetation, such as hedgerows and ditches will be retained, which will maintain connectivity for species across the DCO Site. Any construction within the vicinity of this LWS may require temporary lighting, which has the potential to spill into adjacent habitats. With reference to Chapter 2: The Scheme, construction working hours during summer months will be 7am until 7pm Monday to Friday and during construction in the winter months (where working hours will be 8am until 6pm, Monday to Friday), mobile lighting towers with a power output of 8 kilo volt-amperes (kVAs) will be used. Any lighting that is required for the construction of the Scheme will be directed away from existing retained and sensitive habitats to minimise light disturbance to species associated with these habitats. Any requirements for task-specific lighting during construction will be designed to be downward directional and will only be used for the duration of the task. All temporary lighting will need to satisfy health and safety requirements, as well as minimising potential effects on the surrounding areas by minimising sky glow, glare and light spillage. The direction of required construction lighting (facing away from Coates Wetland LWS and into the Scheme) will also reduce the potential for light spill on sensitive habitats from construction activities.

During construction, there is potential for pollutant spills and surface runoff into watercourses hydrologically connected to Coates Wetland LWS, which has the potential to adversely affect aquatic habitats and, consequently, species associated with them. Embedded mitigation measures, with regards to the management of construction site run-off, the management of spillage risk, the management of flood risk, the management of risk to morphology of waterbodies (as described in Chapter 9: Water Environment) will ensure that no indirect impacts to watercourses, which in turn could affect Coates Wetland LWS occurs, Standard environmental protection measures (such as dust suppression and pollution prevention) will be implemented and adopted during construction. These measures will be included within the Framework CEMP submitted with the ES as part of the DCO submission. With the



IEF	Importance (see section 8.6 and Table 8-2)	Potential Impacts (see section 8.8)	Potential for an effect to occur?
		implementation of standard environmental protection measures, there will be no indirect impacts to this LWS during construction.	
		There will be no species mortality of any species associated with Coates Wetland LWS, as a result of construction of the Scheme.	
		Therefore, there are no impact pathways, either directly or indirectly, that would impact upon the integrity or functioning of Coates Wetland LWS during construction.:	
		Operation : Cow Pasture Lane Drains LWS is adjacent to the Grid Connection Route and, during operation of the Scheme, there are no pathways (e.g. habitat loss or disturbance to designated site features such as through noise, water quality, air quality, lighting or visual) which could affect this LWS.	No
		Decommissioning : Medium voltage buried cables will remain in situ and therefore there are no pathways (e.g. habitat loss or disturbance to designated site features such as through noise, water quality, air quality, lighting or visual) which could affect this LWS during decommissioning.	No
Knaith Park Wood LWS (located approximately 15m from the DCO Site)	Medium	Construction : Knaith Park Wood LWS is a woodland LWS which is directly adjacent to the Solar and Energy Storage Park Site with ecological and hydrological connections between this LWS and the Scheme.	No
		The construction of the Scheme will not directly impact on habitat within Knaith Park Wood LWS and measures to ensure incursion into this LWS does not occur will be put in place, e.g. security fencing. Furthermore, buffers from woodland habitats are embedded into the design of the Scheme (see Section 8.10). These measures will be included within the Framework CEMP submitted with the ES as part of the DCO submission.	
		There will be no fragmentation of habitats, or of populations of species using habitats, within Knaith Park Wood LWS during construction. Boundary vegetation, such as hedgerows connecting woodland sites will be retained, which will maintain connectivity for species across the DCO Site. Furthermore, the construction of the majority of the Scheme will be screened by existing vegetation, which will prevent disturbance to species using woodland habitats in Knaith Park Wood LWS.	
		Any construction within the vicinity of Knaith Park Wood LWS may require temporary lighting, which has the potential to spill into adjacent habitats. With reference to Chapter 2: The	



8.6 and Table 8-2)

Importance (see section Potential Impacts (see section 8.8)

Potential for an effect to occur?

Scheme, construction working hours during summer months will be 7am until 7pm Monday to Friday and during construction in the winter months (where working hours will be 8am until 6pm, Monday to Friday) mobile lighting towers with a power output of 8 kilo volt-amperes (kVAs) will be used. Any lighting that is required for the construction of the Scheme will be directed away from existing retained and sensitive habitats to minimise light disturbance to species associated with these habitats. Any requirements for task-specific lighting during construction will be designed to be downward directional and will only be used for the duration of the task. All temporary lighting will need to satisfy health and safety requirements, as well as minimising potential effects on the surrounding areas by minimising sky glow, glare and light spillage. The direction of required construction lighting (facing away from Knaith Park Wood LWS and into the Scheme) will also reduce the potential for light spill on sensitive habitats from construction activities.

During construction, there is potential for pollutant spills and surface runoff into watercourses hydrologically connected to Knaith Park Wood LWS, which has the potential to adversely affect woodland habitats and, consequently, species associated with them. Embedded mitigation measures, with regards to the management of construction site run-off, the management of spillage risk, the management of flood risk, the management of risk to morphology of waterbodies (as described in Chapter 9: Water Environment)) will ensure that no indirect impacts to watercourses, which in turn could affect Knaith Park Wood LWS occurs. Buffer zones, of a minimum of 15m between woodland habitats (including Knaith Park Wood LWS) (see Section 8.10) and any development is embedded into the Scheme and standard environmental protection measures (such as dust suppression and pollution prevention) will be implemented and adopted during construction. These measures will be included within the Framework CEMP submitted with the ES as part of the DCO submission. With the buffer zones and implementation of standard environmental protection measures. there will be no indirect impacts to this LWS.

There will be no species mortality of any species associated with Knaith Park Wood LWS, as a result of construction of the Scheme.

Therefore, there are no impact pathways, either directly or indirectly, that would impact upon the integrity or functioning of Knaith Park Wood LWS during construction.



IEF	Importance (see section 8.6 and Table 8-2)	Potential Impacts (see section 8.8)	Potential for an effect to occur?
		Operation : The management of surface water, including for PV array runoff, BESS runoff and foul water drainage (see also Chapter 9 : Water Environment) will ensure no hydrological impacts occur and that there are consequently no impacts upon Knaith Park Wood LWS during operation of the Scheme.	No
		There are no pathways (e.g. habitat loss or disturbance to woodland, such as through noise, lighting or visual), during operation of the Scheme which could affect Knaith Park Wood LWS.	
		Decommissioning : Decommissioning impacts will be similar to those occurring during construction, with any impacts mitigated fully in line with relevant legislative and policy requirements. These measures will be included within the Framework DEMP, submitted with the ES as part of the DCO submission.	No
Cottam Wetlands LWS (located approximately 30m from the DCO Site)	Medium	Construction : Cottam Wetlands LWS lies outside the Grid Connection Route (at a distance of 30m) and the construction of the Scheme will not directly impact on habitat within this non-statutory designated site.	No
,		There will be no fragmentation of habitats, or of populations of species using habitats within Cottam Wetlands LWS during construction. Boundary vegetation, such as hedgerows and ditches will be retained.	
		Preparation of the DCO Site and the construction of the Scheme will result in dust generation, along with noise and visual disturbance. Noise (see Chapter 11: Noise and Vibration) and visual disturbance (see Chapter 10: Landscape and Visual Amenity) will not impact on the integrity or the functioning of Cottam Wetlands LWS. Furthermore, the construction of the Grid Connection Route will be screened by existing vegetation. During construction, there is potential for pollutant spills and surface runoff into watercourses hydrologically connected to Cottam Wetlands LWS, which has the potential to adversely affect habitats and, consequently, species associated with them. Embedded mitigation measures, with regards to the management of construction site run-off, the management of spillage risk, the management of flood risk, the management of risk to morphology of waterbodies (as described in Chapter 9: Water Environment) will ensure that no indirect impacts to watercourses, which in turn could affect this LWS occurs. Standard environmental protection measures (such as dust suppression and pollution prevention) will be	



IEF	Importance (see section 8.6 and Table 8-2)	Potential Impacts (see section 8.8)	Potential for an effect to occur?
		implemented and adopted during construction. These measures will be included within the Framework CEMP submitted with the ES as part of the DCO submission. There will be no species mortality of any species associated with Cottam Wetlands LWS, as a result of construction of the Scheme. Therefore, there are no impact pathways, either directly or indirectly, that would impact upon the integrity or functioning of these non-statutory designated sites.	
		Operation : Cottam Wetlands LWS is approximately 30m from the Grid Connection Route and, during operation of the Scheme, there are no pathways (<i>e.g.</i> habitat loss or disturbance to designated site features such as through noise, water quality, air quality, lighting or visual) which could affect this LWS.	No
		Decommissioning : Medium voltage buried cables will remain in situ and therefore there are no pathways (e.g. habitat loss or disturbance to designated site features such as through noise, water quality, air quality, lighting or visual) which could affect this LWS during decommissioning.	No
Cottam Ponds LWS ((located approximately 30m from the DCO Site)	Medium	Construction: Cottam Ponds LWS lies outside the Grid Connection Route (at a distance of 60m) and the construction of the Scheme will not directly impact on habitat within this non-statutory designated site. There will be no fragmentation of habitats, or of populations of species using habitats within Cottam Ponds LWS during construction. Boundary vegetation, such as hedgerows and ditches will be retained. Preparation of the DCO Site and the construction of the Scheme will result in dust generation, along with noise and visual disturbance. Noise (see Chapter 11: Noise and Vibration) and visual disturbance (see Chapter 10: Landscape and Visual Amenity) will not impact on the integrity or the functioning of Cottam Ponds LWS. Furthermore, the construction of the Grid Connection Route will be screened by existing vegetation. During construction, there is potential for pollutant spills and surface runoff into watercourses hydrologically connected to Cottam Ponds LWS, which has the potential to adversely affect habitats and, consequently, species associated with them. Embedded mitigation measures, with regards to the management of construction site run-off, the management of spillage risk, the management of flood risk, the management of risk to morphology of waterbodies (as	No



IEF	Importance (see section 8.6 and Table 8-2)	Potential Impacts (see section 8.8)	Potential for an effect to occur?
		described in Chapter 9: Water Environment) will ensure that no indirect impacts to watercourses, which in turn could affect this LWS occurs. Standard environmental protection measures (such as dust suppression and pollution prevention) will be implemented and adopted during construction. These measures will be included within the Framework CEMP submitted with the ES as part of the DCO submission.	
		There will be no species mortality of any species occurring within Cottam Ponds LWS, as a result of construction of the Scheme.	
		Therefore, there are no impact pathways, either directly or indirectly, that would impact upon the integrity or functioning of these non-statutory designated sites.	
		Operation : Cottam Ponds LWS is approximately 60m from the Grid Connection Route and, during operation of the Scheme, there are no pathways (<i>e.g.</i> habitat loss or disturbance to designated site features such as through noise, water quality, air quality, lighting or visual) which could affect this LWS.	No
		Decommissioning : Medium voltage buried cables will remain in situ and therefore there are no pathways (e.g. habitat loss or disturbance to designated site features such as through noise, water quality, air quality, lighting or visual) which could affect this LWS during decommissioning.	No
Littleborough Lagoons LWS, Out Ings LWS, Thurlby Wood LWS, Torksey Ferry Road Ditch LWS, Broad Lane Grassland, North Leverton LWS, Mother Drain, Upper Ings LWS, Priory Farm LWS, Ashton's Meadow LWS, Thornhill Lane Drain and Littleborough LWS		Construction: These non-statutory designated sites (all LWS) are all outside the DCO Site, the closest of which is Littleborough Lagoons LWS, which is approximately 370m from the DCO Site. The construction of the Scheme will not directly impact on habitat within these non-statutory designated sites. There will be no fragmentation of habitats, or of populations of species using habitats within any of these non-statutory designated sites during construction. Boundary vegetation, such as hedgerows and ditches will be retained. Preparation of the DCO Site and the construction of the Scheme will result in dust generation, along with noise and visual disturbance. Noise (see Chapter 11: Noise and Vibration) and visual disturbance (see Chapter 10: Landscape and Visual Amenity) will not impact on the integrity or the functioning of these sites, owing to the distance between	No



8.6 and Table 8-2)

Importance (see section Potential Impacts (see section 8.8)

Potential for an effect to occur?

(all located at a distance greater than 300m from the DCO Site)

these non-statutory designated sites and the DCO Site. Furthermore, the construction of the majority of the Scheme will be screened by existing vegetation.

During construction, there is potential for pollutant spills and surface runoff into watercourses hydrologically connected to these sites, which have the potential to adversely affect habitats and, consequently, species associated with them. Embedded mitigation measures, with regards to the management of construction site run-off, the management of spillage risk, the management of flood risk, the management of risk to morphology of waterbodies (as described in Chapter 9: Water Environment) will ensure that no indirect impacts to watercourses, which in turn could affect these LWS's occurs. Standard environmental protection measures (such as dust suppression and pollution prevention) will be implemented and adopted during construction. These measures will be included within the Framework CEMP submitted with the ES as part of the DCO submission.

There will be no species mortality of any species associated with these designated sites, as a result of construction of the Scheme.

Therefore, there are no impact pathways, either directly or indirectly, that would impact upon the integrity or functioning of these non-statutory designated sites.

Operation: The management of surface water, including for PV array runoff, BESS runoff and foul water drainage (see also Chapter 9: Water Environment) will ensure no hydrological impacts occur and that there are consequently no impacts upon any nonstatutory sites during operation of the Scheme.

There are no pathways (e.g. habitat loss or disturbance to habitats, such as through noise, lighting or visual), during operation of the Scheme which could affect any LWS.

Decommissioning: Decommissioning impacts will be similar to those occurring during construction, with any impacts mitigated fully in line with relevant legislative and policy requirements. These measures will be included within the Framework DEMP, submitted with the ES as part of the DCO submission.

No

No

Prepared for: Gate Burton Energy Park Limited



Habitats and Species

8.11.4 The relevant ecological features that have been identified to date and therefore considered in this PEI Report, are presented in Table 8-13. Where there is the potential for significant effects on known IEFs, then this is stated and the relevant receptors assessed in Section 8.12 of this chapter.



Table 8-13 Determination of relevant ecological features – Habitats and Species

IEF	Importance (refer to Section 8.6 and Table 8-2)	Potential Impacts (refer to Section 8.8)	Potential for an effect to occur?
Broad-leaved woodland (including ancient woodland)	Medium	Construction : This habitat was recorded within the DCO Site. The construction of the Scheme will not directly impact broad-leaved woodland and measures to ensure incursion into this habitat does not occur will be put in place, <i>e.g.</i> security fencing. Furthermore, buffers from woodland habitats are embedded into the design of the Scheme (see Section 8.10). These measures will be included within the Framework CEMP submitted with the ES as part of the DCO submission.	No
		There will be no fragmentation of woodland habitats, or of populations of species using woodlands, during construction. Boundary vegetation, such as hedgerows connecting woodland sites will be retained, which will maintain connectivity for species across the DCO Site. Furthermore, the construction of the majority of the Scheme will be screened by existing vegetation, which will prevent disturbance to species using woodland habitats. Buffer zones, of a minimum of 15m between woodland habitats (see Section 8.10) and any development is embedded into the Scheme and standard environmental protection measures (such as dust suppression and pollution prevention) will be implemented and adopted during construction. These measures will be included within the Framework CEMP submitted with the ES as part of the DCO submission. With the buffer zones and	
		implementation of standard environmental protection measures, there will be no indirect impacts to broad-leaved woodland. Therefore, there are no impact pathways, either directly or indirectly, that would impact upon broad-leaved woodland during construction of the Scheme.	
		Operation: There are no impact pathways (e.g. habitat loss or degradation to woodland), during operation of the Scheme which could affect broad-leaved woodland.	No
		Decommissioning: Decommissioning impacts will be similar to those occurring during construction, with any impacts mitigated fully in line with relevant legislative and policy requirements. These measures will be included within the Framework DEMP, submitted with the ES as part of the DCO submission.	No
	Medium	Construction: The construction of the Scheme will not directly impact the area of acid grassland within the DCO site as this habitat is away from areas that will be included for	No



IEF	Importance (refer to Section 8.6 and Table 8-2)	Potential Impacts (refer to Section 8.8)	Potential for an effect to occur?
Acid Grassland (semi-improved)		Solar PV arrays and measures to ensure incursion into this habitat does not occur will be put in place, e.g. security fencing. Furthermore, there are existing features, such as hedgerows which separate the area of acid grassland from the rest of the Scheme, further reducing the likelihood of disturbance. These measures will be included within the Framework CEMP submitted with the ES as part of the DCO submission.	
		Preparation of the DCO Site and the construction of the Scheme will result in dust generation, however, preventive measures as set out and secured in the Framework CEMP and detailed in Chapter 15: Other Environmental Topics , will ensure no degradation to acid grassland. Therefore, there are no impact pathways, either directly or indirectly, that would impact upon acid grassland during construction of the Scheme.	
		Operation: There are no impact pathways (<i>e.g.</i> habitat loss or degradation to grassland), during operation of the Scheme which could affect acid grassland.	No
		Decommissioning: Decommissioning impacts will be similar to those occurring during construction, with any impacts mitigated fully in line with relevant legislative and policy requirements. These measures will be included within the Framework DEMP submitted with the ES as part of the DCO submission.	No
Semi-improved neutral grassland (Coastal and Floodplain and Grazing Marsh)	Medium	Construction: This habitat was recorded within the Grid Connection Route. There will be no direct loss of coastal floodplain and grazing marsh habitat and there will be no fragmentation of habitats, or of populations of species using habitats, during construction. Construction methods across the River Trent and adjacent coastal and floodplain grazing marsh will utilise HDD methods.	No
Grazing Marsh)		During construction, there is potential for pollutant spills and surface runoff into the floodplain habitats and these spills have the potential to adversely affect habitats and species associated with running water habitats. However undeveloped buffers from watercourses and standard environmental protection measures (see Section 8.10) will be implemented and adopted during construction, formalised through the Framework CEMP (submitted with the ES as part of the DCO submission) and these measures will include dust suppression and pollution prevention. Consequently, indirect effects (such as disturbance and habitat degradation) to the floodplain habitats during construction will not occur.	



IEF	Importance (refer to Section 8.6 and Table 8-2)	Potential Impacts (refer to Section 8.8)	Potential for an effect to occur?
		Operation : There are no impact pathways (<i>e.g.</i> habitat loss or degradation), during operation of the Scheme which could affect semi-improved neutral grassland as this habitat is within the Grid Connection Route.	No
		Decommissioning : Decommissioning impacts will be similar to those occurring during construction, with any impacts mitigated fully in line with relevant legislative and policy requirements. These measures will be included within the Framework DEMP, submitted with the ES as part of the DCO submission. However, medium voltage buried cables will remain in situ and therefore there are no pathways (<i>e.g.</i> habitat loss or disturbance to habitat features such as through noise, water quality, air quality, lighting or visual) which could affect this habitat during decommissioning.	No
Marsh / Marshy Grassland	Low	Construction: This habitat was recorded within the Solar and Energy Storage Park Site. The construction of the Scheme will directly impact the small (0.37 ha) area of marshy grassland within the DCO Site as this habitat is currently within areas that will be included for Solar PV arrays. Habitat surveys in May/June 2022 will determine the quality and value of this habitat in detail. These will inform future iterations of the Scheme design and requirements for mitigation.	Yes
		Operation : There are no impact pathways (e.g. habitat loss or degradation), during operation of the Scheme which could affect marshy grassland.	No
		Decommissioning : Decommissioning impacts will be similar to those occurring during construction, with any impacts mitigated fully in line with relevant legislative and policy requirements. These measures will be included within the Framework DEMP, submitted with the ES as part of the DCO submission.	No
Swamp	Low	Construction: The construction of the Scheme will not directly impact swamp habitat, which is found around some of the ponds within the DCO Site. Measures to ensure incursion into this habitat does not occur, such as security fencing will be put into place during construction. Furthermore, buffers from ponds are embedded into the design of the Scheme (see section 8.10). These measures will be included within the Framework CEMP submitted with the ES as part of the DCO submission.	No



IEF	Importance (refer to Section 8.6 and Table 8-2)	Potential Impacts (refer to Section 8.8)	Potential for an effect to occur?
		There will be no fragmentation of swamp habitats, or of populations of species using swamp habitats, during construction. Surrounding habitat will be converted from arable to grassland, which will improve connectivity for any species associated with swamp habitat (such as amphibians).	
		Buffer zones, of a minimum of 20m between ponds (see Section 8.10) and any development is embedded into the Scheme and standard environmental protection measures (such as dust suppression and pollution prevention) will be implemented and adopted during construction. These measures will be included within the Framework CEMP submitted with the ES as part of the DCO submission. With the buffer zones and implementation of standard environmental protection measures, there will be no indirect impacts to swamp habitat. Therefore, there are no impact pathways, either directly or indirectly, that would impact upon	
		swamp habitats during construction of the Scheme. Operation: There are no impact pathways (e.g. habitat loss or degradation), during operation of the Scheme which could affect swamp habitats.	No
		Decommissioning : Decommissioning impacts will be similar to those occurring during construction, with any impacts mitigated fully in line with relevant legislative and policy requirements. These measures will be included within the Framework DEMP, submitted with the ES as part of the DCO submission.	No
Standing Water	Low	Construction: All standing water (ponds) present within the DCO Site will be retained and measures embedded within the Scheme design to protect retained habitats during construction, such as that security fencing will be established at an early stage to protect retained habitats from incursion during construction. Therefore, there will be no direct loss of standing water habitat. There will be no fragmentation of habitats, or of populations of species using standing water habitats (such as amphibians), during construction and swamp habitat (see above) and marginal vegetation around ponds will be retained. Furthermore, surrounding habitat will be converted from arable to grassland, which will improve connectivity for any species associated with standing water (such as amphibians).	No



IEF	Importance (refer to Section 8.6 and Table 8-2)	Potential Impacts (refer to Section 8.8)	Potential for an effect to occur?
		During construction, there is the potential that preparation of the DCO Site and construction of the Scheme will result in dust and other pollutants (such as emissions from construction vehicles and oil-spills) which may impact ponds, through surface water run-off. Implementation of standard environmental protection measures during construction, such as dust suppression and pollution prevention, will be adopted and these measures are formalised through the Framework CEMP submitted with the ES as part of the DCO submission. Embedded mitigation measures, with regards to the management of construction site run-off, the management of spillage risk, the management of flood risk, the management of risk to morphology of waterbodies will be included in the assessment of the water environment (Chapter 9: Water Environment) to ensure that no indirect impacts to standing water habitats occurs. Consequently, pollution during construction will not affect the integrity of ponds and of those species using ponds. There will be no species mortality of any species using standing water habitats during construction of the Scheme. Therefore, there are no impact pathways, either directly or indirectly, that would impact upon standing water within the DCO Site.	
		Operation : There are no impact pathways (e.g. habitat loss or degradation), during operation of the Scheme which could affect standing water.	No
		Decommissioning : Decommissioning impacts will be similar to those occurring during construction, with any impacts mitigated fully in line with relevant legislative and policy requirements. These measures will be included within the Framework DEMP, submitted with the ES as part of the DCO submission.	No
Running Water	Medium	Construction: There will be no direct loss of running water habitat and there will be no fragmentation of habitats, or of populations of species using habitats, within the River Trent during construction. Construction methods across the River Trent will utilise HDD methods. However, dependent on the construction methods used to install the Grid Connection Route, there is potential to directly impact on running water habitat along a working right of way of 30m to 40m (see Chapter 2: The Scheme). Methods such as boring, micro-tunnelling or impact moling methods would not directly impact upon running water habitats, although the exact route and construction methods to be used are yet to be defined. Once defined, these	Yes



Importance (refer to Section 8.6 and Table 8-2)

Potential Impacts (refer to Section 8.8)

Potential for an effect to occur?

measures to remove or reduce impacts on running water will be included within the Framework CEMP submitted with the ES as part of the DCO submission.

Construction of the grid connection route will lead to temporary fragmentation of running water habitats. Boundary vegetation will be retained and protected, as much as is practicable, which will maintain connectivity for any species using running water habitats and protected species surveys will be undertaken in 2022 to determine the presence of riparian mammals.

Any construction within the vicinity of watercourses may require temporary lighting, which has the potential to spill into the River Trent. Artificially lighting of these habitats may disrupt species' movements. Therefore, any lighting that is required for the construction of the Scheme will be directed away from existing retained and sensitive habitats to minimise light disturbance to species associated with these habitats. Any requirements for task-specific lighting during construction will be designed to be downward directional and will only be used for the duration of the task. All temporary lighting will need to satisfy health and safety requirements, as well as minimising potential effects on the surrounding areas by minimising sky glow, glare and light spillage.

During construction, there is potential for pollutant spills and surface runoff into the River Trent and other watercourses and these spills have the potential to adversely affect habitats and species associated with running water habitats. However, standard environmental protection measures (see Section 8.10) will be implemented and adopted during construction, formalised through the Framework CEMP (submitted with the ES as part of the DCO submission) and these measures will include dust suppression and pollution prevention. Consequently, indirect effects (such as disturbance and habitat degradation) to the River Trent and other watercourses during construction will not occur.

There will be no species mortality of any species associated with running water during construction of the Scheme. Therefore, there are no impact pathways, either directly or indirectly, that would impact upon running water.

Operation: There are no pathways (*e.g.* habitat loss, disturbance of habitats and pollution), during operation of the Scheme which could affect retained habitats.

No



IEF	Importance (refer to Section 8.6 and Table 8-2)	Potential Impacts (refer to Section 8.8)	Potential for an effect to occur?
		Decommissioning: Decommissioning impacts will be similar to those occurring during construction, with any impacts mitigated fully in line with relevant legislative and policy requirements. These measures will be included within the Framework DEMP, submitted with the ES as part of the DCO submission. However, medium voltage buried cables will remain in situ and therefore there are no pathways (<i>e.g.</i> habitat loss or disturbance to habitats such as through noise, water quality, air quality, lighting or visual) which could affect this habitat during decommissioning.	No
Hedgerows	Medium	Construction: Hedgerows are located across the DCO Site. Whilst the embedded mitigation includes the retention and avoidance of the majority of hedgerows, there is the potential for a loss of small sections of hedgerow during construction, to facilitate the grid connection route, new fence lines and access routes. These habitats will be restored, post-construction, but there is likely to be a temporary (short-term) adverse effect on this habitat type. Buffer zones, of a minimum of 5m between hedgerows (see Section 8.10) and any solar development is embedded into the Scheme and standard environmental protection measures (such as dust suppression and pollution prevention) will be implemented and adopted during construction. These measures will be included within the Framework CEMP submitted with the ES as part of the DCO submission. With the buffer zones and implementation of standard environmental protection measures, there will be no indirect impacts to the majority of hedgerows.	Yes
		Operation : There are no impact pathways (<i>e.g.</i> habitat loss or degradation), during operation of the Scheme which could affect hedgerows.	No
		Decommissioning : Decommissioning impacts will be similar to those occurring during construction, with any impacts mitigated fully in line with relevant legislative and policy requirements. These measures will be included within the Framework DEMP, submitted with the ES as part of the DCO submission.	No
Wintering Birds	Up to Medium	Construction: The construction of the Scheme will lead to the loss of arable habitat, although the amount of permanent habitat loss within the DCO Site has been minimised as far as reasonably practicable to ensure the majority of wintering birds are not affected. Hedgerows and woodland areas will be retained and new habitats will be created (such as	No



IEF	Importance (refer to Section 8.6 and Table 8-2)	Potential Impacts (refer to Section 8.8)	Potential for an effect to occur?
		cover crops) to mitigate for the loss of species reliant on arable farmland (such as Skylark) (see Section 8.10).	
		There will be no fragmentation of habitats used by non-breeding (wintering) birds as the majority of hedgerows will be retained. Connectivity across the DCO Site will be improved with the creation of new hedgerows (see Section 8.10).	
		Best practice construction methods, as detailed in the Framework CEMP which will be submitted with the ES as part of the DCO application will include implementation of measures to minimise noise, lighting and vibration disturbance, which will in turn remove any potential disturbance to wintering birds in retained habitats.	
		There will be no species mortality during construction of the Scheme.	
		Therefore, there are no impact pathways that could affect wintering birds during construction of the Scheme.	
		Operation: During operation, no part of the Scheme will be continuously lit (see Chapter 2: The Scheme) and any lighting will be directional (into the Scheme and using directional fittings), manually operated and for operational and security purposes around electrical infrastructure (as described in Chapter 2: The Scheme). Therefore, lighting will not impact upon retained habitats (such as woodland and hedgerows) or newly created habitats (such as grassland or cover crops) and any wintering birds using such habitats. The management of surface water, including for PV array runoff, will ensure no hydrological impacts occur on retained and newly created habitats and that there are consequently no impacts upon wintering birds using them.	No
		Therefore, there are no impact pathways ($e.g.$ habitat loss, disturbance of habitats and pollution), during operation of the Scheme which could affect wintering birds.	
		Decommissioning: Decommissioning impacts will be similar to those occurring during construction with retention and avoidance, where reasonably practicable, of habitats supporting non-breeding birds at the time of decommissioning. Any impacts would require mitigating, fully in line with relevant legislative and policy requirements at the time of decommissioning and these measures will be included within the Framework DEMP.	No



IEF	Importance (refer to Section 8.6 and Table 8-2)	Potential Impacts (refer to Section 8.8)	Potential for an effect to occur?
Bats – roosting	Up to Medium	Construction: The construction of the Scheme will avoid features used by roosting bats, such as woodland and hedgerows and any trees identified as being of potential to support roosting bats. There will be no loss of important habitats used by bats anywhere within the DCO Site.	No
		The construction of the Scheme will be undertaken over many months and will not impact upon hedgerows and other boundary features associated with habitats with the potential to support roosting bats, which will retain connectivity across the DCO Site for commuting and foraging and therefore will not indirectly impact upon roosting bats. Therefore, there will be no fragmentation of habitats used by bats.	
		During construction, there is potential for disturbance and light pollution which could adversely affect habitats used by roosting bats. However, standard environmental protection measures will be implemented and adopted during construction, as detailed in the Framework CEMP which will be submitted with the ES as part of the DCO application This will include measures for dust suppression, pollution prevention, screening of important habitats and measures to control light spill. Consequently, indirect effects to habitats supporting bats during construction will be avoided.	
		There will be no species mortality during construction of the Scheme. Therefore, there are no impact pathways, either directly or indirectly, that would impact upon roosting bats.	
		Operation: During operation, no part of the Scheme will be continuously lit and any lighting will be directional (into the Scheme and using directional fittings), manually operated and for operational and security purposes around electrical infrastructure. Therefore, lighting will not impact upon retained habitats (such as woodland and hedgerows) and any bats using such habitats for roosting.	No
		Therefore, there are no pathways (e.g. habitat loss and/ or disturbance, such as noise, lighting or visual), during operation of the Scheme which could affect roosting bats.	
		Decommissioning: Decommissioning impacts will be similar to those occurring during construction, with retention and avoidance, where reasonably practicable, of habitats supporting bats at the time of decommissioning and any impacts mitigated fully in line with	No



IEF	Section 8.6 and Table 8-2)		Potential for an effect to occur?
		relevant legislative and policy requirements. These measures will be included within the Framework DEMP.	
Badger	Low	Construction: The construction of the Scheme will retain and avoid Badger setts recorded within the DCO Site. Furthermore, buffers from identified setts are embedded into the design of the Scheme (see Section 8.10). These measures will be included within the Framework CEMP submitted with the ES as part of the DCO submission. Pre-construction Badger surveys will be undertaken to determine baseline conditions remain the same as currently recorded and if any changes to Badger distribution are identified then a Natural England licence may be required and mitigation measures updated accordingly (see Section 8.10). There will be no fragmentation of habitats used by Badger as the Scheme has embedded sufficient buffers from retained habitats to ensure that Badger can move freely across the DCO Site. Any perimeter fencing will be permeable to Badgers (see Section 8.10), Connectivity across the DCO Site will be improved with the creation of new hedgerows and grassland, therefore increasing foraging opportunities for Badger. Standard best practice measures during construction including covering excavations or leaving them with suitable egress and safe storage of chemicals would be implemented to minimise the potential of injury to Badgers during the construction phase. These measures will be included within the Framework CEMP submitted with the ES as part of the DCO application. Therefore, there are no impact pathways (e.g. habitat loss, disturbance of habitats and pollution), during operation of the Scheme which could affect Badger.	No
		Operation: During operation, no part of the Scheme will be continuously lit (see Chapter 2: The Scheme) and any lighting will be directional (into the Scheme and using directional fittings), manually operated and for operational and security purposes around electrical infrastructure (as described in Chapter 2: The Scheme). Therefore, lighting will not impact upon Badger that utilise retained habitats (such as woodland and hedgerows), newly created habitats (such as grassland or cover crops) or on Badger setts. The management of surface water, including for PV array runoff, will ensure no hydrological impacts occur on Badger setts, or retained and newly created habitats and that there are consequently no impacts upon Badger.	No



IEF	Importance (refer to Section 8.6 and Table 8-2)	Potential Impacts (refer to Section 8.8)	Potential for an effect to occur?
		Therefore, there are no impact pathways (<i>e.g.</i> habitat loss, disturbance of habitats and pollution), during operation of the Scheme which could affect Badger.	
		Decommissioning: Decommissioning impacts will be similar to those occurring during construction with retention and avoidance of habitats supporting Badger (including Badger setts) at the time of decommissioning. Any impacts would require mitigating, fully in line with relevant legislative and policy requirements at the time of decommissioning and these measures will be included within the Framework DEMP.	No
Other Mammals (Brown Hare and Hedgehog)	Low	Construction : The construction of the Scheme will convert arable farmland, used by Brown Hare, into permanent grassland. Hedgerows, scrub and woodland (potentially used by Hedgehog) will be retained and avoided.	No
		There will be no fragmentation of habitats used by Brown Hare or Hedgehog as the Scheme has embedded sufficient buffers from retained habitats to ensure that both species can move freely across the DCO Site. Any perimeter fencing will be permeable to both species (see section 8.10),	
		Connectivity across the DCO Site will be improved with the creation of new hedgerows and grassland, therefore increasing foraging opportunities for both species.	
		Standard best practice measures during construction including covering excavations or leaving them with suitable egress and safe storage of chemicals would be implemented to minimise the potential of injury to Brown Hare and Hedgehog during the construction phase. These measures will be included within the Framework CEMP submitted with the ES as part of the DCO application.	
		The construction of the Scheme, if undertaken within the Brown Hare breeding season (typically March to August inclusive) has the potential to cause mortality to this species using habitats that are to be removed. However, the construction of the Scheme will be undertaken over many months and therefore any impacts upon Brown Hare during construction are likely to be localised and short-term. Additionally, there will be no species mortality of Hedgehog as this species, if present, would occupy retained habitats such as woodland and hedgerows. Therefore, there will be no species mortality of Brown Hare or Hedgehog during construction of the Scheme	



IEF	Importance (refer to Section 8.6 and Table 8-2)	Potential Impacts (refer to Section 8.8)	Potential for an effect to occur?
	Therefore, there are no impact pathways (e.g. habitat loss, disturbated pollution), during operation of the Scheme which could affect Brown		
		Operation: During operation, no part of the Scheme will be continuously lit and any lighting will be directional (into the Scheme and using directional fittings), manually operated and for operational and security purposes around electrical infrastructure. Therefore, lighting will not impact upon retained or newly created habitats.	No
		The management of surface water, including for PV array runoff, will ensure no hydrological impacts occur on retained and newly created habitats and that there are consequently no impacts upon species using them (such as Brown Hare or Hedgehog).	
		The conversion of arable farmland to grassland and creation of new habitats (such as hedgerows) will improve connectivity across the DCO Site for both species.	
		Therefore, there are no pathways (e.g. habitat loss and/ or disturbance, such as noise, lighting or visual), during operation of the Scheme which could affect Brown Hare or Hedgehog and there are likely to be beneficial effects to both species.	
		Decommissioning: Decommissioning impacts will be similar to those occurring during construction with retention and avoidance of habitats supporting Brown Hare and Hedgehog at the time of decommissioning. Any impacts would require mitigating, fully in line with relevant legislative and policy requirements at the time of decommissioning and these measures will be included within the Framework DEMP.	No



8.12 Significance of Effects

- 8.12.1 The effects on known IEFs have been assessed following consideration of the potential impacts outlined in Section 8.11 and with consideration of the embedded mitigation measures in Section 8.10 of this chapter.
- 8.12.2 The aim of the evaluation was to identify potentially significant effects and determine the need for bespoke mitigation measures additional to those detailed in Section 8.10 of this chapter.
- 8.12.3 Accordingly, the evaluation has identified that during construction, the following impacts on IEFs have been taken forward for further preliminary assessment:
 - Temporary loss of habitat within Cow Pasture Lane Drains LWS;
 - Temporary fragmentation of habitat within Cow Pasture Lane Drains LWS;
 - Temporary loss of running water habitat;
 - Temporary fragmentation of running water habitat;
 - · Direct loss of marshy grassland habitat; and
 - Direct loss of hedgerows within the DCO Site.
- 8.12.4 It is acknowledged that baseline surveys are ongoing and that these surveys may determine the presence of further IEFs, such as Great Crested Newt, Otter, Water Vole and protected and priority breeding bird species. These will be subject to detailed assessment, following the methods detailed in Section 8.6 and in line with the assessment presented for the IEFs identified to date in Section 8.9, and will be presented in the ES. The absence of significant effects presented in this chapter does not preclude further significant effects arising as further ecological data becomes available and allows the full characterisation of the ecological baseline and identification of any additional IEFs. The significance of effects on any further IEFs identified, will be presented in the ES.
- 8.12.5 Where the current characterisation of the baseline and assessment have identified that potential or reasonable likely presence of an IEF, but this is either not confirmed or the extent of any presence fully established yet, Table 8-14 sets out how the scheme has either embedded mitigation to avoid a significant effect occurring or whether further additional mitigation may be required, subject to outcomes of detailed surveys, to avoid and reduce an effect.



Table 8-14: IEFs not fully defined at this stage.

Potential IEF	Current understanding of the baseline and presence	Embedded and Additional Mitigation	Further surveys being undertaken to characterise baseline?	Potential Requirement for Additional Mitigation
Habitats	Priority habitats, such as hedgerows, woodland and marshy grassland, occurring within the DCO Site.	 Retention of majority of known priority and notable habitats. Undeveloped buffers of at least 15m from woodlands, individual trees and hedgerows with trees and at least 5m from hedgerows without trees. Construction Secured through the CEMP, the Scheme will comply with industry good practice and environmental protection legislation during construction e.g. prevention of surface and ground water pollution, fugitive dust management. The implementation of a security perimeter fence will prevent construction activity in proximity to retained habitats within and adjacent to the DCO Site. Specific tree protection measures will be implemented, including fencing and construction exclusion zones. Tree Root Protection fencing will be erected around retained trees, in line with British Standard BS 5837: Trees in relation to design, demolition and construction – Recommendations 	Yes. Detailed botanical surveys being undertaken to determine the value of identified habitats and categorise further habitats of value. These will be used to inform specific mitigation requirements and inform scheme design evolution, e.g. location of access tracks and internal cable routes.	Retention and protection of further habitats within the DCO Site. Creation of further habitats within the DCO Site to mitigate any further impacts.
Flora/plants	Notable arable flora have been recorded in the study area.	Scheme Design	Yes.	Retention of any areas where notable flora are recorded.

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				ENERGY PARK
Potential IEF	Current understanding of the baseline and presence	Embedded and Additional Mitigation	Further surveys being undertaken to characterise baseline?	Potential Requirement for Additional Mitigation
	Given, the arable landscape there is a high chance that notable arable flora may be present within the DCO Site.	 Retention of known priority and notable habitats. Undeveloped buffers of at least 15m from woodlands, individual trees and hedgerows with trees and at least 5m from hedgerows without trees. Construction Secured through the CEMP, the Scheme will comply with industry good practice and environmental protection legislation during construction e.g. prevention of surface and ground water pollution, fugitive dust management, . The implementation of a security perimeter fence will prevent construction access into retained habitats within and adjacent to the DCO Site. Specific tree protection measures will be implemented, including fencing and construction exclusion zones. Tree Root Protection fencing will be erected around retained trees, in line with British Standard BS 5837: Trees in relation to design, demolition and construction – Recommendations. 	Detailed botanical surveys being undertaken to determine the presence and locations of notable flora and plant species. These will be used to inform specific mitigation requirements and inform scheme design evolution.	Creation of further areas within the DCO Site to mitigate any further impacts on flora.
Terrestrial Invertebrates	Notable terrestrial invertebrates have been recorded in the study area. The DCO Site contains areas of habitat, e.g. grasslands and hadgerows suitable to	Scheme DesignRetention of known priority and notable habitats.	Yes. Terrestrial invertebrate scoping survey being undertaken to identify and characterise any areas within the	Retention of any areas where notable invertebrates are recorded, such as field margins and additional areas of grassland.

and hedgerows suitable to



Potential IEF	Current understanding of the baseline and presence	Embedded and Additional Mitigation	Further surveys being undertaken to characterise baseline?	Potential Requirement for Additional Mitigation
	support assemblages of notable species.	 Undeveloped buffers of at least 15m from woodlands, individual trees and hedgerows with trees and at least 5m from hedgerows without trees. Construction 	DCO Site of an elevated value for terrestrial invertebrates. These will be used to inform specific mitigation requirements and inform scheme design evolution	Creation of further areas within the DCO Site to mitigate any further impacts on invertebrates.
		 Secured through the CEMP, the Scheme will comply with industry good practice and environmental protection legislation during construction e.g. prevention of surface and ground water pollution, fugitive dust management. The implementation of a security perimeter fence will prevent construction access into retained habitats within and adjacent to the DCO Site. 	g	
Aquatic Invertebrates	There are aquatic habitats present with the DCO Site (e.g. ponds and watercourses) with potential to support notable aquatic invertebrate species and assemblages.	 Scheme Design Retention of ponds and a minimum of 10m of terrestrial habitats surrounding ponds. 10m buffer from watercourses within the Solar and Energy Storage Park Site to protect riparian habitats and to mitigate for potential hazards such as chemical and soils spills into watercourses and avoid potential direct impacts to water courses and any species that use them. The Scheme drainage strategy will include measures to manage surface 	Aquatic invertebrate scoping survey being undertaken to identify and characterise any areas within the DCO Site of an elevated value for aquatic invertebrates. These will be used to inform specific mitigation requirements and inform scheme design evolution	Retention of additional areas of existing habitats for aquatic invertebrates. Requirement for non-intrusive methods for crossing watercourses.



Potential IEF	Current understanding of the baseline and presence	Embedded and Additional Mitigation	Further surveys being undertaken to characterise baseline?	Potential Requirement for Additional Mitigation
		water runoff during operation and will reduce the likelihood and severity of potential pollution incidents and flooding affecting watercourses and the local ditch network to reduce or eliminate adverse effects for aquatic and riparian species and habitats Construction Secured through the CEMP, the Scheme will comply with industry good practice and environmental protection legislation during construction e.g. prevention of surface and ground water pollution, fugitive dust management.		
Amphibians	Four species of amphibian are known to be present in the study area, including Great Crested Newt. Ponds are present within the DCO Site.	 Scheme Design Retention of ponds and a minimum of 10m of terrestrial habitats surrounding ponds. Construction Secured through the CEMP, the Scheme will comply with industry good practice and environmental protection legislation during construction e.g. prevention of surface and ground water pollution, fugitive dust management, The implementation of a security perimeter fence will prevent construction access into retained 	Yes. Great Crested Newt surveys currently being undertaken to determine the presence of the species within the DCO Site and wider Zol for the species. These will be used to inform specific mitigation requirements and inform scheme design evolution	Retention of larger areas of terrestrial habitats surrounding ponds containing Great Crested Newt and maintaining connectivity throughout the DCO Site.



Potential IEF	Current understanding of the baseline and presence	Embedded and Additional Mitigation	Further surveys being undertaken to characterise baseline?	Potential Requirement for Additional Mitigation
		habitats within and adjacent to the DCO Site.		
Reptiles	Grass Snake is known to be present in the study area. Small pockets of reptile habitat present within the DCO Site, including uncropped field margins, hedgerows, woodland edge habitats and ditches.	 Scheme Design Retention of majority of known priority and notable habitats. Undeveloped buffers of at least 15m from woodlands, individual trees and hedgerows with trees and at least 5m from hedgerows without trees. Construction Secured through the CEMP, the Scheme will comply with industry good practice and environmental protection legislation during construction e.g. prevention of surface and ground water pollution, fugitive dust management, The implementation of a security perimeter fence will prevent construction access into retained habitats within and adjacent to the DCO Site. 	Yes. Reptile surveys will be undertaken to determine the presence of reptile species within the DCO Site. These will be used to inform specific mitigation requirements and inform scheme design evolution.	Retention of larger areas of habitats containing reptiles and maintaining connectivity throughout the DCO Site.
Breeding Birds	Peregrine, Hobby, Golden Plover, Barn Owl, Cetti's Warbler, Kingfisher and Red Kite have been recorded in the study area, with Barn Owl and Hobby observed within the DCO Site. Lapwing and Skylark have also been recorded within the DCO Site.	 Scheme Design Retention of majority of known priority and notable habitats. Undeveloped buffers of at least 15m from woodlands, individual trees and hedgerows with trees and at least 5m from hedgerows without trees. 	Yes. Breeding birds survey being undertaken to identify and characterise any areas within the DCO Site of an elevated value for breeding birds and to determine the presence and locations of protected and notable bird species.	Retention of additional areas of existing habitats for breeding birds. Undeveloped buffers and/or construction buffers to minimise disturbance to protected breeding species, i.e. those on Schedule 1 of the WCA.



Potential IEF	Current understanding of the baseline and presence	Embedded and Additional Mitigation	Further surveys being undertaken to characterise baseline?	Potential Requirement for Additional Mitigation
		 New habitats will be provided to increase the biodiversity of the Scheme and will include bare ground, grassland, 'cover crops', hedgerows, tree and scrub planting. 	These will be used to inform specific mitigation requirements and inform scheme design evolution.	
		The Scheme has integrated areas for such species, at an early stage, including undeveloped plots of land approximately 50x50m within arrays provide nesting habitat for Skylark and undeveloped zones within the DCO Site where management can be targeted at Lapwing.		
		 Secured through the CEMP, the Scheme will comply with industry good practice and environmental protection legislation during construction e.g. prevention of surface and ground water pollution, fugitive dust management, The implementation of a security perimeter fence will prevent construction access into retained habitats within and adjacent to the DCO Site. 		
Bats	At least six bat species (Brown Long-eared <i>Plecotus auritus</i> , Common Pipistrelle <i>Pipistrellus pipistrellus</i> , Noctule <i>Nyctalus noctule</i> , Natterer's bat <i>Myotis nattereri</i> , Soprano Pipistrelle	 Scheme Design Reasonable avoidance measures, including appropriate buffers (of 15m) around any trees with bat roost 	Yes. Bat activity survey and roost appraisals being undertaken to identify and characterise any areas within the DCO Site of an elevated value for bats and to determine the	Retention of additional areas of existing habitats for bats. Undeveloped buffers and/or construction buffers to minimise disturbance to bats.



Potential IEF

Current understanding of the baseline and presence

Pipistrellus pygmaeus, Daubenton's bat Myotis daubentonii, and Myotis sp), recorded within the study area, with Common Pipistrelle. Soprano Pipistrelle, Noctule, Brown Long-eared, Leisler's Nyctalus leisleri and Myotis sp. recorded foraging/commuting across the DCO Site.

Embedded and Additional Mitigation

potential throughout the Solar and Energy Storage Park Site.

- be planted with suitable native species to improve the connectivity of scheme design evolution. habitats (such as between ancient and other broad-leaved woodland) within and adjacent to the DCO Site.
- New areas of tree planting will be provided to create screening from Scheme infrastructure, improve habitat connectivity and increase the area of hedgerow (and woodland habitat) within the DCO Site.
- No part of the Scheme will be continuously lit. Manually operated and motion-detection lighting will be utilised for operational and security purposes around electrical infrastructure such as inverters. transformers and switchgear across the Solar PV Array Areas, and within the compounds and substations. Lighting will be directed downward and away from boundaries. No visible lighting will be utilised at the site perimeter fence, aside from the site entrance points.

Construction

 Secured through the CEMP, the Scheme will comply with industry good practice and environmental

Further surveys being undertaken to characterise baseline?

species. • Gaps in currently defunct hedges will These will be used to inform specific mitigation requirements and inform

presence and locations of bat

Potential Requirement for Additional Mitigation



Potential IEF	Current understanding of the baseline and presence	Embedded and Additional Mitigation	Further surveys being undertaken to characterise baseline?	Potential Requirement for Additional Mitigation
		protection legislation during construction e.g. prevention of surface and ground water pollution, fugitive dust management, • The implementation of a security perimeter fence will prevent construction access into retained habitats within and adjacent to the DCO Site.		
Otter	Otter recorded within the study area. Watercourses and waterbodies within the DCO Site have the potential to support Otter.	 Scheme Design 10m buffer from watercourses within the Solar and Energy Storage Park Site to protect riparian habitats and to mitigate for potential hazards such as chemical and soils spills into watercourses and avoid potential direct impacts to water courses and any protected species (such as Otter) that use them. The Scheme drainage strategy will include measures to manage surface water runoff during operation and will reduce the likelihood and severity of potential pollution incidents and flooding affecting watercourses and the local ditch network to reduce or eliminate adverse effects for aquatic and riparian species and habitats Construction Secured through the CEMP, the Scheme will comply with industry good practice and environmental 		Retention of additional areas of existing habitats for Otter. Undeveloped buffers and/or construction buffers to minimise disturbance to Otter.



Potential IEF	Current understanding of the baseline and presence	Embedded and Additional Mitigation	Further surveys being undertaken to characterise baseline?	Potential Requirement for Additional Mitigation
		protection legislation during construction e.g. prevention of surface and ground water pollution, fugitive dust management,		
Water Vole	Water Vole recorded within the study area. Evidence of Water Vole presence found within the Solar and Energy Storage Park Site.	 Scheme Design 10m buffer from watercourses within the Solar and Energy Storage Park Site to protect riparian habitats and to mitigate for potential hazards such as chemical and soils spills into watercourses and avoid potential direct impacts to water courses and any protected species (such as Water Vole) that use them. Construction Secured through the CEMP, the Scheme will comply with industry good practice and environmental protection legislation during construction e.g. prevention of surface and ground water pollution, fugitive dust management. 	Vole. These will be used to inform specific mitigation requirements and inform scheme design evolution.	



Construction

Temporary loss of habitat within Cow Pasture Lane Drains LWS

- 8.12.6 The construction of the grid connection route for the Scheme is predicted to directly impact upon habitats within Cow Pasture Lane Drains LWS, although the exact construction methods within this area and habitats affected (as a result of no survey information at the time of writing this PEI Report) are not known. Standard environmental protection measures will be implemented during construction of the Scheme to prevent indirect impacts occurring and also to habitats outside of the grid connection route.
- 8.12.7 Taking into account the embedded mitigation measures, standard mitigation measures and the temporary land-take required to install the grid connection route(see Section 8.4.1) resulting in the temporary loss of habitat within this LWS (which will be restored post-construction), the magnitude of this impact (see Table 8-3) has been provisionally assessed as **medium**, which results in a temporary **moderate adverse** effect, that is potentially significant in EIA terms.

Temporary fragmentation of habitat within Cow Pasture Lane Drains LWS

- 8.12.8 The construction of the grid connection for the Scheme is predicted to directly impact upon habitats within Cow Pasture Lane Drains LWS which in turn will lead to temporary fragmentation of habitats within this LWS, although the exact construction methods within this LWS and habitats affected (as a result of no survey information at the time of writing this PEI report) are not known.
- 8.12.9 Taking into account the embedded mitigation measures, standard mitigation measures and the temporary nature of the installation of the grid connection (see Section 8.4.1), resulting in the temporary fragmentation of habitat within this LWS (which will be restored post-construction), the magnitude of this impact (see Table 8-3) has been provisionally assessed as **medium**, which results in a temporary **moderate adverse** effect, that is potentially significant in EIA terms.

Temporary loss of running water habitat

- 8.12.10 The construction of the grid connection route is predicted to directly impact upon running water habitats, although the exact construction methods and habitats affected (as a result of limited survey information at the time of writing this PEI Report) are not known. Standard environmental protection measures will be implemented during construction of the Scheme to prevent indirect impacts occurring and also to running water habitats outside of the Grid Connection Route.
- 8.12.11 Taking into account the embedded mitigation measures, standard mitigation measures and the temporary land-take required to install the grid connection (see Section 8.4.1), resulting in the temporary loss of running water habitat (which will be restored post-construction), the magnitude of this impact (see



Table 8-3) has been provisionally assessed as **medium**, which results in a temporary **moderate adverse** effect, that is potentially significant in EIA terms.

Temporary fragmentation of running water habitat

- 8.12.12 The construction of the grid connection route is predicted to directly impact upon running water habitats which in turn will lead to temporary fragmentation of running water, although the exact construction methods (as a result of limited survey information at the time of writing this PEI report) are not known.
- 8.12.13 Taking into account the embedded mitigation measures, standard mitigation measures and the temporary nature of the installation of the grid connection (see Section 8.4.1), resulting in the temporary fragmentation of running water habitat (which will be restored post-construction), the magnitude of this impact (see Table 8-3) has been provisionally assessed as **medium**, which results in a temporary **moderate adverse** effect, that is potentially significant in EIA terms.

Direct loss of marshy grassland within the DCO Site

8.12.14 Construction activities will result in the direct loss of 0.37ha of marshy grassland. The magnitude of this impact (see Table 8-3) has been provisionally assessed as **high**, which results in a temporary **moderate adverse** effect, that is potentially significant in EIA terms.

Direct loss of hedgerows within the DCO Site

- 8.12.15 Construction activities are predicted to result in the potential for the loss of small sections of hedgerow as a result of grid connection cables, fences and access routes. Whilst the extent of any loss of this habitat is currently unknown, the majority of hedgerows across the DCO Site will be avoided and any replanting required has been embedded within the Scheme design for creation of hedgerows. It is noted that this may take time to develop and therefore, there is likely to be a temporary (short-term) adverse effect on this habitat type in some areas. Lengths of new, species rich, hedgerow would be planted to compensate for any lost, using three core species: Hawthorn, Blackthorn (*Prunus spinosa*) and Field Maple with others to add diversity including: Oak, Hornbeam, Holly (Ilex aquifolium), Hazel, Spindle, Crab Apple (Malus sylvestris), Elder (Sambucus nigra), Buckthorn (Rhamnus cathartica), Dogwood (Cornus sanguinea), and English Elm* (Ulmus procera) (*a disease resistant cultivar). Once hedgerows establish along with additional hedgerow planting proposed across the DCO Site, it is predicted that the Scheme will be able to deliver a net gain in this habitat and the overall impact will be beneficial.
- 8.12.16 Taking into account embedded protection measures and Scheme design to minimise the impact of construction activities causing direct loss of small sections of hedgerows, it is provisionally assessed that the magnitude of this impact has been provisionally assessed as **medium**, which results in a temporary **moderate adverse** effect, that is potentially significant in EIA terms.



Operation

8.12.17 The evaluation has concluded that the operation of the Scheme will not lead to any impacts on IEFs identified. The significance of effects during operation of the Scheme on any further IEFs identified, will be presented in the ES.

Decommissioning

8.12.18 The evaluation has concluded that the decommissioning of the Scheme will not lead to any impacts on IEFs identified. The significance of effects during decommissioning of the Scheme on any further IEFs identified, will be presented in the ES. At this stage, the effects of decommissioning of the Scheme are likely to be similar to those for construction and will need to follow legislation and policy requirements at the time of decommissioning.

8.13 Summary of Magnitude of Impact and Significance of effect

8.13.1 Table 8-15 summarises the sensitivity (value) of IEFs, impacts and effects resulting from construction of the Scheme. No impacts and effects, arising from operation or decommissioning of the Scheme have been identified at this stage.

Table 8-15 Summary of Magnitude of Impact and Significance of Effect

Receptor	Sensitivity (value)	Description of Impact	Magnitude of Impact	Effect Category	Potential for significant effect?
Cow Pasture Lane Drains LWS	Medium (County)	Temporary loss of habitat Temporary fragmentation of habitat	Medium	Moderate adverse	Yes
Running Water	Up to Medium (County)	Temporary loss of habitat Temporary fragmentation of habitat	Medium	Moderate adverse	Yes
Marshy Grassland	Low (Local)	Permanent loss of habitat	High	Moderate adverse	Yes
Hedgerows	Up to Medium (County)	Temporary loss of habitat	Medium	Moderate adverse	Yes

8.14 Enhancement Measures

8.14.1 Aspirational enhancement measures, beyond those outlined in Section 8.10 as embedded within the Scheme design, which would have an additional beneficial outcome will be considered and presented as part of the ES. For ecology and nature conservation, additional enhancement measures will be



included where appropriate and defined by the findings of the detailed ecological surveys that are currently ongoing.

8.15 Residual Effects and Conclusions

- 8.15.1 At this stage, there is the potential for significant effects on known IEFs and therefore additional mitigation measures have been identified as necessary and will be developed further to avoid significant effects in known IEFs. Accordingly, significant residual effects on ecological features are currently predicted during construction of the Scheme on the following IEFs:
 - Cow Pasture Lane Drains LWS;
 - Running water;
 - · Marshy grassland; and
 - Hedgerows.
- 8.15.2 No significant residual effects on ecological features are currently predicted during operation or decommissioning of the Scheme.
- 8.15.3 The final assessment of residual effects will be presented in the ES and submitted as part of the DCO submission for the Scheme.

8.16 Cumulative Assessment

- 8.16.1 The cumulative schemes are currently being agreed in consultation with Lincolnshire and Nottinghamshire County Council, and as such the cumulative effects will be reviewed following statutory consultation and fully addressed in the ES.
- 8.16.2 At this stage of the PEI Report, developments that may give rise to cumulative effects on ecology and nature conservation with the Scheme have not yet been fully assessed. A list of relevant developments is presented in **Chapter 16: Cumulative Effects and Interactions**. The cumulative assessment methodology is presented within **Chapter 5: EIA Methodology**. Cumulative effects will be assessed in the ES.
- 8.16.3 It is therefore not possible to definitely state the significance of cumulative impacts, however based on an initial review of the list and their nature and distance from the DCO Site, it is not expected that cumulative schemes would elevate any of the residual effects identified in this assessment.



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9. Water Environment

9.1 Introduction

- 9.1.1 This chapter of the Preliminary Environmental Information (PEI) Report relates to the potential effects of the Scheme on surface water bodies (e.g. rivers, streams, ditches, canals, lakes and ponds) including water quality and hydromorphology, flood risk and drainage. This chapter also considers potential effects on hydrogeology, with ground condition issues discussed in **Chapter 15: Other Environmental Topics**. The potential for likely significant effects as a result of the Scheme on the water environment, the scope for mitigation, and how it is proposed to assess the significance of these potential effects, is described.
- 9.1.2 This chapter is supported by the following figures in **PEI Report Volume 2**:
 - Figure 9-1: Water Resource Features and Attributes;
 - Figure 9-2: Fluvial Flood Risk;
 - Figure 9-3: Surface Water Flood Risk; and
 - **Figure 9-4**: Internal Drainage Board (IDB) watercourses and pumping stations.
- 9.1.3 This chapter is supported by the following appendices in **PEI Report Volume**
 - Appendix 9-A: Water Framework Directive Screening Assessment:
 - Appendix 9-B: Flood Risk Assessment;
 - Appendix 9-C: Legislation and Planning Policy; and
 - Appendix 9-D: Summary of Non-Significant Effects.

9.2 Consultation

- 9.2.1 A request for an EIA Scoping Opinion was sought from the Secretary of State through the Planning Inspectorate in November 2021 as part of the EIA Scoping Process. Consultation responses in relation to the Water Environment, to date, are presented in **PEI Report Volume 3: Appendix 1-C**.
- 9.2.2 A request for water resources data (e.g. licensed abstractions, Water Activity Permit locations, pollution incident locations), WFD information and water quality and flow data was requested from the Environment Agency to inform the desk study in March 2022. A response had not been received at the time of writing this chapter in May 2022, however, it is considered that sufficient baseline information has been gathered from desk study and site survey to enable a robust assessment to be undertaken.
- 9.2.3 Further consultation will be undertaken with key stakeholders as the Scheme progresses towards the full impact assessment and publication of the



Environmental Statement (ES). This is anticipated to include the Environment Agency, Lincolnshire County Council (as LLFA for Lincolnshire) and Nottinghamshire County Council (as LLFA for Nottinghamshire), Trent Valley Internal Drainage Board (IDB) and Upper Witham IDB.

9.3 Legislation and Planning Policy

- 9.3.1 Relevant policy documents are listed below. More detailed information regarding legislation and planning policy can be found in **PEI Report Volume** 3: Appendix 9-C.
- 9.3.2 Legislation to be considered includes:
 - Environment Act 2021 (Ref 9-1);
 - Water Act 2014 (Ref 9-2);
 - Flood and Water Management Act 2010 (Ref 9-3);
 - Environmental Protection Act 1990 (Ref 9-4);
 - Land Drainage Act 1991 (as amended) (Ref 9-5);
 - Water Resources Act 1991 (as amended) (Ref 9-6);
 - Salmon and Freshwater Fisheries Act 1975 (as amended) (Ref 9-7);
 - Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (Ref 9-8);
 - The Environmental Damage (Prevention and Remediation) Regulations 2017 (as amended) (Ref 9-9);
 - Environmental Permitting (England and Wales) Regulations 2016 (as amended 2018) (Ref 9-10);
 - Groundwater (England and Wales) Regulations 2009 (Ref 9-11);
 - Eels (England and Wales) Regulation 2009 (Ref 9-12);
 - Control of Pollution (Oil Storage) (England) Regulations 2001 (Ref 9-13).
 - The Water Resources Act (Amendment) (England and Wales) Regulations 2009 (Ref 9-14);
 - The Floods and Water (Amendment etc.) (EU Exit) Regulations 2019 (Ref 9-15);
 - The Control of Substances Hazardous to Health (Amendment) Regulations 2004 (Ref 9-16);
 - The Anti-Pollution Works Regulations 1999 (Ref 9-17); and
 - The Water Framework Directive (Standards and Classification) Directions 2015 (Ref 9-18).
- 9.3.3 National planning policy and guidance to be considered includes:
 - National Planning Policy Statement EN-1 (2011) (Ref 9-19);
 - National Planning Policy Statement EN-3 (2011) (Ref 9-20);



- National Planning Policy Statement EN-5 (2011) (Ref 9-21);
- Revised National Policy Statements for EN-1, EN-3 and EN-5 (Ref 9-22).
- National Planning Policy Framework (NPPF) (2021) (Ref 9-23);
- National Planning Practice Guidance (NPPG) (2014) (Ref 9-24), including Flood Risk and Coastal Change (Ref 9-25)
- National Planning Practice Guidance: Flood Risk and Coastal Change (Ref 9-25);
- The UK Government's 25 Year Environment Plan (Ref 9-26);
- The UK Government's Future Water Strategy (2011) (Ref 9-27);
- Non-statutory technical standards for Sustainable Drainage Systems (Ref 9-28).
- CIRIA Report C753 The SuDS Manual 2nd Edition (2016) (Ref 9-29).
- National Highways (2020) DMRB CD532 Vegetated Drainage Systems for Highways Runoff (Ref 9-30).
- The Building Regulations. Approved Document Part H: Drainage and Waste Disposal (2010) (Ref 9-31).
- Water UK Sewerage Sector Guidance (2019) (Ref 9-32).
- 9.3.4 Local planning policy and guidance considered includes:
 - Central Lincolnshire Local Plan 2012-2036 (Ref 9-35);
 - Bassetlaw District Council Core Strategy and Development Management Policies DPD, adopted 22 December 2011 (Ref 9-36);
 - Draft Bassetlaw Local Plan 2020-2037 (Ref 9-37);
 - Lincolnshire County Council SuDS Guidance (Ref 9-38).

9.4 Assessment Assumptions and Limitations

- 9.4.1 This preliminary assessment is based on baseline information available at the time of writing this PEI Report. An initial assessment of the Solar and Energy Storage Park and the Grid Connection Route has been undertaken as part of this PEI Report. Following consultation, a further assessment will be undertaken as part of the EIA and will be reported in the ES that will be submitted with the DCO submission.
- 9.4.2 A request for water resources data (e.g. licensed abstractions, Water Activity Permit locations, pollution incident locations), WFD information and water quality and flow data was requested from the Environment Agency to inform the desk study in March 2022. A response had not been received at the time of writing this chapter in May 2022. However, as mentioned above, it is considered that sufficient baseline information has been gathered from desk study and site survey to enable a robust assessment to be undertaken.
- 9.4.3 At the time of writing, the full details regarding locations and methodologies of construction and installation of the cable within the Grid Connection Route



remain under development. However, it has been confirmed that the River Trent will be crossed using underground techniques (e.g. horizontal directional drilling techniques that would not disturb the watercourse), with the depth of the cable below the bed expected to be 10-15m and subject to appropriate consents being obtained. Smaller watercourse crossings are currently assumed to require open cut installation techniques. As such, open cut crossings are assumed as a worst-case scenario within this chapter. For these crossings it is assumed that water flow would be maintained by damming and over pumping. Several of the ditches within the DCO Site boundary are ephemeral and if works could be carried out in the drier months this would reduce the risk of pollution propagating downstream, although this cannot be guaranteed and thus no weight has been attributed to this in the impact assessment.

- The PV Panels will be off set from watercourses and ponds. The point of 9.4.4 measurement will be agreed with the Environment Agency through further consultation, but for the purposes of the assessment it is assumed for all watercourses other than the River Trent to be measured from the centre line of the watercourse as determined from Ordnance Survey mapping. This avoids issues related to determining the watercourse edge in situations where this varies considerably as flow rate changes. This buffer will ensure all construction activities for the installation of PV Panels would be offset from surface watercourses, other than where there is a need for crossing of a watercourse (for cabling installation or possible temporary access) of temporary discharge of treated construction site runoff. Any works to enhance watercourses would require direct works to the channel and banks, although given the aim of these works and their small-scale and 'soft-engineering' nature, construction impacts would be minimal. Overall, the purpose of this buffer reduces the risk of any pollutants entering the watercourse directly, whilst also providing space for mitigation measures (e.g. fabric silt fences) should they be required.
- The risk from surface water runoff to surface or groundwater bodies has been 9.4.5 provisionally assessed qualitatively on the basis of design principles that will be presented in an outline drainage strategy at the ES stage, and delivery of this will be a requirement under the DCO. As part of the environmental impact assessment presented within the ES and accompanying the DCO application, the risk from surface water runoff from new hard standing to surface or groundwater bodies will be assessed according to the Simple Index Approach presented in the C753 The SuDS Manual (Ref 9-29). It is expected on the basis of professional judgement that the pollutant risk will not be very high from runoff given that it will predominantly consist of runoff from panels for the majority of the Solar and Energy Storage Park Site, and so that only one layer of treatment may be required. It is also expected that there will be sufficient space within the Solar and Energy Storage Park Site for a treatment solution following SuDS principles. However, there is also potential to use proprietary measures if there is a greater risk around certain infrastructure or there are localised constraints.
- 9.4.6 Within the impact assessment, flood risk will be considered in terms of the potential for the Scheme to change existing flood risk (from all sources) and



- to impact on receptors including existing infrastructure assets, residential buildings, commercial buildings, agricultural land, and property potentially affected by the Scheme.
- 9.4.7 Requirements for any hydraulic modelling of watercourses has not yet been determined. If required, the scope of this will be discussed with the Environment Agency/LLFA and undertaken as part of the ES to inform the FRA and Surface Water Drainage Strategy. A draft FRA is included as PEI Report Volume 3: Appendix 9-B.
- 9.4.8 The FRA and Surface Water Drainage Strategy will be based on desktop surveys, site walkover and site layout proposals. Where available, topographical data will be used to support the FRA. In the absence of topographical data, LiDAR data will be used to inform the FRA and the Surface Water Drainage Strategy. The use of LiDAR data is not a limitation to the conclusions provided in these documents to date.
- 9.4.9 With regard to flood risk, temporary works will not be assessed unless they are of a potentially significant scale and have the potential to adversely affect flood risk or impact the quality or form of water bodies. The temporary works where such risks are considered significant (for example, excavations for the Grid Connection Route), will be identified and assessed within the FRA and impact assessment (within this chapter and within the ES).
- 9.4.10 During construction it is envisaged that an estimated 2,200m³ of water (1,700m³ for welfare and 500m³ for wheel washes) will be required during construction to support welfare facilities onsite and other uses. The water will either be transported to the DCO Site by road from an existing nearby licenced water abstraction source and stored on site in tanks of up to 10m³ capacity (10,000 litres) or connected through a mains connection. Further details will be provided at the ES stage.
- 9.4.11 There will be welfare facilities associated with the Scheme for up to four permanent FTE members of staff. Given the low daily occupancy only small volumes of foul drainage will be generated. At this point in time it is not known how any wastewater from permanent welfare facilities will be managed. However, this is anticipated to consist of a self-contained independent nonmains domestic storage and/or treatment system. An alternative where this is not possible, would be for a self-contained foul drainage system to a septic tank or similar. These tanks would be regularly emptied under contract with a registered recycling and waste management contractor. As there would be no discharge of foul water to a watercourse, and no discharge to the public foul sewer is anticipated, no further assessment of foul waste from the Scheme is proposed. This will be reviewed at the ES stage when further detail is available. We note that in the Scoping Opinion, the Planning Inspectorate was content to scope this impact out on the basis that foul water would not be connected to a mains foul drainage system.

9.5 Study Area

9.5.1 For the purposes of this assessment, a general study area (Zone of Influence) of approximately 1km from the DCO Site boundary has been considered in



- order to identify water bodies that are hydrologically connected to the Scheme and have the potential to be directly impacted by the activities associated with the Scheme. The study area is shown in **PEI Report Volume 2: Figure 9-1**.
- 9.5.2 Given that watercourses flow and water quality and flood risk impacts may propagate downstream, where relevant, the assessment will also consider a wider study area to include as far downstream as a potential impact may influence the quality or quantity of the waterbody, In this case, watercourses across the study area generally drain to the River Trent which is considered the final receiving waterbody that could conceivably be affected.

9.6 Assessment Methodology

- 9.6.1 This section describes the methodology proposed for the assessment of effects on the water environment, including the criteria for the determination of the significance of the receptor and the magnitude of change from the baseline condition. Potential impacts of the Scheme on the water environment will be assessed by:
 - Considering the existing (baseline) status of the water environment within the Scheme and relevant surrounds with respect to flood risk, surface water, groundwater and drainage, following the source-pathway-receptor approach;
 - Identifying potential impacts of the Scheme on the water environment during the operational and construction phases, as well as cumulative effects;
 - Proposing suitable mitigation measures to be incorporated into the development design, construction and operation to avoid, prevent, minimise or offset any adverse impacts (i.e. embedded and additional mitigation); and
 - Reviewing any residual impacts.

Sources of Information

Desktop Research

- 9.6.2 The water environment baseline conditions have been determined by a desk study of available information, and various other online data sources including:
 - Online Ordnance Survey (OS) maps viewed to identify any surface water bodies within 1km of the Scheme as well as general topography and land uses (Ref 9-39);
 - Online aerial photography (Ref 9-40);
 - Meteorological Office website for general climate information for the study area (Ref 9-41);
 - National Rivers Flow Archive website (Ref 9-42);
 - Part 1: Anglian River Basin District River Basin Management Plan (Ref 9-33);



- Part 1: Humber River Basin District River Basin Management Plan (Ref 9-34);
- Environment Agency Catchment Data Explorer website (Ref 9-43);
- Environment Agency Water Quality Archive website (Ref 9-44);
- Environment Agency Fish and Ecology Data Viewer (Ref 9-45);
- Defra's Multi-agency geographical information for the countryside website (MAGIC) map (Ref 9-46);
- British Geological Survey (BGS) Geoindex website (Ref 9-47);
- Natural England website for designated sites (Ref 9-48);
- Environment Agency Online Interactive Maps:
 - Flood map for planning (rivers and sea);
 - Risk of flooding from surface water;
 - Risk of flooding from reservoirs; and
 - Flood warning areas and risk.
- 9.6.3 In addition, further information and data has been requested directly from the Environment Agency regarding WFD information, water abstractions, discharge consents and pollution incidents. A response had not been received at the time of writing (May 2022). West Lindsey Local Council and Bassetlaw District Council have been contacted regarding Private Water Supplies (PWS). Responses have been received from both councils.

Surveys

- 9.6.4 An initial site walkover was undertaken on 22 September 2021 in fair weather conditions. The aim of this site visit was to assess watercourse connectivity, quality, and condition. An additional site visit of the Grid Connection Route watercourse crossing locations was undertaken on 8 February 2022 in overcast, dry conditions.
- 9.6.5 Water quality surveying has not been undertaken at this stage given that the nature of water bodies associated with the Scheme are generally minor. Water quality of the more significant watercourses along the boundary and beyond the Scheme has been determined with reference to background water quality data from routine Environment Agency monitoring.
- 9.6.6 Further water quality monitoring is not considered necessary at this stage given the Environment Agency data that is publicly available, and that importance of water bodies will be determined from a holistic review of water body features and does not rely on water quality due to the principle that no controlled water may be polluted. Water quality impacts will be assessed based on a risk assessment that does not require input of raw background water quality data (described further below). Furthermore, water quality monitoring is also only effective when there is a clear purpose for it and may require monitoring over a long period of time to ensure reliable and robust results. This approach will be agreed with the Environment Agency prior to the ES being produced.



Source-Pathway-Receptor Approach

- 9.6.7 Based on professional judgement and experience of other similar schemes, a qualitative assessment of the likely significant effects on surface water quality and water resources has been undertaken.
- 9.6.8 The predominantly qualitative assessment of the likely significant effects has considered the construction, operation, and decommissioning phases, as well as cumulative effects with other developments. It is based on a source-pathway-receptor approach. For an impact on the water environment to exist the following is required:
 - An impact source (such as the release of polluting chemicals, particulate matter, or biological materials that cause harm or discomfort to humans or other living organisms, or the loss or damage to all or part of a water body);
 - A receptor that is sensitive to that impact (i.e. water bodies and the services they support); and
 - A pathway by which the two are linked.
- 9.6.9 The first stage in applying the Source-Pathway-Receptor model is to identify the causes or 'sources' of potential impact from a development. The sources will be identified through a review of the details of the Scheme, including the size and nature of the development, potential construction methodologies and timescales.
- 9.6.10 The next step in the model is to undertake a review of the potential receptors, that is, the water environment receptors that have the potential to be affected. Water bodies including their attributes have been identified through desk study and site surveys.
- 9.6.11 The last stage of the model is, therefore, to determine if there is a viable exposure pathway or a 'mechanism' linking the source to the receptor. This is undertaken in the context of local conditions relative to the water receptors within the study area, such as topography, geology, climatic conditions and the nature of the impact (e.g. the mobility of a liquid pollutant or the proximity to works that may physically impact a water body).
- 9.6.12 To support the assessment some sub-topic specific assessments will be undertaken. These are described in more detail in the following sections.

Drainage Strategy

9.6.13 An outline operational surface water drainage strategy will be prepared to support the DCO application and will be secured as a requirement of the DCO. The drainage strategy will comprise of a concept design of the system, proposing above ground conveyance and attenuation features, to mimic the natural flow regime as far as practicable whilst reducing flood risk.

Assessment of Surface Water Runoff for the Operational Phase

9.6.14 During operation, surface water runoff from the Scheme may contain pollutants derived from impermeable surfaces (e.g. inert particulates, litter, hydrocarbons, metals, nutrients and de-icing salts). This mixture of pollutants is collectively known as 'urban diffuse pollutants,' and although each pollutant



may itself not be present in harmful concentrations, the combined effects over the long term can cause chronic adverse impacts. Changes in impermeable surfaced area within the Site boundary may lead to increases in the rate and quantities of these pollutants being runoff to receiving watercourses. An assessment is therefore undertaken to determine the potential risk to the receiving waterbodies and to inform the development of suitable treatment measures.

- 9.6.15 For this PEI Report stage, and given that the drainage strategy remains under development, a qualitative assessment has been undertaken based on the design principles for this developing strategy.
- 9.6.16 At the ES stage, the appropriateness of the surface water drainage measures in terms of providing adequate treatment of diffuse pollutants will be assessed with reference to the Simple Index Assessment method described in the SuDS Manual (Ref 9-29). The Simple Index Approach follows three steps:
 - Step 1 Determine suitable pollution hazard indices for the land use(s);
 - Step 2 Select SuDS with a total pollution mitigation index that equals or exceeds the pollution hazard index (for three key types of pollutants - total suspended solids, heavy metals and hydrocarbons). Only 50% efficiency should be applied to second, third etc. treatment train components; and
 - Step 3 If the discharge is to a water body protected for drinking water, consider a more precautionary approach.
- 9.6.17 The SuDS Manual (Ref 9-29) only provides a limited number of land use types and so those selected will be the most suitable for the components of the Scheme, based on professional judgement. Where more than one pollution hazard category applies to a component of the Scheme, the worst pollution hazard will be selected.

Hydromorphological Assessment

- 9.6.18 Potential hydromorphological impacts have been qualitatively appraised based on a desk study, a site walkover and a review of the Scheme components that may affect the physical form of water bodies.
- 9.6.19 Consideration has been given to how the Scheme is likely to impact upon the WFD objectives for the relevant watercourses within PEI Report Volume 3: Appendix 9-A. Effects are described according to the method for determining effect significance (see below).

Flood Risk Assessment

9.6.20 A site-specific FRA has been prepared for the DCO Site (see PEI Report Volume 3: Appendix 9-B). The FRA has been prepared in accordance with the requirements of the NPPF and relevant guidance. It includes a review the current and future flood risk to the Site from all sources (including surface water, groundwater and fluvial sources), to inform the Scheme design and set out any proposed mitigation requirements that are to be addressed within the Surface Water Drainage Strategy.



9.6.21 The majority of the development is located outside of areas with a risk of flooding. Where development is proposed in areas susceptible to flooding there may be a requirement for flood compensation or mitigation measures to ensure no detrimental effect to flooding potential within or from the affected watercourse in the catchment once the Scheme is operational. The final FRA will be a technical appendix to the ES.

Water Framework Directive Assessment

- 9.6.22 Proposed schemes having the potential to impact on current or predicted WFD status are required to assess their compliance against the objectives defined for potentially affected water bodies. As part of its role, the Environment Agency must consider whether proposals for new developments have the potential to:
 - Cause a deterioration of a water body from its current status or potential; and/or
 - Prevent future attainment of Good status (or potential where not already achieved).
- 9.6.23 The following guidance on how to undertake WFD assessments will be used to inform this assessment:
 - Environment Agency Advice Note Water Framework Directive Risk Assessment: How to assess the risk of your activity' (Ref 9-49); and
 - The Planning Inspectorate Advice Note 18: The Water Framework Directive' (Ref 9-50).
- 9.6.24 The assessment will be undertaken in three stages. The first stage is 'screening', the aim of which is to identify the Scheme components that could affect WFD status and 'screen out' aspects of the project that do not require any further consideration. The second stage is 'scoping', whereby WFD receptors that are potentially at risk are identified and it is determined how the risk will be assessed. Finally, and if required, stage 3 involves a full impact assessment, and potentially, consideration of the criteria in Article 4.7 of the Directive, if required. Article 4.7 sets out the conditions that must be met to justify derogation of the Directive.
- 9.6.25 **PEI Report Volume 3: Appendix 9-A** presents the screening (Stage 1) and scoping (Stage 2) phases of the WFD assessment, with full impact assessment (Stage 3) to be undertaken alongside the ES.

Matters Scoped Out of the Assessment

- 9.6.26 With regards to potable water supply, the study area is supplied by Anglian Water. All water companies are required by the Government to produce a Water Resources Management Plan (WRMP) to show how they plan to maintain a secure supply of water to all their customers over the next 25 years Ref 9-51).
- 9.6.27 During construction, based on an assumed 10 litres/day, an estimated 1,100m³ total (850 m³ for welfare and 250 m³ for wheel washes) of water will be required to support welfare facilities onsite and other uses. The water will



- either be transported to the DCO Site by road from an existing nearby licensed water abstraction source and stored on site in tanks of up to 10m³ (10,000 litres) capacity or connected through a mains connection.
- 9.6.28 The Scheme will contain solar PV technology and no residential usage of water required in the long term, with water demand only required to provide for an estimated four operation workers on the DCO Site. This will have a very minor impact on local potable mains water supplies. Therefore, assessment of potential impact on public potable water has not been scoped in for further consideration.

Significance Criteria

- 9.6.29 As outlined in **Chapter 5: EIA Methodology**, the evaluation of the significance of an effect is important; it is the significance that determines the resources that should be deployed in avoiding or mitigating a significant adverse effect, or conversely, the actual value of a beneficial effect.
- 9.6.30 The significance of effects for the water environment will be determined using the principles of the guidance and criteria set out in the Design Manual for Roads and Bridges (DMRB) LA113 Road Drainage and the Water Environment (Ref 9-52) and DMRB LA104 Environmental Assessment and Monitoring (Ref 9-53) adapted for this assessment to take account of hydromorphology. Although these assessment criteria were developed for road infrastructure projects, this method is suitable for use on any development project and it provides a robust and well tested method for predicting the significance of effects. The methodology also considers advice set out in Department of Transport TAG Unit A3, Environmental Impact Appraisal (Ref 9-54). The criteria that will be used to determine receptors importance is presented in Table 9-1.
- 9.6.31 Whilst other disciplines may consider 'receptor sensitivity', 'receptor importance' is considered here. This is because when considering the water environment, the availability of dilution means that there can be a difference in the sensitivity and importance of a water body. For example, a small drainage ditch of low conservation value and biodiversity with limited other socio-economic attributes is very sensitive to impacts, whereas an important regional scale watercourse, that may have conservation interest of international and national significance and support a wider range of important socio-economic uses, is less sensitive by virtue of its ability to assimilate discharges and physical effects. Irrespective of importance, all controlled waters in England are protected by law from being polluted.
- 9.6.32 In accordance with the stages of the methodology, there are three stages to the assessment of effects on the water environment, which are as follows:
 - A level of importance (low to very high) is assigned to the water resource receptor based on a combination of attributes (such as the size of the watercourses, the spatial extent of importance (e.g. habitat protected by international law), WFD designation, water supply and other uses, biodiversity, and recreation etc.) and on receptors to flood risk based on the vulnerability of the receptor to flooding;



- The magnitude of potential and residual impact (classed as negligible, minor, moderate or major adverse / beneficial) is determined based on the criteria listed in Table 9-2 and the assessor's professional judgement and the likelihood of the effect occurring. The likelihood of an effect occurring is based on a scale of certain, likely, or unlikely. Likelihood has been considered in the case of water resources only, as likelihood is inherently included within the FRA; and
- A comparison of the importance of the resource and magnitude of the impact (for both potential and residual impacts) results in an assessment of the overall significance of the effect on the receptor using the matrix presented in Table 9-3. The significance of each identified effect (both potential and residual) is classed as very large, large, moderate, slight or neutral and either beneficial or adverse significance.
- 9.6.33 The following significance categories have been used for both potential and residual effects:
 - Negligible: An imperceptible effect or no effect to a water resource receptor;
 - Beneficial: A beneficial / positive effect on the quality of a water resource receptor; or
 - Adverse: A detrimental / negative effect on the quality of a water resources receptor.
- 9.6.34 In the context of this assessment, an effect can be temporary or permanent, with effects quantified temporally as being short-term (0-5 years), medium term (6-10 years) and long-term (>10 years).
- 9.6.35 At a spatial level, 'local' effects are those affecting the Scheme within the DCO Site boundary and neighbouring receptors within the study area, while effects upon receptors beyond the vicinity of the study area are considered to be at a 'regional' level. Effects which affect different parts of the country, or England as a whole, are considered being at a 'national' level. Spatial importance is built into the criteria for determining importance as outlined in Table 9-1 and is therefore taken into account in the process of determination significance of effects.

The importance of the receptor (Table 9-1) and the magnitude of impact (Table 9-2) are determined independently from each other and are then used to determine the overall significance of effects (Table 9-3). Options for mitigation will be considered and secured where possible to avoid, minimise and reduce adverse impacts, particularly where significant effects may have otherwise occurred. The residual effects of the Scheme with identified mitigation in place will then be reported. Effects of moderate or greater are considered significant.



Table 9-1: Criteria to Determine Receptor Importance (adapted from DMRB LA113, Ref 9-52)

Importance	General Criteria	Surface Water	Groundwater	Hydromorphology ¹	Flood Risk
Very High	The receptor has little or no ability to absorb change without fundamentally altering its present character, is of very high environmental value, or of international importance.	EC Designated Salmonid / Cyprinid fishery; Watercourse having a WFD classification as shown in a River Basin Management Plan (RBMP) and Q95 ≥ 1.0 m³/s; site protected / designated under EC or UK habitat legislation (SAC, SPA, SSSI, WPZ, Ramsar site, Species protected by EC legislation. Critical social or economic uses (e.g. public water supply and navigation).	Source Protection Zone (SPZ) 1; Principal aquifer providing a regionally important resource and/or supporting a site protected under EC and UK legislation; Groundwater locally supports GWDTE; Water abstraction: >1,000 m³/day	Unmodified, near to or pristine conditions, with well-developed and diverse geomorphic forms and processes characteristic of river and lake type.	Floodplain or defence protecting more than 100 residential properties from flooding; Flood Zone 3a and/or 3b; Essential Infrastructure or highly vulnerable development. Very high risk from nonfluvial flood sources.
High	The receptor has low ability to absorb change without fundamentally altering its present character, is of high environmental value, or of national importance.	Watercourse having a WFD classification as shown in a River Basin Management Plan (RBMP) and Q95 < 1.0 m³/s; Major Cyprinid Fishery; Species protected under EC or UK habitat legislation. Critical social or economic uses (e.g. water supply and navigation). Important social or economic uses such as water supply, navigation or mineral extraction.	Principal Aquifer providing locally important source supporting rover ecosystem; SPZ2; Groundwater supports GWDTE; Water abstraction: 500-1,000m3/day.	Conforms closely to natural, unaltered state and will often exhibit well-developed and diverse geomorphic forms and processes characteristic of river and lake type. Deviates from natural conditions due to direct and/or indirect channel, floodplain, bank modifications and/or catchment development pressures.	Floodplain or defence protecting between 1 and 100 residential properties or industrial premises from flooding; Flood Zone 2; More vulnerable development. High risk from non-fluvial flood sources.

¹ Based on the water body 'Reach Conservation Status' presently being adopted for a major infrastructure project (and developed originally by Atkins) and developed from EA conservation status guidance (Ref 9-55, Ref 9-56) as LA113 (Ref 9-52) does not provide any criteria for morphology.



Importance	General Criteria	Surface Water	Groundwater	Hydromorphology ¹	Flood Risk
Medium	The receptor has moderate capacity to absorb change without significantly altering its present character, has some environmental value or is of regional importance.	Watercourses not having a WFD classification shown in a RBMP and Q95 >0.001m³/s. May be designated as a local wildlife site (LWS) and support a small / limited population of protected species. Limited social or economic uses.	providing water for agricultural or industrial	Shows signs of previous alteration and/or minor flow / water level regulation but still retains some natural features or may be recovering towards conditions indicative of the higher category.	Floodplain or defence protecting 10 or fewer industrial properties from flooding; Flood Zone 2; Less vulnerable development. Medium risk from non-fluvial flood sources.
Low	The receptor is tolerant of change without detriment to its character, is low environmental value, or local importance.	Watercourses not having a WFD classification shown in a RBMP and Q95 <0.001m³/s. Low aquatic fauna and flora biodiversity and no protected species. Minimal economic or social uses.	Generally Unproductive strata. Water abstraction: <50m³/day	Substantially modified by past land use, previous engineering works or flow / water level regulation. Watercourses likely to possess an artificial crosssection (e.g. trapezoidal) and will probably be deficient in bedforms and bankside vegetation. Watercourses may also be realigned or channelized with hard bank protection or culverted and enclosed. May be significantly impounded or abstracted for water resources use. Could be impacted by navigation, with associated high degree of flow regulation and bank protection, and probable strategic need for maintenance dredging. Artificial and minor drains	Floodplain with limited constraints and low probability of flooding of residential and industrial properties; Flood Zone 1; Water compatible development. Low risk from non-fluvial flood sources.



Importance	General Criteria	Surface Water	Groundwater	Hydromorphology ¹	Flood Risk
				and ditches will fall into this category.	
Negligible	The receptor is resistant to change and is of little environmental value	Not applicable.	Not applicable.	Not applicable.	Not applicable.



Table 9-2: Magnitude of Impact Criteria (adapted from DMRB LA 113, Ref 9-52)

Magnitude of Impact	Description	Examples
Major Adverse	Results in a loss of	Surface water:
wajor Adverse	attribute and/ or	Loss or extensive change to a fishery.
	quality and integrity	Loss of regionally important public water supply.
	of the attribute.	Loss or extensive change to a designated nature conservation site.
		Reduction in water body WFD classification
		<u>Groundwater</u> :
		Loss of, or extensive change to, an aquifer.
		Loss of regionally important water supply.
		Loss of, or extensive change to groundwater dependent terrestrial ecosystem (GWDTE) or baseflow contribution to protected surface water bodies.
		Reduction in water body WFD classification.
		Loss or significant damage to major structures
		through subsidence or similar effects.
		Flood Risk:
		Increase in peak flood level >100 mm.
Moderate	Results in impact on	Surface water:
Adverse	integrity of attribute, or loss of part of attribute.	Partial loss in productivity of a fishery.
		Degradation of regionally important public water supply or loss of major
		commercial/industrial/agricultural supplies.
		Contribution to reduction in water body WFD classification
		Groundwater:
		Partial loss or change to an aquifer.
		Degradation or regionally important public water supply or loss of significant
		commercial/industrial/agricultural supplies.
		Partial loss of the integrity of GWDTE. Contribution to reduction in water body WFD
		classification.
		Damage to major structures through subsidence
		or similar effects or loss of minor structures.
		Flood Risk:
		Increase in peak flood level > 50mm
Minor Adverse	Results in some	Surface water:
	measurable change	Minor effects on water supplies.
	in attribute's quality or vulnerability.	Groundwater:
	or vaniciability.	Minor effects on an aquifer, GWDTEs,
		abstractions and structures.
		Flood Risk:
		Increase in peak flood level >10mm
Negligible	Results in impact on attribute, but of	Surface / Groundwater:



Magnitude of Impact	Description	Examples
	insufficient magnitude to affect the use or integrity.	The proposed project is unlikely to affect the integrity of the water environment. Flood Risk: Negligible change to peak flood level (≤ +/-10mm).
Minor Beneficial	Results in some beneficial impact on attribute or a reduced risk of negative impact occurring.	Surface Water: Contribution to minor improvement in water quality, but insufficient to raise WFD classification. Groundwater: Reduction of groundwater hazards to existing structures. Reductions in waterlogging and groundwater flooding. Flood Risk: Creation of flood storage and decrease in peak flood level (>10 mm).
Moderate beneficial	Results in moderate improvement of attribute quality.	Surface Water: Contribution to improvement in waterbody WFD classification. Groundwater: Contribution to improvement in water body WFD classification. Improvement in water body catchment abstraction management strategy (CAMS) (or equivalent) classification. Support to significant improvements in damaged GWDTE. Flood Risk: Creation of flood storage and decrease in peak flood level (>50 mm).
Major beneficial	Results in major improvement of attribute quality	Surface Water: Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse. Improvement in water body WFD classification. Groundwater: Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring. Recharge of an aquifer. Improvement in water body WFD classification. Flood Risk: Creation of flood storage and decrease in peak flood level (>100 mm).
No change		on of characteristics, features or elements; no t in either direction.



Table 9-3: Matrix for Assessment of Significance (adapted from DMRB LA 104, Ref 9-53)

Importance Magnitude of Impact of Receptor

	Major	Moderate	Minor	Negligible	No change
Very High	Very Large	Large or Very Large	Moderate or Large	Slight	Neutral
High	Large or Very Large	Moderate or Large	Slight or Moderate	Slight	Neutral
Medium	Moderate or Large	Moderate	Slight	Neutral or Slight	Neutral
Low	Slight or Moderate	Slight	Neutral or Slight	Neutral or Slight	Neutral
Negligible	Slight	Neutral or Slight	Neutral or Slight	Neutral	Neutral

9.7 Baseline Conditions

Existing Baseline

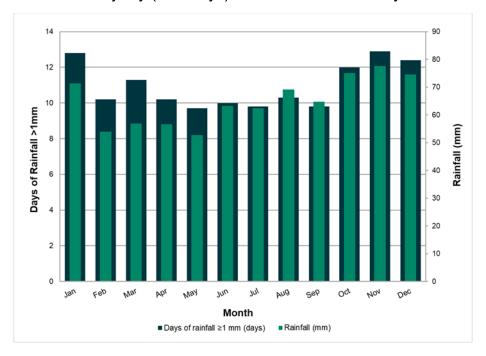
- 9.7.1 This section provides a description of the current Scheme baseline and identifies the sensitive receptors and their individual importance (value).
- 9.7.2 Where relevant, waterbodies and their attributes have been presented in a series of figures that support this chapter. PEI Report Volume 2: Figure 9-1 presents surface and groundwater bodies and related water resource information and attributes; PEI Report Volume 2: Figure 9-2 shows Environment Agency Flood Zones; PEI Report Volume 2: Figure 9-3 shows Surface Water Flood Risk and PEI Report Volume 2: Figure 9-4 shows IDB watercourses and pumping station locations.

Topography, Climate and Land Use

- 9.7.3 The topography of the study area is generally flat. The elevation ranges from 30m above ordnance datum (AOD) to <10m AOD (Ref 9-39). The topographical highs (~30m AOD) are found within the north of the study area (north of Knaith Park) and the topographical lows are associated with the River Trent waterbody and its floodplain, resulting in a gentle slope from north-east to south-west across the Site boundary. Land rises very gently away from the River Trent on its western bank along the Grid Connection Route, with the majority of the study area on this western side of the river being <10m AOD.
- 9.7.4 The land use within the study area is generally a mosaic of arable farmland and, with patches of woodland, drains and ponds scattered across the area. The River Trent bisects the study area, with the Solar and Energy Storage Park located east of this river. There is a large, decommissioned power station (Cottam Power Station) adjacent to the southern extent of the Grid Connection Route, next to Cottam Substation, which is the proposed connection point to the National Grid. The study area also includes several small villages such as Gate Burton, Willingham by Stow, and Knaith Park. The A156 (Gainsborough Road) runs almost parallel to the River Trent waterbody through the study



- area, and a railway line passes across the Solar and Energy Storage Park in an approximately north-south orientation. Lincoln Golf Course lies within the study area to the south east of the DCO Site.
- 9.7.5 The nearest Met Office weather monitoring station is Scampton which is located approximately 12km to the south-east of the DCO Site (Ref 9-41). Based on the available data from this weather station (1981–2010), it is estimated that the study area is likely to receive an average of 613.2mm of rainfall per year, with it raining (greater or equal to 1mm of rain) on approximately 115.6 days per year. This suggests that rainfall in the area is low and can be considered below average for rainfall in the United Kingdom. Rainfall is highest from mid-winter to mid-spring and generally peaks in November, with the least rainfall falling in May on average (see Graph 9-1).
- 9.7.6 The same weather station reports that the area generally gets around 54.8 days of air frost a year, distributed across all months except July and August, whereas the majority (11.7 days) occurs across February.



Graph 9-1 Scampton weather station: monthly rainfall and days of rainfall >1 mm (Ref. 9-41).

Geology, Groundwater and Soils

- 9.7.7 The DCO Site is primarily underlain by three bedrock geologies of which are all mudstone formations (Ref 9-47). These include:
 - Scunthorpe Mudstone Formation mudstone and limestone, interbedded;
 - Penarth Group mudstone; and
 - Mercia Mudstone Group mudstone.
- 9.7.8 The Solar and Energy Storage Park is primarily underlain by the Scunthorpe Mudstone Formation, with a narrow band of Penarth Group immediately west of the A156. East of the A156 is Mercia Mudstone Group, and this extends



across the entire study area west of the River Trent and underlies the Grid Connection Route.

- 9.7.9 The superficial deposits are generally patchy across the study area. The floodplain of the River Trent constitutes alluvium (clay, silt sand and gravel). The Grid Connection Route is also underlain in part by patches of Holme Pierrepont Sand and Gravel Member. There are also some deposits of till (diamicton) close to Rampton. The centre of the study area is primarily covered by the Holme Pierrepoint Sand and Gravel Member, while the Solar and Energy Storage Park is underlain by patches of Mid-Pleistocene glaciofluvial deposits (sand and gravel), alluvium and till (in a small part of the southern boundary of the Solar and Energy Storage Park adjacent to the railway). However, much of the Solar and Energy Storage Park has no recorded superficial deposits.
- 9.7.10 There are small patches of peat present between Marton and Torksey (beneath the Grid Connection Route corridor) but these are not hydrogeologically extensive. They will provide some groundwater storage to slowly leak into local watercourses. However, the peat overlies a sand and gravel aquifer, which is considered to be providing almost all of the baseflow to the streams. As these deposits are not spatially extensive the pipelines for the Grid Connection Route will avoid peat deposits where possible. Should this not be feasible, assessment of impacts to peat deposits will be considered further within the ES.
- 9.7.11 The bedrock beneath the Solar and Energy Storage Park and Grid Connection Route is generally classified as a Secondary B aquifer (Ref 9-46). Secondary B aquifers are predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers. There is a strip of Secondary (undifferentiated) aquifer, which is associated with the Penarth Group mudstone. Secondary (undifferentiated) aquifer is where it is not possible to apply either a Secondary A or B definition. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type. The patchy superficial deposits within the study area are Secondary A aquifer, with the exception of till deposits which are Secondary (undifferentiated) aquifer. Secondary A aquifers comprise permeable layers that can support local water supplies and may form an important source of base flow to rivers.
- 9.7.12 There are numerous borehole scans available online on the BGS Geoindex website (Ref 9-47) across the study area, some of which include groundwater depths. An indication of some of the depths are as follows:
 - Kexby (reference SK88NE6, NGR SK 87190 86080, 1973) water 1.9m below ground level (bgl) – northeast of the study area;
 - Willingham-by-Stow (reference SK88SE27, NGR SK 87444 84567, 2003)
 water 1.2m bgl east of the study area;



- Broom Hills, Knaith (reference SK88SW19 NGR SK 84040 84330, 1971), no water struck in a 6m borehole – within the Solar and Energy Storage Park, south of Knaith Park;
- Central Park Farm, Knaith (reference SK88SW18, SK 83290 84400, 1971) – no water struck in a 4.2m borehole – within the Solar and Energy Storage Park, south of Knaith Park;
- Marton village (reference SK88SW1, NGR SK 83857 82191, 1933) water had a rest level 4.7m bgl – in the study area, west of the DCO Site at Marton;
- Spafford Close, Marton (reference SK88SW58, NGR SK 84400 81750, 2002) – groundwater seepages at 1.9 m bgl – within the study area, west of DCO Site at Stow Park Road;
- West Burton / Waltham Cross (reference SK88SW26, NGR SK 83653 80957, 1968) – groundwater 7.01 m bgl – within the Grid Connection Route;
- Cottam, (reference SK88SW17, NGR SK 81690 80280, 1971) groundwater 2.3m bgl – immediately adjacent to the Grid Connection Route; and
- Cottam, Wymondley Power Line (reference SK87NW109, NGR SK 81708 78631, 1967) water encountered from 3.96m bgl, within the Grid Connection Route, south of Cottam Power Station.
- 9.7.13 The study area falls within two WFD groundwater bodies (Ref 9-43). The far north and east extents of the study area fall within the Witham Lias groundwater body (GB40502G401400) within the Anglian RBMP, while the remainder of the Scheme is covered by the Lower Trent Erewash Secondary Combined groundwater body (GB40402G990300) within the Humber RBMP (see **PEI Report Volume 2: Figure 9-1**).
- 9.7.14 The Witham Lias groundwater body (WFD ID: GB40502G401400) covers a total area of 683.57 km² and under the WFD Cycle 2 classifications (2019), was classified as being at Good Status, overall, quantitatively and chemically. The Lower Trent Erewash Secondary Combined groundwater body (WFD ID: GB40402G990300) covers a total area of 1924.4 km² and during 2019 Cycle 2, was given Good Status, overall, quantitatively and chemically (Ref 9-43).
- 9.7.15 The Soilscape map viewer (Ref 9-57) describes the soils beneath the Solar and Energy Storage Park area of the Scheme as 'Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils'. These have moderate fertility and are most at risk from overland flow from compacted or poached fields. East and south of Marton there is an area of 'Naturally wet very acid sandy and loamy soils'. Where cropped this soil is vulnerable to leaching of nitrate and pesticides to groundwater, and is vulnerable to wind erosion in dry weather. There is also a small patch of 'Lime-rich loamy and clayey soils with impeded drainage' south of Marton. The floodplain of the River Trent is underlain by 'Loamy and clayey floodplain soils with naturally high groundwater' which has moderate fertility and is most at risk from



pollution from floodwater scouring. This spans much of the Grid Connection Route, along with another band of '*Naturally wet very acid sandy and loamy soils*' around the Cottam Power Station and substation.

Surface Water Bodies

- 9.7.16 The DCO Site is located between the Witham Management Catchment within the Anglian RBMP (Ref 9-33) and the Lower Trent and Erewash Management Catchment within the Humber RBMP (Ref 9-34). There are six WFD surface waterbody catchments within the study area. These are:
 - Trent from Carlton-on-Trent to Laughton Drain (WFD ID: GB104028058480) Main River;
 - Till (Witham) (WFD ID: GB105030062500) Main River;
 - Tributary of the Till (WFD ID: GB105030062480) Upper Witham IDB watercourse, known as Carr Drain;
 - Marton Drain Catchment (Trib of Trent) (WFD ID: GB104028057840) Trent Valley IDB watercourse;
 - Seymour Drain Catchment (WFD ID: GB104028058340) Trent Valley IDB watercourse: and
 - Skellingthorpe Main Drain waterbody (WFD ID: GB105030062390) Ordinary Watercourse.
- 9.7.17 Further details for each of these waterbodies is given in Table 9-4. Refer to **PEI Report Volume 2: Figure 9-1** for locations and **PEI Report Volume 2: Figure 9-4** which shows IDB watercourses.



Table 9-4: WFD Surface Waterbodies in the Study Area

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach	Reasons for Not Achieving Good Status
Trent from Carlton-on-Trent to Laughton waterbody (GB104028058480)	Moderate Ecological Potential (note that Biological Status is Bad due to a Bad classification for invertebrates)	Fail	Good (2027)	Artificial	The designation extends from the town of Carlton-on-Trent (approximately 18km south of Gate Burton as the crow flies) from where it flows predominantly north-north east for 58.6km to Laughton where the waterbody is then designated as the 'Humber Upper' WFD waterbody. The catchment has an area of 153 km².	Physical modifications relating to navigation and agriculture, continuous sewage discharges, diffuse agricultural pollution, poor soil management in the catchment and transport drainage

Relation to Scheme: The River Trent is located to the west of the Solar and Energy Storage Park but would be crossed by the Grid Connection Route to Cottam Substation at approximate NGR SK 83100 80866 (see **PEI Report Volume 2: Figure 9-1**).

Site Observations: The River Trent was observed between Cottam and Littleborough during the site visit, where it flows from south to north and is approximately 90m wide. The watercourse is tidal with the National Tidal Limit (NTL) being approximately 28km upstream of the DCO Site. The river occupies an expansive floodplain which is flanked by successions of terrace deposits that indicate the river's former dynamic character. However, the Trent has a long history of anthropogenic modification, resulting in a single-thread, passively meandering and morphologically homogenous river that is disconnected from its floodplain by extensive embankments. Flow within the channel was noted to be uniform and laminar, owing to the over-deep form maintained by artificial confinement; with no apparent hydraulic variance present. It was not possible to view the substrate character of the channel during the site visit; however, it is assumed to consist of fine gravels, sands and silts (the latter of which is derived predominantly from catchment-wide intensive agriculture and urbanisation). The adjacent riparian zone is severely depleted with only a thin yet fragmented strip adjoining the channel. However, the aforementioned embankments, which are maintained for the purposes of flood management, limit potential for development of a high-functioning riparian zone.

The river is used for navigation and is managed by the Canal and River Trust within the study area. The nearest moorings indicated on the Canal and River Trust website (Ref 9-58) are at the confluence of the Fossdyke Canal and River Trent at Torksey Lock, approximately 2.5km upstream of the DCO Site. There are 55 leisure berths at this mooring facility. The Torksey Yacht Club is also based at this location. There is also a fishery of 365m length on the left bank of the River Trent, within the study area, immediately north of the DCO Site at the River Trent crossing for the Grid Connection Route (Ref 9-58).

Further details regarding hydrology, tides and water quality are provided later in the baseline (see River Trent – Hydrology and Tidal Cycle and Water Quality subsections below).

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Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach	Reasons for Not Achieving Good Status
Till (Witham) waterbody (GB105030062500)	Moderate Ecological Potential (on the basis of Moderate physico- chemical quality elements, notably phosphates which are at Poor status)	Fail	Moderate (2015)	Heavily Modified	The watercourse designation extends from where it rises to the south of Gainsborough east of Warren Wood and continues east and south past Upton, Kexby and Willingham-on-Stow, to its confluence with the 'Lower Till' waterbody between Stow and Coates-on-Stow. The watercourse is 14.1km length and drains an area of around 35.2km².	Trade/industry discharges, sewage discharge (continuous) and poor nutrient management from agriculture.

Relation to Scheme: The River Till is located at the eastern extent of the study area, and would not be directly impacted by the Scheme. However, it is hydrologically connected to the Scheme via the 'Tributary of the Till' WFD waterbody. The Tributary of the Till's confluence with the River Till is 1.4 km downstream of the DCO Site (see **PEI Report Volume 2: Figure 9-1**).

Site Observations: This watercourse was not observed given that there would be no direct physical impact to it.

Tributary of the Till waterbody (GB105030062480)	Poor Ecological Status (on the basis of Poor macrophytes and phytobenthos combined)	Fail	Moderate (2027)	Not Artificial or Heavily Modified	Designated from its source east of the Solar and Energy Storage Park, just north of Kexby Lane, and continues south along the eastern margin of the Scheme (Solar and Energy Storage Park), and then continues south to meet the River Till at Tilby Dale. The watercourse is 4 New length and drains an area	Diffuse pollution from poor soil management and physical modification relating to land drainage
					is 4.9km length and drains an area of around 17.1km ² .	

Relation to Scheme: The Tributary of the Till forms the eastern extent of the Scheme boundary for approximately 1km to the west of Willingham by Stow. It also has tributaries (drains) that extend into the Scheme boundary (see **PEI Report Volume 2: Figure 9-1**).

Site Observations: This watercourse was observed between Marton Road and Park Farm and is agricultural in character. It is highly modified, with extensive straightened sections with signs of recent dredging. The channel is trapezoidal with steep incised banks and the wetted width was approximately 1m at the time of the visit. It is conveyed beneath Marton Road through a box culvert of approximately 1.5m width. Flow is impounded upstream of the culvert to create a pool with a water

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Waterbody	Ecological Status /	Chemical	Overall Target	Hydromorphological Designated Reach	Reasons for Not
-	Potential	Status	Objective	Designation	Achieving Good Status

depth at the time of the walkover of around 30cm. Arable agriculture extends to the channel margins on both banks in this stretch with no riparian buffer, and so would be expected to suffer from agricultural pollution. The watercourse was covered in extensive duck weed and *Calamagrostis* spp. grasses. Bed substrate, where visible, was dominated by fine sediments. Water was generally standing in pools at the time of the site visit (low flow conditions) with no observable flow.

Marton Drain	Moderate Ecological	Fail	Good (2027)	Heavily Modified	The watercourse is designated from	Physical modifications,
Catchment	Status (on the basis of			•	Torksey Village Green and flows	sewage discharge
(tributary of Trent)	dissolved oxygen				north to meet the River Trent west	pollution and poor
waterbody	which is at Moderate				of Marton. It is 3.14km in length and	livestock management
(GB104028057840)	status)				drains a total area of 5.04 km ² .	

Relation to Scheme: Marton Drain would be crossed by the Grid Connection Route at approximate NGR SK 83715 81113.

Site Observations: Marton Drain was visited at its crossing of the A156 south of Marton. It has a straightened, trapezoidal channel and was approximately 5m in width. It has steep incised banks rising approximately 5m from the bed on the left bank, and 3m on the right bank. At the time of the site visit the water within the channel was extremely turbid and so the depth could not be ascertained. The margins showed extensive fine sediment deposition and a brown scum indicative of poor water quality. There was rough grassland on the left bank for approximately 5m to provide a buffer from the adjacent arable field. No macrophytes were observed at the time of the site visit.

Seymour Drain Catchment (tributary of Trent) (GB104028058340)	Fail	Good (2027)	Heavily Modified	The watercourse rises in an agricultural region, south of the village of Rampton where it flows in a step-like fashion in a north easterly direction for 6.5km before reaching the confluence with Trent from Carlton-on-Trent to Laughton waterbody (River Trent). It is 6.5 km in length and drains a catchment of	management and transport drainage
				19.6km ² .	

Relation to Scheme: Seymour Drain would be crossed by the Grid Connection Route at approximate NGRs SK 81532 78691 and SK 82080 80728.

Site Observations: Seymour Drain to the south of the Cottam Power station is a straightened, and artificial channel. It is approximately 1.5m wide, with banks rising 2-3m from the bed. Water depth at the time of the site visit was approximately 0.3m. Along the left bank there is deciduous hedgerow vegetation which will provide a degree of shading and a buffer from the adjacent arable fields. The left bank lacks any riparian vegetation between the channel and the adjacent field. The bed is dominated by fine sediment and there were no macrophytes present in the watercourse at this point. The watercourse flows along Torksey Ferry Road, under which it is then culverted before entering another culvert beneath the Cottam Power Station. The watercourse was also visited off Headstead Bank, downstream of the Cottam

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Waterbody	Ecological Status /	Chemical	Overall Target	Hydromorphological Designated Reach	Reasons for Not
	Potential	Status	Objective	Designation	Achieving Good Status

Power Station. Here it exhibited a small degree of sinuosity, albeit in a sharply defined and over deep channel. The channel width was approximately 4m wide at this point, with banks rising 3m from the bed. Depth was around 0.5m. There is no significant riparian vegetation to provide a buffer from the adjacent fields. The water is relatively clear and noticeably less turbid compared to adjacent watercourses surveyed although the bed is dominated by fine sediment, and there were some submerged macrophytes present.

Skellingthorpe Main Drain (GB105030062390)	Moderate Ecological Potential	Fail	Moderate (2015)	Heavily Modified	The designated waterbody rises south of Broadholme and flows southeast to meet the River Witham in Lincoln. It is 10.2km in length and drains a large catchment of 98.3km². It is this wider catchment that extends into the study area for	
					the Scheme.	

Relation to Scheme: The Skellingthorpe Main Drain is approximately 10km south of the DCO Site and flows south-east from near Saxilby towards Lincoln. However, its WFD catchment covers much of the Solar and Energy Storage Park and there may be hydrological connectivity to the watercourse via the drains and tributaries that extend into the Solar and Energy Storage Park.

Site Observations: Given that there would be no direct physical impact to this waterbody and that it is approximately 10km south of the DCO Site it was not visited during the walkover.

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9.7.18 In addition to the WFD watercourses, there are several undesignated tributaries of these waterbodies present within the study area, along with drains, ditches and ponds. Named watercourses that have been identified on the basis of Ordnance Survey mapping (Ref 9-39) are listed in Table 9-5.

Table 9-5: Named watercourses in the study area

Waterbody	Relevant WFD Catchment	Watercourse Description	Site Observations
Padmoor Drain	Upstream tributary of the 'Tributary of the Till' (Carr Drain)	This watercourse rises adjacent to Thurlby Wood (northeast of Knaith Park) immediately north of the study area and flows in a south-south-easterly direction through the study area for 1.4km before being WFD designated as 'Tributary of Till' from in between Kexby Lane and Padmoor Lane. This is an Upper Witham IDB watercourse. It does not cross into the DCO Site and is upstream of the Scheme.	The watercourse was observed from Padmoor Lane. Here it was a straight, artificial, trapezoidal channel of around 1.5m width. The bed was dominated by fine sediment. The channel has step, incised banks rising up to 2m from the bed. Off Padmoor Lane the eastern bank had little riparian buffer to the adjacent arable agricultural land but hedgerow vegetation was found along the western bank.
Causeway Drain	Upstream tributary of the 'Tributary of the Till' (Carr Drain)	This watercourse is located adjacent to Kexby Lane in the northern extent of the study area. It then flows north and east following artificial ninety degree turns to join Padmoor Drain at the point where it becomes WFD designated. This is an Upper Witham IDB watercourse, and is partially located within the Solar and Energy Storage Park. It has a total length of 1.5km.	This watercourse was observed along Kexby Lane. Here it almost resembled a swale, being a grassy trapezoidal channel of 1m width. It had recently been mowed with cut grass having accumulated in the channel. Plant were present dredging out the channel at the time of the visit. Kexby Lane is located within a metre of the watercourse and it is likely to receive over the edge drainage from the road. The northern bank is adjacent to an arable agricultural field, but there is a buffer strip of grassland of around 3m width.
Mother Drain	Tributary of Trent from Carlton-on- Trent to Laughton Drain Water Body	This watercourse is located at the north eastern extent of the study area (but does not cross into the DCO Site). It rises adjacent to Coates Road, south of Littleborough and flows generally north to discharge to the River	This watercourse was observed north of Littleborough Road. Mother Drain is a straightened, trapezoidal, artificial channel. It is approximately 6m wide. There is little to no floodplain connectivity due to the over deep nature of the channel banks rising 3m up from the



Waterbody	Relevant WFD Catchment	Watercourse Description	Site Observations
		Trent at Out Ings. It has a total length of approximately 4.3km, and is a Trent Valley IDB watercourse. It is also an LWS of interest for water beetles.	bed. The water during the site visit was very turbid but the depth could be seen to be approximately 0.5m. The bed was dominated by fine sediment. There was a surface scum around the channel margins and duck weed was widespread. There are numerous culverted crossings of the watercourse for farm tracks.

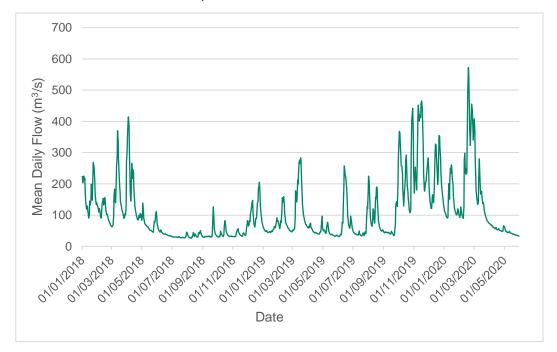
- 9.7.19 There are many unnamed agricultural drains ubiquitous across the area (see PEI Report Volume 2: Figure 9-1). Based on the site visits undertaken to date, all of these watercourses are of a highly modified character, with extensive straightened sections and ongoing dredging activity observed throughout. The presence of many of the linear watercourses within the study area is a consequence of land drainage activities which have facilitated intensive arable farming across what was once expansive floodplain and wetland environments connected to the rivers Trent and Till. Consequently, the watercourses are grossly over-deepened, trapezoidal ditches, with very little hydraulic variation, although the survey was conducted during exceptionally low flow conditions. Channel substrate is predominantly silt, with little or no gravel present, resulting in essentially no variance of bedform throughout.
- 9.7.20 The riparian zone adjacent to the channels is generally depleted with obvious signs of management and cutting, presumably to maintain drainage conveyance. In-channel vegetation is mostly defined by excessive nutrient ingress and lack of flow: duck weed was especially abundant, indicating that flow within the channels is very slow or stagnated.
- 9.7.21 Overall, the watercourses within the study area are either man-made or extensively modified, with limited potential for hydromorphological improvement.
- 9.7.22 There are numerous standing waterbodies and ponds located across the study area. The largest is within a meander on the western bank of the River Trent at NGR SK 82713 83290 and is approximately 4.02 ha in size. This is known as Littleborough Lagoon and is a Local Wildlife Site (LWS). It is a shallow lagoon within a flood bank and drain of botanical and ornithological importance.
- 9.7.23 There is a wetland area within a meander of the River Trent at Coates within the study area (but not the DCO Site), known as Coates wetland (SK 83136 81442). This is an LWS, consisting of a group of pools with rough grazing land, providing an area of zoological and botanical interest.



- 9.7.24 There are several large waterbodies within the Cottam Power Station site, as well as a wetland area located between the Cottam Power Station and River Trent in the southern extent of the study area close to Torksey Viaduct (SK 83031 79169). This wetland area is known as Cottam Wetlands and is an LWS due to being an excellent wetland mosaic comprising lagoons, marshy grasslands, swamp and a representative length of the River Trent.
- 9.7.25 Aside from these larger waterbodies and wetlands, there are numerous small agricultural ponds located across the entire study area. At this stage none of these small ponds are known to have any particular biodiversity value or current socio-economic use.

River Trent - Hydrology and Tidal Cycle

- 9.7.26 The NTL for the River Trent is approximately 28km upstream of the DCO Site (Ref 9-39) at Cromwell Weir, shortly downstream of Newark-on-Trent.
- 9.7.27 The nearest Environment Agency gauging station on the River Trent is at North Muskham which lies approximately 23km south (upstream) of the Scheme near the village of Collingham. Annual mean flow at this station is 90.43m³/s (based on data between 1968 and 2020), with a maximum daily flow of 857m³/s registered on 27/02/1977. The flow that is exceeded 95% of the time (Q95) is 28.9 m³/s (Ref. 9-42). Graph 9-1 shows the mean daily flow at North Muskham for the period 2018 to 2020 inclusive.



Graph 9-1 Mean daily flow for the River Trent at North Muskham Gauging Station, 2018-2020 (Source: National River Flow Archive, Ref 9-42).

9.7.28 The River Trent is characterised by a semi-diurnal tide (i.e. a cycle which has two high and two low tides a day). There is approximately 24 hours 50 minutes between two tidal crests (for example, high– low –high–low–high) and so one tidal cycle (that is, high–low–high) has a period of approximately 12 hours 25 minutes. In this regime, the two high tide levels are commonly unequal.



- 9.7.29 A complete tidal cycle from high tide to low tide to high tide comprises two distinct elements the flood tide (the incoming tide when water levels are rising) and the ebb tide (the outgoing tide when water levels are falling).
- 9.7.30 There are two key variations in tides which occur over a 29-day cycle (i.e. spring and neap tides), with two spring and two neap tides occurring over this period. During neap tides, the tidal range is significantly reduced compared with that experienced during spring tides (that is, high tide levels are lower and low tide levels are higher). The maximum spring and neap tides occur approximately 1.5 days after new/ full Moon or first/ last quarter. These two variations have a significant influence on the range of impact on water quality and suspended sediment.
- 9.7.31 The tides experienced in the River Trent estuary have very pronounced spring and neap tides. In addition, the tidal cycle seen in the River Trent estuary is not perfectly symmetrical (i.e. flood and ebb portions of the cycle are of unequal lengths). This is due to frictional resistance between oncoming and reflected tidal waves within the irregular coastline of the Humber estuary. In the River Trent, the time between ebb slack and flood slack is approximately three hours, while the difference between flood slack and ebb slack is approximately nine hours. This gives rise to a very rapid rise in tide level followed by a slow decline in the tide level. These times are subject to natural variation, particularly due to weather and flow within the River Trent itself (Ref 9-59).
- 9.7.32 At Gainsborough, the usual range of the River Trent taking account of tidal variability is between 1.29m and 5.00m (Ref 9-60).
- 9.7.33 There are two Trent Valley IDB pumping stations located on the banks of the River Trent in the study area, with one located on the east bank adjacent to Marton (NGR SK 82576 81524) and another on the west bank adjacent to Coates (SK 83487 81342), see **PEI Report Volume 2: Figure 9-4**. There are a further two pumping stations at Torksey Lock, south of the study area.

Water Quality

- 9.7.34 Water quality data for the River Trent (at Dunham), Seymour Drain, Marton Drain (at Brampton Grange) and the Tributary of the Till (Carr Drain) at Kexby Lane has been obtained from the Environment Agency's Water Quality Archive website (Ref 9-44) and is summarised in Table 9-6a and 9-6b for the period 2017-2021, with relevant WFD standards provided for comparison in Table 9-7. Monitoring locations are shown on **PEI Report Volume 2: Figure 9-1**.
- 9.7.35 Table 9-6a indicates that the River Trent is slightly alkaline in nature, with an average pH of 8.09 and falls into the WFD classification of High (see Table 9-7 for WFD environmental quality standards). A 10th percentile dissolved oxygen saturation of 88.66% is over the High classification threshold which suggests the waterbody is well oxygenated. Ammonia concentrations are classified as High which suggests pollution from organics such as sewage materials are not having a detrimental effect on the waterbody. Nitrates and orthophosphate concentrations are elevated, and is not surprising given the agricultural landscape surrounding the River Trent in this stretch of the river.



- 9.7.36 Table 9-6a indicates the water quality at Seymour Drain at Cottam is circumneutral with a mean pH of 7.68 and this falls within the WFD High classification, based on the 44 samples considered here (2017-2021). A 10th percentile dissolved oxygen saturation of 50.24% falls within the Poor WFD classification (with a 10th percentile of 54% being Moderate). Biochemical Oxygen Demand (BOD) is within the High WFD classification with a concentration of 1.419mg/l, suggesting low levels of organic pollution. Ammonia levels fall within the WFD classification for High at a 90th percentile value of 0.17mg/l (90th percentile lower than 0.3 mg/l is High) which similarly suggests pollution from organics is limited. Nitrate values are elevated (mean of 8.009mg/l N), as are orthophosphate concentrations (mean 0.68 mg/l) and again indicate probable pressure from the surrounding agricultural land uses through use of fertilisers and other products which may runoff to the watercourse.
- 9.7.37 Table 9-6b indicates that Marton Drain at Brampton Grange is circum-neutral with a mean pH of 7.62 and falls within the WFD high classification, based on the 28 samples considered here. A 10th percentile dissolved oxygen saturation of 65.88% is Good (with a 10th percentile of 70% being High under the WFD EQS) which suggests the waterbody is well oxygenated. BOD falls within the Moderate WFD classification with a 90th percentile value of 6.68mg/l, suggesting moderate levels of organic pollution. However, the maximum value recorded is 19 mg/l, which indicates periodic episodes of worsened organic pollution. Ammonia concentrations fall within the WFD classification for Good at a 90th percentile value of 0.6mg/l. Nitrate values are high (mean of 10.33mg/l N) and indicate probable pressure from the surrounding agricultural land uses. Orthophosphate values have a mean of 0.1mg/l.
- 9.7.38 Table 9-6b indicates that the tributary of the River Till at Kexby Lane is circumneutral with a mean pH of 7.75 (within the WFD EQS, see Table 9-7), based on the 15 samples considered here. Dissolved oxygen saturation is within the WFD High classification range, BOD and ammonia meet the High EQS indicating low organic pollution. Nitrate values are elevated (mean of 7.31mg/l N) similarly to the other monitoring sites relating to the study area and indicate agricultural pressure. However, orthophosphate values are lower than at the other nearby monitoring sites with a mean of 0.038mg/l.



Table 9-6a Summary Environment Agency water quality monitoring data (2017-2021)

Determinant	Units	Seymour I	Orain				Tidal Trent – a	t Dunham			
		Average	Max	Min	90th%ile	10th%ile	Average	Max	Min	90th%ile	10th%ile
рН	pH Units	7.68	8.05	7.17	7.9	7.4	8.09	9.01	7.67	8.16	7.91
Temperature of Water	°C	10.9	16.7	4.1	16.04	5.92	10.6	21.6	4.6	19.0	5.1
Conductivity at 25°C	µs/cm	1692	1807	1542	1779	1600	812	1035	505	976	612
Biochemical Oxygen Demand (BOD): 5 Day ATU	mg/l	1.2	1.5	1.0	1.4	1.0	-	-	-	-	-
Ammoniacal Nitrogen as N	mg/l	0.09	0.85	0.03	0.18	0.03	0.12	0.44	0.03	0.23	0.03
Nitrogen, Total Oxidised as N	mg/l	8.61	15.5	4.20	11.0	6.52	9.2	12.3	5.5	10.98	7.19
Nitrate as N	mg/l	8.01	10.9	4.42	9.434	6.39	8.37	11.4	4.35	10.32	6.47
Nitrite as N	mg/l	0.049	0.110	0.019	0.082	0.021	0.32	7.92	0.01	0.09	0.02
Ammonia un- ionised as N	mg/l	0.0007	0.0026	0.0002	0.0013	0.0003	0.002	0.015	0.001	0.003	0.001
Alkalinity to pH 4.5 as CaCO3	mg/l	236.2381	280	200	260	210	164	178	136	178	144
Orthophosphate, reactive as P	mg/l	0.678	1.77	0.256	1.188	0.289	0.269	0.44	0.12	0.39	0.16
Oxygen, Dissolved, % Saturation	%	78.52	132.8	20	98.09	50.24	96.32	118.40	83.3	100.47	88.66



Determinant	Units	Seymour Drain					Tidal Trent – at Dunham				
		Average	Max	Min	90th%ile	10th%ile	Average	Max	Min	90th%ile	10th%ile
Oxygen, Dissolved	mg/l	8.67	14.7	3.74	11.6	4.61	10.85	13.00	7.69	12.66	8.71

Table 9-6b Summary of Environment Agency water quality monitoring data (2017-2021)

Determinant	its Marton Drain at Brampton Grange					Tributary of the Till at Kexby Lane					
		Average	Max	Min	90th%ile	10th%ile	Average	Max	Min	90th%ile	10th%ile
рН	pH Units	7.62	8.31	7.32	7.85	7.41	7.75	8.34	7.34	8.16	7.38
Temperature of Water	°C	10.74	19.80	3.50	19.12	4.38	9.29	15.8	2.5	14.38	4.04
Conductivity at 25°C	μs/cm	1032	1044	1020	1041	1022	731	1010	504	914	598
Biochemical Oxygen Demand (BOD): 5 Day ATU	mg/l	3.41	19.0	1.00	6.68	1.18	2.1	5.6	1	2.8	1
Ammoniacal Nitrogen as N	mg/l	0.37	3.70	0.03	0.60	0.05	0.13	0.73	0.035	0.129	0.039
Nitrogen, Total Oxidised as N	mg/l	10.45	33.00	5.57	15.00	5.76	7.35	17.0	2.20	10.49	3.32
Nitrate as N	mg/l	10.33	32.90	5.49	15.40	5.65	7.31	16.80	2.18	10.48	3.28
Nitrite as N	mg/l	0.0952	0.3400	0.0250	0.1578	0.0351	0.03999	0.1900	0.0154	0.0519	0.0168
Ammonia un- ionised as N	mg/l	0.002	0.018	0.000	0.003	0.0004	0.0010	0.0026	0.0001	0.0025	0.0001
Alkalinity to pH 4.5 as CaCO3	mg/l	207	250	130	233	190	205	258	110	238	187



Determinant	Units	Marton Dra	Marton Drain at Brampton Grange			Tributary of the Till at Kexby Lane					
		Average	Max	Min	90th%ile	10th%ile	Average	Max	Min	90th%ile	10th%ile
Orthophosphate, reactive as P	mg/l	0.1063	0.2900	0.0100	0.2000	0.0270	0.038	0.074	0.019	0.056	0.021
Oxygen, Dissolved, % Saturation	%	89.97	148.50	52.40	138.28	65.88	87.91	126	48.3	120.28	60.78
Oxygen, Dissolved as O2	mg/l	9.95	15.50	6.30	13.63	7.43	10.14	14.8	5.01	13.4	7.09



Table 9-7 Summary of WFD Standards for watercourses in the study area

Determinant	Unit	Statistic	High	Good	Moderate	Poor	Bad
BOD	mg/l	90%ile	4	5	6.5	9	>9
Ammonia	mg/l	90%ile	0.3	0.6	1.1	2.5	>2.5
Dissolved Oxygen	% sat	10%ile	70	60	54	45	<45
рН	pH units	High-Good: 5 and 95%ile; Mod-Poor 10%ile	>6 &<9	>6 &<9	4.7	4.2	<4.2
Temperature	Degrees Celsius (°C)	98%ile (not in salmonid WBs and canals)	25	28	30	32	>32

Aquatic Ecology

9.7.39 Historic records of fish, macroinvertebrate and aquatic macrophyte surveys within the last ten years are available from the Environment Agency Ecology and Fish Data Explorer website. Details of relevant Environment Agency monitoring sites are summarised in Table 9-8.

Table 9-8: Location of relevant Environment Agency fish, macroinvertebrate and macrophyte monitoring sites in the study area

Site name (ID)	WFD Waterbody	Site National Grid Reference	Distance from Site	Year last surveyed	Group monitored
Marton Drain (52709)	GB104028057 840	SK8350081240	0.05km d/s of Grid Connection Route (GCR) crossing	2020	Macrophytes
Marton Drain (54038)	GB104028057 840	SK8412980987	0.02km d/s of GCR crossing	2013	Invertebrates
Seymour Drain (165003)	GB104028058 340	SK8216480935	0.2km d/s of GCR crossing	2015	Macrophytes
Seymour Drain (158852)	GB104028058 340	SK8258081417	0.9km d/s of GCR crossing	2012	Invertebrates
Padmoor Drain (160480/16170 9)	GB105033062 480	SK8723683541	Within Solar and Energy Storage Park boundary	2016	Invertebrates, Macrophytes

9.7.40 Three macroinvertebrate surveys were undertaken at the Marton Drain (52709) monitoring site between March and October 2013. A total of 47 macroinvertebrate taxa were recorded, including two non-native species: the non-invasive New Zealand mud snail *Potamopyrgus antipodarum* and the invasive amphipod *Crangonyx pseudogracilis/floridanus*. No protected macroinvertebrate taxa were recorded.



- 9.7.41 One macroinvertebrate survey was undertaken at the Seymour Drain (158852) monitoring site in March 2012. A total of 28 macroinvertebrate taxa were recorded, including the non-native and invasive C. pseudogracilis/floridanus. No protected macroinvertebrate taxa were recorded.
- 9.7.42 Four macroinvertebrate surveys were undertaken at the Padmoor Drain (160480) monitoring site in March and September 2013 and 2016. A total of 61 macroinvertebrate taxa were recorded, including two non-native species: *P. antipodarum* and *C. pseudogracilis/floridanus*. No protected macroinvertebrate taxa were recorded.
- 9.7.43 One macrophyte survey was undertaken at the Marton Drain (52709) monitoring site in August 2020. A total of 15 macrophyte taxa were recorded, including the non-native and invasive Nuttal's waterweed *Elodea nuttallii*. No protected macrophyte species were recorded.
- 9.7.44 Two macrophyte surveys were undertaken at the Seymour Drain (165003) EA monitoring site in June 2013 and August 2015. A total of 20 macrophyte taxa were recorded, including the invasive *E. nuttallii*. No protected macrophyte species were recorded.
- 9.7.45 The nearest fish survey undertaken on the River Trent was at North Clifton (SK8167872697), approximately 9km upstream. The most recent survey undertaken at this site was in October 2015. A single catch sample recorded 117 chub Leuciscus cephalus, 117 bleak Alburnus alburnus, 20 minnow Phoxinus phoxinus, 3 3-spined stickleback Gasterosteus aculeatus, 2 perch Perca fluviatilis, 1 roach Rutilus rutilus, 1 common goby Pomatoschistus microps, and 1 flounder Platichthys flesus.

Nature Conservation Sites

- 9.7.46 Within the study area, there are no designated protected areas of national importance including Sites of Special Scientific Interest (SSSIs), Special Areas of Conservation (SACs), National Nature Reserves (NNRs), or Local Nature Reserves (LNRs).
- 9.7.47 The nearest such site is the Lea Marsh SSSI, approximately 1.8km north-west of the Solar and Energy Storage Park. The Lea Marsh SSSI is 27ha in area. It is designated as an important area of unimproved floodplain meadow and wet pasture adjacent to the River Trent. The site lies on seasonally-inundated alluvial soils and includes an unusually large area of a nationally rare grassland type. Populations of two nationally scarce plants (narrow-leaved water-dropwort *Oenanthe silaifolia* and mousetail *Myosurus minimus*) with a restricted distribution in the East Midlands are particularly notable, whilst breeding waders provide additional interest. Approximately 45% of the site is meeting 'favourable' status, while 52% is 'unfavourable no change' (Ref 9-48). While this site is on the floodplain of the River Trent, it is over 9km downstream of the proposed Grid Connection Route crossing beneath the Trent, and as such there is not considered a pathway to impact this site, given the large dilution and dispersal potential for pollutants offered by the river. It is therefore scoped out of further assessment.



9.7.48 There are seven Non-Statutory Designated LWS sites of aquatic importance within the study area. Details of these sites are shown in Table 9-9 below.

Table 9-9: Non-Statutory Designated Sites of aquatic importance within the study area

Site name	Designation	Grid Reference	Distance from site	Nature conservation interest
Thurlby Wood	LWS	SK 84676 86417	0.4km from Solar and Energy Storage Park boundary	Semi-natural ancient woodland of significant botanical interest. Wettest parts of the site, including a pond, support a range of macrophytes
Out Ings	LWS	SK 82566 84730	0.5km from Solar and Energy Storage Park boundary	A diverse mosaic of grassland, open water and carr communities adjacent to the River Trent
Mother Drain, Upper Ings	LWS	SK 82148 83371	Partially within study area for Grid Connection Route	A drain of interest for water beetles
Littleborough Lagoons	LWS	SK 82719 83297	Crossed by Grid Connection Route	A shallow lagoon with flood bank and drain of botanical and ornithological importance
Coates Wetland	LWS	SK 83136 81442	Crossed by Grid Connection Route	A group of pools with rough grazing land and a section of the River Trent, providing an area of zoological and botanical interest
Cow Pasture Lane Drains	LWS	SK 80682 80384	Crossed by Grid Connection Route	Drains with notable aquatic and bankside vegetation
Cottam Wetlands	LWS	SK 83031 79169	Crossed by Grid Connection Route	A wetland mosaic comprising lagoons, marshy grasslands, swamp and a representative length of the River Trent

Water Resources

- 9.7.49 The north-west of the DCO Site and the 1km study area west of Knaith and south to Littleborough falls under a Drinking Water Protected Area. Drinking Water Protected Areas (Surface Water) are where raw water is abstracted from rivers and reservoirs and additional measures are required to protect the raw water supply to reduce the need for additional purification treatment (Ref 9-46). However, the study area does not fall within any Drinking Water Safeguard Zones for surface water or groundwater (Ref 9-62).
- 9.7.50 The entire study area is split between four Nitrate Vulnerable Zones (NVZ). These are i) NVZ S347 R Trent from Carlton-on-Trent to Laughton Drain; ii) NVZ S375 Lower Witham; iii) NVZ S343 Seymour Drain Catchment (trib of Trent); and iv) NVZ S344 Catchwater Drain Catchment (trib of Trent). NVZs are statutory designated areas at risk from agricultural nitrate pollution and includes about 55% of land in England. The designations are made in accordance with the Nitrate Pollution Prevention Regulations 2015.
- 9.7.51 There are no Source Protection Zones within the study area (Ref 9-46).
- 9.7.52 The River Trust's 'Is My River Fit to Play In' website (Ref 9-61) indicates that there is a combined sewer overflow into Causeway Drain within the study area



(permit ANNNF13805), as well as a pumping station discharging sewage into Padmoor Drain (permit AW3NFF384) and sewage treatment works discharging treated effluent into a tributary of Marton Drain (permit T/69/45820/R) and Seymour Drain (permit EPRJP31214GK). Further details on licensed discharges (Water Activity Permits) in the study area has been requested from the Environment Agency and will be presented in the ES.

9.7.53 Further information regarding licensed water abstractions and pollution incidents that have occurred in the study area have also been requested from the Environment Agency but had not been received at the time of writing (May 2022). Details of Private Water Supplies (PWS) in the study area have been requested from West Lindsey District Council and Bassetlaw District Council. Bassetlaw District Council and West Lindsey District Council have confirmed that there are no known PWS in the study area. All additional data received will be provided within the Environment Statement.

Flood Risk

Solar and Energy Storage Park

9.7.54 Flood risk from all sources for the Solar and Energy Storage Park is summarised in Table 9-10. Refer to **PEI Report Volume 2: Figure 9-2** for mapping of fluvial flood risk in relation to the Scheme, and **PEI Report Volume 2: Figure 9-3** for mapping of surface water flood risk.

Table 9-10: Flood Risk from All Sources -Solar and Energy Storage Park

Flood Risk Source	Flood Risk Level	Comments
Fluvial	Low (majority)	Source: Environment Agency Flood Zone Dataset
	Medium - High (North west side	The Solar and Energy Storage Park is predominantly in Flood Zone 1 (land assessed as having a less than 1 in 1000 annual probability of river or sea flooding).
	and west boundary, Padmoor drain corridor)	However, the north-east corner of the Solar and Energy Storage Park does cross an area of Flood Zone 2 and 3 associated with Padmoor drain (ordinary watercourse) along Kexby Lane. This is land assessed as having between a 1 in 1000 (0.1% Annual Exceedance Probability (AEP)) and 1 in 100 (1% AEP) annual probability of river or sea flooding.
		To the east of the Solar and Energy Storage Park is a corridor of Flood Zone 3 that is associated with Padmoor Drain (1 in 100 or greater annual probability of river flooding (>1% AEP)), draining south towards the River Till.
		Source: Lincolnshire County Council PFRA 2011 (Ref 9-63)
		PFRA mapping shows these areas highlighted above to be classified as floodplain, and therefore classified as Flood Zone 3b (functional floodplain).
		Source: West Lindsey SFRA (2009) (Ref 9-64)
		SFRA uses Flood Zone 2 as a proxy for extent of Flood Zone 3a including climate change (possible extent of flood zone 3 in 100 years (based on predictions in 2009)).
		Assuming Flood Zone 2 as the climate change Flood Zone 3a extent, flood risk is still confined to the watercourse, so there will be no change in flood risk in this location, to or for the Scheme.



Flood Risk Source	Flood Risk Level	Comments
		Summary: The majority of the site lies in Flood Zone 1, with areas of Flood Zone 2 and 3 (3b) running across the north-east corner of the Solar and Energy Storage Park and along the eastern border, both associated with Padmoor Drain. Development should not be located outside Flood Zone 3b, unless it is classified as "essential infrastructure", has passed the exception test, and is water compatible in design (Ref 9-23).
Surface Water	Very low (majority) Low – high (localised shallow patches)	Source: EA surface water flood risk mapping (Ref 9-65) The risk of surface water flooding is generally very low (annual chance of flooding of less than 0.1% AEP) for most of the site, with areas of low (chance of flooding of between 0.1% and 1% AEP), medium (chance of flooding of between 1% and 3.3% AEP) and high risk (chance of flooding of greater than 3.3% AEP) generally associated flow pathways following topographic low points including drains and agricultural ditches. Padmoor Drain, the western side of the railway line embankment and the southern fields draining from the Solar and Energy Storage Park show the greatest extent of potential surface water flooding.
		The water depth associated with both the high and medium risk scenarios is generally less than 900mm and very localised. For the low risk (chance of flooding of between 0.1% and 1%) scenario depths only exceed 900mm in only a very limited area.
Ground water	Very Low - Low(majority)	Source: Lincolnshire County Council PFRA 2011 (Ref 9-63) PFRA mapping indicates susceptibility to groundwater flooding is predominantly <25% with minimal areas of 25-50% and 50-75% susceptibility. Further confirmation will be sought via BGS Groundwater Flood Map at the ES stage.
Sewers	Very low	Source: Anglian Water Drainage and Water Search - considered low risk based on location and extent of assets versus the extent of the Solar and Energy Storage Park.
Artificial	Very low	The Scheme is not at risk from reservoir flooding.
Tidal	Low	There is a tidal influence, in this area however it is reasonable to assume that the fluvial influence is likely to outweigh the tidal influence and therefore the risk from tidal flooding is considered low based on the distance upstream from river mouth and flood defences in the area.

Grid Connection Route

9.7.55 Flood risk from all sources for the Grid Connection Route is summarised in Table 9-11. Refer to **PEI Report Volume 2: Figure 9-2** for mapping of fluvial flood risk in relation to the Scheme, and **PEI Report Volume 2: Figure 9-3** for mapping of surface water flood risk.



Table 9-11: Flood Risk from All Sources - Grid Connection Route

Flood Risk	Flood Risk Level	Comments
Source		

Fluvial

High (but defences are present)

Source: EA Flood Zone mapping (Ref 9-65)

Majority of the Grid Connection Route is in Flood Zone 3 (1 in 100 or greater annual probability of river flooding), entering this zone shortly after exiting the southern boundary of the Solar and Energy Storage Park at Marton and remains within Flood Zone 3 for the remainder of the route. South of Marton the proposed route crosses a flood alleviation channel associated with Marton pumping station, as well as several smaller drains on both sides of the River Trent.

The corridor intersects the flood defence embankments on the eastern side of the River Trent crossing, and on the western side. On the west bank the route intersects the western flood defence embankment before continuing north of Cottam.

Flood Zone 2 and 3 are associated with the River Trent and its floodplain, however there are flood defences that border this watercourse through its entire length through the Scheme.

Source: West Lindsey SFRA (2009) (Ref 9-64) – East of R. Trent

SFRA uses Flood Zone 2 as a proxy for extent of Flood Zone 3a including climate change (possible extent of flood zone 3 in 100 years (based on predictions in 2009)).

Assuming Flood Zone 2 as the climate change Flood Zone 3a extent as a conservative approach, there is no change in flood risk to the Grid Connection Route to the east of the River Trent.

Source: Bassetlaw SFRA (2019) (Ref 9-66) – West of R. Trent

The climate change mapping in this SFRA uses the results from the existing Environment Agency hydraulic models (100-year +20%) and where no hydraulic models exist, Flood Zone 2 has been used as a conservative indication. EA mapping along the Grid Connection Route (100-year + 20%) appears to result in the same extent as the current Flood Zone 3 and does not exceed Flood Zone 2.

Assuming Flood Zone 2 as the climate change Flood Zone 3a extent as a conservative approach, there is no change in flood risk to the Grid Connection Route to the west of the River Trent.

Summary:

The majority of the Grid Connection Route is in Flood Zone 3, associated with the River Trent and its floodplain. Development should not be permitted within Flood Zone 3, unless it is classified as "essential infrastructure". In Flood Zone 3a essential infrastructure should be



Flood Risk Source	Flood Risk Level	Comments
		designed and constructed to remain operational and safe in times of flood.
Surface Water	Very low (majority)	Source: EA surface water flood risk mapping (Ref 9-65)
		The risk of surface water flooding is generally very low (annual chance of flooding of less than 0.1% AEP) with isolated patches of low (chance of flooding of between 0.1% and 1% AEP), medium (chance of flooding of between 1% and 3% AEP) and high risk (chance of flooding of greater than 3.3% AEP) generally associated with drains and agricultural ditches.
		The Bassetlaw SFRA (Ref 9-66) confirms that the Grid Connection Route does not fall within a Critical Drainage Area.
Groundwater	High	Source: Lincolnshire County Council PFRA 2011 (Ref 9-63) PFRA mapping indicates susceptibility to groundwater flooding is predominantly >75% within the Grid Connection Route. Further confirmation will be sought via BGS Groundwater Flood Map at the ES stage.
Sewers	Low	Source: Bassetlaw SFRA Addendum (2021) - Considered low risk based on information within the SFRA Addendum (1-2 sewer flooding incidences across postcode area that falls within Grid Connection route).
Artificial	High	Source: EA Risk of reservoir flooding map (Ref 9-65) The River Trent and some of its immediate riparian margin as it passes through the DCO Site is within the risk of flooding from a reservoir breach. The majority of the route is covered by the combined risk of when there is also flooding from rivers, with a small area North and east of Cottam that would be flooded when river levels are normal. Statutory reservoirs (large, raised reservoirs with volumes above ground of 25,000m³ or over) are regularly inspected and maintained as set out in the Reservoirs Act 1975. As such, flooding from these sources is considered to be negligible.
Tidal	Low	There is a tidal influence, in this area however it is reasonable to assume that the fluvial influence is likely to outweigh the tidal influence and therefore the risk from tidal flooding is considered low based on the distance upstream from river mouth and flood defences in the area.



Future Baseline

9.7.56 The future baseline scenarios are set out in **Chapter 5: Methodology** and described below.

Future Baseline – 2025-2026 No Development, 2025-2028 Construction, 2028 Operation

Surface Water

- 9.7.57 The Till (Witham) WFD waterbody and Skellingthorpe Main Drain WFD waterbody are currently at their target WFD objective for 2015 (Moderate Ecological Status), whereas the remaining WFD waterbodies are all below their target objectives for 2027. However, these WFD classifications are subject to change during RBMP Cycle 3 (due to be published as originally scheduled for 2021).
- 9.7.58 There is a general trend for water quality improvements over time in response to improved regulation and treatment practices. However, the current receptor importance criteria presented in Table 9-1 is largely based on the presence or not of various attributes (e.g. Drinking Water Protected Area, designated nature conservation site or WFD designation) and flow (i.e. the size of the watercourse). The application of these criteria is therefore not sensitive to more subtle changes or improvements in water quality as may be experienced over time. Thus, no significant changes to current baseline conditions are predicted for the future baseline in the absence of the scheme, as the principal reasons for differences in water body importance are unlikely to change. For this reason, the impact assessment within this chapter is undertaken against existing baseline conditions.

Groundwater

- 9.7.59 The WFD groundwater bodies (Lower Trent Erewash Secondary Combined and Witham Lias) are at their target WFD objective of Good Status. However, these WFD classifications are subject to change during RBMP Cycle 3 (due to be published as originally due in 2021).
- 9.7.60 No significant changes to current baseline conditions are predicted for the future baseline for the same reasons as outlined above for surface water. The impact assessment within this chapter is therefore undertaken against existing baseline conditions.

Flood Risk

- 9.7.61 Climate change is predicted to alter the future fluvial flood risk and thus it is important that it is taken into account by the Scheme FRA (see PEI Report Volume 3: Appendix 9-B). Climate change resilience will be accounted for within the surface water drainage strategy for the Scheme, accommodating current government climate change projections.
- 9.7.62 The Scheme will not alter the current flood risk baseline described above. The drainage strategy will seek to ensure no detrimental impact relating to the surface water runoff from the Scheme following its construction. Therefore, no significant adverse changes to current baseline conditions are predicted for



the future baseline, and so the impact assessment is undertaken against existing baseline conditions.

Future Baseline (Decommissioning) - (assumed for the purpose of the assessment to be up to 48 months, not earlier than 2088)

- 9.7.63 It is considered that continued environmental improvements, tighter regulation at both national, regional and local scales, and environmental enhancements would lead to a gradual improvement over current baseline conditions in terms of water quality.
- 9.7.64 Climate change has the potential to significantly impact on drainage and flood risk, for example through increased storm intensity and changes in future rainfall patterns. However, the design of the Scheme will incorporate the climate change projections required by the Environment Agency to ensure that potentially increased surface water flows are accounted for and managed across the lifetime of the Scheme. Therefore, no significant adverse changes to current baseline conditions are predicted for the future baseline in 2088 (assumed to be the decommissioning date), and so the impact assessment within this chapter is undertaken against existing baseline conditions.

Importance of Receptors

9.7.65 Table 9-12 provides a summary of the waterbodies that may be impacted by the Scheme (i.e. there is a source and a possible pathway), a description of their attributes, and states the importance of the waterbody as used in this impact assessment. Importance is based on the criteria presented in Table 9-1. Separate importance classifications are provided for water quality and morphological aspects of waterbodies as it is not always appropriate to have the same rating (e.g. a waterbody may be heavily modified or even artificial and thus have a low morphology importance, but the water quality may be high by virtue of supporting protected species or other important potable or socio-economic and recreational uses). Refer to **PEI Report Volume 2: Figure 9-1** for surface water features.

Table 9-12: Importance of Receptors

Waterbody	Importance
River Trent (Trent from Carlton-on-Trent to Laughton Drain WFD waterbody)	Very High importance receptor for water quality on the basis of its scale, being WFD designated and having a Q95 flow greater than 1m³/s. It is also important for the dilution and dispersion of treated/ untreated sewerage/ trade/ process wastewater, which at the same time influence water quality and present a risk of chemical spillages. The river's importance for water supply and navigation add to its importance. Low importance for morphology due to the heavily modified nature of the channel, particularly along the banks.
River Till (Till (Witham) WFD waterbody)	High Importance for water quality on the basis of being a WFD designated watercourse but with an estimated Q95 flow of <1.0 m³/s. However, there is expected to be pressure on water quality in the watercourse from agricultural pollution and there may be surface water abstractions from the watercourse in the study area for agriculture, although this will be confirmed at the ES stage. Low Importance for morphology on the basis of showing evidence of substantial modification and realignment, being artificially straight with



Waterbody	Importance
	steep, incised banks in places with a lack of any bedform variability and is subject to significant fine sediment accumulation.
Tributary of the Till WFD waterbody / Carr Drain	High Importance for water quality on the basis of being a WFD designated watercourse but with an estimated Q95 flow of <1.0 m³/s. Water quality monitoring data indicates that the watercourse is under pressure from agricultural pollution and there may be surface water abstractions from the watercourse in the study area for agriculture, although this will be confirmed at the ES stage.
	<u>Low Importance for morphology</u> on the basis of showing evidence of substantial modification and realignment, being artificially straight with steep, incised banks in places with a lack of any bedform variability and is subject to significant fine sediment accumulation.
Marton Drain Catchment (Trib of Trent) (GB104028057840)	High Importance for water quality on the basis of being a WFD designated watercourse but with an estimated Q95 flow of <1.0 m ³ /s. Water quality monitoring data indicates that the watercourse is under pressure from agricultural pollution and there may be surface water abstractions from the watercourse in the study area for agriculture, although this will be confirmed at the ES stage. It also receives treated
	sewage from Marton STW and is therefore of importance for dispersal of this effluent. Low Importance for morphology on the basis of showing evidence of substantial modification and realignment, being artificially straight with steep, incised banks in places with a lack of any bedform variability and is subject to significant fine sediment accumulation.
Seymour Drain Catchment (GB104028058340)	High Importance for water quality on the basis of being a WFD designated watercourse but with an estimated Q95 flow of <1.0 m³/s. Water quality monitoring data indicates that the watercourse is under pressure from agricultural pollution and there may be surface water abstractions from the watercourse in the study area for agriculture, although this will be confirmed at the ES stage. It also receives treated sewage from Cottam STW and is therefore of importance for dispersal of this effluent.
	Low Importance for morphology on the basis of showing evidence of substantial modification and realignment, being artificially straight with steep, incised banks in places with a lack of any bedform variability and is subject to significant fine sediment accumulation.
Skellingthorpe Main Drain waterbody (GB105030062390)	High Importance for water quality on the basis of being a WFD designated watercourse but with an estimated Q95 flow of <1.0 m³/s. The watercourse itself is geographically distant from the Scheme, but its upstream catchment does extend north to cover much of the Solar and Energy Storage Park. Low Importance for morphology on the basis of artificially straight and heavily modified.
Padmoor Drain	Medium Importance for water quality on the basis of not being a WFD designated watercourse but has an estimated Q95 flow of >0.001 m³/s. The watercourse is expected to be under pressure from agricultural pollution. The watercourse has some importance in dispersing effluent from a pumping station which discharges into it, and which is then conveyed downstream to the Tributary of the Till WFD waterbody. Low Importance for morphology on the basis of showing evidence of substantial modification and realignment, being artificially straight with steep, incised banks in places with a lack of any bedform variability and is subject to significant fine sediment accumulation.
Mother Drain	Medium Importance for water quality on the basis of not being a WFD designated watercourse but has an estimated Q95 flow of >0.001 m ³ /s. The watercourse is expected to be under pressure from agricultural



Waterbody	Importance
	pollution. The watercourse is also an LWS due to it water beetle population. Low Importance for morphology on the basis of showing evidence of
	substantial modification and realignment, being artificially straight with steep, incised banks in places with a lack of any bedform variability and is subject to significant fine sediment accumulation.
Causeway Drain	Medium Importance for water quality on the basis of not being a WFD designated watercourse and has an estimated Q95 flow that may be below 0.001 m³/s. However, the watercourse has some importance in dispersing effluent from a pumping station which discharges into it, and which is then conveyed downstream to the Tributary of the Till WFD waterbody. Low Importance for morphology on the basis of showing evidence of
	substantial modification and realignment, being artificially straight with steep, incised banks in places with a lack of any bedform variability and is subject to significant fine sediment accumulation.
Ubiquitous Drains	As artificial, generally ephemeral agricultural drains and ditches lacking any protected species or designations, these are considered <u>Low</u> <u>Importance waterbodies for water quality and morphology</u> .
Littleborough Lagoon / Cottam Wetland /	As these waterbodies all support LWS they are considered to be of medium importance for water quality.
Coates Wetland	Low importance for morphology given they are largely artificial waterbodies related to past activity on the floodplain of the River Trent.
Waterbodies at Cottam Power Station	As artificial waterbodies lacking any known protected species or designations, these are considered <u>Low Importance waterbodies for water quality and morphology</u> .
Small Ponds	Low Importance for water quality given they are ubiquitous across the study area, and have no known ecological value at this stage. Given their abundance in the study area the ponds are considered to not reach the required levels to fulfil the criteria of a priority habitat and are considered as being of no more than local importance.
	<u>Low importance for morphology</u> as generally artificial waterbodies or have been heavily impacted by surrounding land uses (i.e. agriculture).
Groundwater	Medium importance as all bedrock and superficial deposits are Secondary aquifers. Groundwater may support some agricultural abstraction, and this will be reviewed at the ES stage following receipt of data from a request made to the Environment Agency. The groundwater across the study area is also WFD designated and at Good Status.

Floodplain Sensitivity for Impact Assessment

- 9.7.66 For the construction assessment, the key receptor in terms of all forms of flood risk are the construction workers present within the DCO Site, who are considered to be of Very High sensitivity.
- 9.7.67 For the operation assessment, the importance is based on understanding of the receptors present within areas at risk of flooding and the existing risk of flooding from all sources.
- 9.7.68 The majority of the Solar and Energy Storage Park lies in Flood Zone 1, with areas of Flood Zone 2 and 3 running across the north-east corner of the Solar and Energy Storage Park and along the eastern border, both associated with Padmoor Drain. The majority of the Grid Connection Route is in Flood Zone



- 3, associated with the River Trent and its floodplain. Development should not be located inside Flood Zone 3b (functional floodplain), unless it is classified as "essential infrastructure", has passed the exception test, and is water compatible in design (Ref 9-23).
- 9.7.69 The areas of Flood Zone 2 and 3 around the watercourses are at medium to high sensitivity to fluvial flooding. In EIA terms the sensitivity is Very High, due to the presence of essential power supply infrastructure (see Table 9-2). However, the larger areas of agricultural land across the study area are less sensitive and not considered essential infrastructure.
- 9.7.70 The criteria described in Table 9-2 does not provide examples of sensitivity for other forms of flood risk and so the sensitivity is based on the existing baseline risk described earlier in this chapter. For the purpose of this impact assessment the sensitivity of non-fluvial forms of flood risk is as follows:
 - Flooding from surface water generally very low risk (annual chance of flooding of less than 0.1% AEP) for most of the site, with areas of low (chance of flooding of between 0.1% and 1% AEP), medium (chance of flooding of between 1% and 3.3% AEP) and high risk (chance of flooding of greater than 3.3% AEP) generally associated flow pathways following topographic low points including drains and agricultural ditches.
 - Flooding from groundwater PFRA mapping indicates susceptibility to groundwater flooding is predominantly >75% within the Grid Connection Route. Further confirmation will be sought via BGS Groundwater Flood Map at the ES stage for the Solar and Energy Storage Park;
 - Flooding from sewers considered low risk but sewer flooding incident records will be reviewed at the assessment stage; and
 - Flooding from artificial sources the Scheme is considered at low risk from reservoir flooding given the requirements of the Reservoirs Act 1975 to ensure reservoirs are properly maintained.
- 9.7.71 Flood risk sensitivity is considered with **PEI Report Volume 3, Appendix 9-B: Flood Risk Assessment** and will be re-evaluated within the ES.

9.8 Potential Impacts

9.8.1 A number of activities during construction, operation and maintenance, and decommissioning phases, are likely to generate impacts, which have the potential to affect the water environment, if unmitigated. The impacts and effects (both beneficial and adverse) are outlined in the sections below. The proposed activities have been assessed in Section 9.10 following consideration of the embedded mitigation measures as described in Section 9.9.

Construction (2025-2027)

9.8.2 Many activities during construction and decommissioning phases are likely to generate impacts, which have the potential to affect the water environment, if unmitigated.



- 9.8.3 The greatest risks of adverse impacts during construction and decommissioning are in the vicinity of the watercourses, waterbodies and numerous small ponds present in the study area, which may be directly affected by the Scheme (and potentially local groundwater resources noting that information on licensed and unlicensed abstractions has not yet been received but will be available for the full assessment within the ES).
- 9.8.4 Overall, during the construction phase the following adverse impacts may occur:
 - Pollution of surface or groundwater due to deposition or spillage of soils, sediment, oils, fuels, or other construction chemicals, or through uncontrolled site run-off and foul waste water, or break out of drilling fluids when crossing watercourses using non-intrusive techniques;
 - Potential impact on groundwater quality from piling and dewatering operations associated with watercourse crossings;
 - Temporary impacts on sediment dynamics and hydromorphology within watercourses and waterbodies, e.g. where new crossings are required due to construction works to lay cables;
 - Temporary changes in flood risk from changes in surface water runoff and exacerbation of localised flooding, due to deposition of silt, sediment in drains and ditches;
 - Temporary changes in flood risk due to the construction of solar PV panels, site compound and storage facilities, which alter the surface water runoff from the Scheme; and
 - Potential impacts on local water supplies.

Operation (2028-2088)

- 9.8.5 During the operation phase the following adverse impacts may occur:
 - Impacts on water quality in affected water bodies that may receive surface water run-off or be at risk of chemical spillages from supporting infrastructure (e.g. substations, battery stores, solar stations, local site offices and car parking etc. and including the use of fire-water) and maintenance activities:
 - Potential for reduced chemical loading of watercourses associated with the change in land use and the possible cessation of nitrate, pesticide, herbicide and insecticide applications on arable fields, which would be beneficial.
 - Impacts on groundwater quality from creation of new pollutant pathways along any piled foundations;
 - Impacts on flow in watercourses from structures impeding groundwater flow and baseflow to watercourses; including Solar PV struts, BESS and substation foundations, cable routes;
 - Impacts on hydromorphology within watercourses and waterbodies where new crossings or drainage outfalls are required;



- Impacts on flood risk from increased runoff from new impervious areas across the site;
- Potential impacts on hydrology as a result of the Scheme by changing the way water infiltrates into the ground; and
- Potential for reduced irrigation of crops, if it is confirmed that water is abstracted locally for this purpose at the ES stage.

Decommissioning (assumed for the purpose of the assessment to be up to 48 months, not earlier than 2088)

9.8.6 Potential impacts from the decommissioning of the Scheme are similar in nature to those during construction, as some groundwork would be required to remove infrastructure installed. Ducting beneath watercourses is likely to remain in-situ but the cables removed.

9.9 Mitigation Measures

- 9.9.1 The Scheme has been designed, as far as possible, to avoid and minimise impacts and effects on the water environment through the process of design development, and by embedding measures into the design of the Scheme.
- 9.9.2 A number of standard and embedded measures have been identified, which would be implemented during construction to manage the impacts and reduce the effects that the construction of the Scheme would have on the water environment.

Embedded Mitigation

- 9.9.3 The construction of the Scheme will take place in accordance with a Construction Environmental Management Plan (CEMP). The CEMP details the measures that would be undertaken during construction to mitigate the temporary effects on the water environment. A Framework CEMP will be prepared and accompany the ES and secured through the DCO. The Framework CEMP will provide the structure and content for the detailed CEMP, which will be completed once a contractor is appointed, following submission of the DCO Application.
- 9.9.4 The Framework CEMP will comprise good practice methods that are established and effective measures to which the development will be committed through the development consent. The measures within the CEMP will focus on managing the risk of pollution to surface waters and the groundwater environment. It will also consider the management of activities within floodplain areas (i.e. kept to a minimum and with temporary land take required for construction to be located out of the floodplain as far as reasonably practicable).
- 9.9.5 The Framework CEMP will be reviewed, revised and updated as the project progresses to ensure all potential impacts and residual effects are considered and addressed as far as practicable, in keeping with available good practice at that point in time. The principles of the mitigation measures set out below are the minimum standards that will be implemented. However, it is



acknowledged that for some issues, there are multiple ways in which they may be addressed and methods of dealing with pollutant risk will be continually reviewed and adapted as construction works progress (e.g. the management of construction site runoff containing excessive levels of fine sediments).

- 9.9.6 The Framework CEMP will be standard procedure for the Scheme and will describe the principles for the protection of the water environment during construction. The final CEMP will be supported by a Water Management Plan (WMP), that will provide greater detail regarding the mitigation to be implemented to protect the water environment from adverse effects during construction. The potential for adverse impacts would be minimised by the adoption of the general mitigation measures outlined below, which will be described in the WMP and CEMP.
- 9.9.7 The high voltage cables associated with the Grid Connection Route will be below ground, requiring trenching typically of 2m depth. Underground techniques (such as HDD) will be used to install power cables beneath the River Trent, and would be at a depth of 10-15 m, subject to design and ground conditions, to avoid impacting the channel or the bed. Where underground techniques are not feasible, crossings will be installed using open-cut techniques. In such cases, water flow would be maintained (e.g. by over-pumping). It will be a requirement that the watercourses are reinstated as found and water quality monitoring will be undertaken prior to, during, and following on from the construction activity.
- 9.9.8 The construction of the Scheme will be undertaken in accordance with good practice as detailed below. Where not disapplied through the DCO, temporary and relevant permanent consents/permits would be obtained where necessary, and these are outlined later in the chapter. The principal contractor will comply with any conditions imposed by any relevant permission.

Good Practice Guidance (GPP)

- 9.9.9 The following relevant GPPs have been released to date on the NetRegs website (Ref 9-67) and are listed below. While these are not regulatory guidance in England where the UK government website outlines regulatory requirements, it remains a useful resource for best practice. They will be documented in the Framework CEMP and secured through the final CEMP:
 - GPP 1: Understanding your environmental responsibilities good environmental practices;
 - GPP 2: Above ground oil storage;
 - GPP 3: Use and design of oil separators in surface water drainage systems;
 - GPP 4: Treatment and disposal of wastewater where there is no connection to the public foul sewer;
 - GPP 5: Works and maintenance in or near water;
 - GPP 8: Safe storage and disposal of used oils;
 - GPP 13: Vehicle washing and cleaning;



- GPP 19: Vehicles: Service and Repair;
- GPP 20: Dewatering underground ducts and chambers;
- GPP 21: Pollution Incident Response Plans;
- GPP22: Dealing with spills; and
- GPP26: Safe storage drums and intermediate bulk containers.
- 9.9.10 Where new GPPs are yet to be published, previous Pollution Prevention Guidance (PPGs) still provide useful advice on the management of construction to avoid, minimise and reduce environmental impacts, although they should not be relied upon to provide accurate details of the current legal and regulatory requirements and processes. Construction phase operations would be carried out in accordance with guidance contained within the following PPGs:
 - PPG6: Working at construction and demolition sites (Ref 9-68);
 - PPG7: Safe storage the safe operation of refuelling facilities (Ref 9-69);
 and
 - PPG18: Managing fire water and major spillages (Ref 9-70).
- 9.9.11 Additional good practice guidance for mitigation to protect the water environment can be found in the following key CIRIA documents and British Standards Institute documents:
 - British Standards Institute (2009) BS6031:2009 Code of Practice for Earth Works (Ref 9-71);
 - British Standards Institute (2013) BS8582 Code of Practice for Surface Water Management of Development Sites (Ref 9-72);
 - C753 (2015) The SuDS Manual (second edition) (Ref 9-29);
 - C741 (2015) Environmental good practice on site guide (fourth edition) (Ref 9-73);
 - C648 (2006) Control of water pollution from linear construction projects, technical guidance (Ref 9-74);
 - C609 (2004) Sustainable Drainage Systems, hydraulic, structural and water quality advice (Ref 9-75);
 - C532 (2001) Control of water pollution from construction sites Guidance for consultants and contractors (Ref 9-76); and
 - C736F Containment systems for prevention of pollution (Ref 9-77).

Management of Construction Site Runoff

- 9.9.12 Mitigation measures are described in detail below and would be adhered to during the construction phase of the Scheme. They apply equally to all components of the Scheme.
- 9.9.13 The construction of the Scheme would be in accordance with good practice as detailed in 'Good Practice Guidance' above.



- 9.9.14 The measures outlined below, which will be included in the Framework CEMP (which will accompany the ES), will be required for the management of fine particulates in surface water runoff as a result of the construction activities:
 - All reasonably practicable measures will be taken to prevent the
 deposition of fine sediment or other material in, and the pollution by
 sediment of, any existing watercourse, arising from construction activities.
 The measures will accord with the principles set out in industry guidelines
 including the CIRIA report 'C532: Control of water pollution from
 construction sites' (Ref 9-76) and CIRIA report 'C648 Control of water
 pollution from linear construction sites' (Ref 9-74). Measures may include
 use and maintenance of temporary lagoons, tanks, bunds and fabric silt
 fences or silt screens as well as consideration of the type of plant used;
 - A temporary drainage system will be developed to prevent runoff contaminated with fine particulates from entering surface water drains without treatment. This will include identifying all land drains and waterbodies in the DCO Site and ensuring that they are adequately protected using drain covers, sand bags, earth bunds, geotextile silt fences, straw bales, or proprietary treatment (e.g. lamella clarifiers);
 - Site drainage, including surface runoff and dewatering effluents, will be discharged to sewers where possible and relevant permissions will be obtained from the sewerage or statutory undertaker. Discharge to watercourses will only be permitted where discharge consent or other relevant approval has been obtained (where necessary);
 - Scheme drainage during construction will receive appropriate pollution control measures as agreed with the sewerage undertaker or the Environment Agency as appropriate. Holding or settling tanks, separators and other measures may be required, will be provided and maintained;
 - The relevant sections of BS 6031: Code of Practice for Earthworks (Ref 9-71) will be followed for the general control of site drainage;
 - Where practical, earthworks will be undertaken during the drier months of the year. When undertaking earth moving works periods of very wet weather will be avoided, where practical, to minimise the risk of generating runoff contaminated with fine particulates. However, it is likely that some working during wet weather periods will be unavoidable, in which case other mitigation measures (see below) will be implemented to control fine sediment laden runoff. Water may also be required to dampen earthworks during dry weather to reduce dust impacts, and any runoff generated will need to be appropriately managed by the Contractor in accordance with the pollution prevention principles described in this chapter;
 - To protect watercourses from fine sediment runoff, topsoil/subsoil will be stored a minimum of 20m from watercourses on flat lying land. Where this is not practicable, and it is to be stockpiled for longer than a two-week period, the material will either be covered with geotextile mats, seeded to promote vegetation growth, or runoff prevented from draining to a watercourse without prior treatment;



- Appropriately sized runoff storage areas for the settlement of excessive fine particulates in runoff will be provided. Construction site runoff will either be treated on site and discharged under a Water Discharge Activity Permit from the Environment Agency to Controlled Waters (potentially also including infiltration to ground) or to the nearest public sewer with sufficient capacity for treatment following discussions with Anglian Water, or removed from site for disposal at an appropriate and licensed waste facility;
- Equipment and plant are to be washed out and cleaned in designated areas within the Scheme compound where runoff can be isolated for treatment before disposal as outlined above;
- Mud deposits will be controlled at entry and exit points to the Site using wheel washing facilities and/or road sweepers operating during earthworks activities or other times as required;
- Debris and other material will be prevented from entering surface water drainage, through maintenance of a clean and tidy site, provision of clearly labelled waste receptacles, grid covers and the presence of site security fencing; and
- The WMP (which will be produced post consent) will include details of pre, during and post-construction water quality monitoring. This will be based on a combination of visual observations and reviews of the Environment Agency's automatic water quality monitoring network.

Management of Spillage Risk

- 9.9.15 The measures outlined below will be implemented to manage the risk of accidental spillages on the DCO Site and potential conveyance to nearby waterbodies via surface runoff or land drains. These measures will be included in the Framework CEMP and adopted during the construction works:
 - Fuel will be stored and used in accordance with the Control of Substances Hazardous to Health Regulations 2002 (Ref 9-78), and the Control of Pollution (Oil Storage) (England) Regulations 2001 (Ref 9-13). Particular care will be taken with the delivery and use of concrete and cement as it is highly corrosive and alkaline;
 - Fuel and other potentially polluting chemicals will either be in self-bunded leak proof containers or stored in a secure impermeable and bunded area (minimum capacity of 110% of the capacity of the containers);
 - Any plant, machinery or vehicles will be regularly inspected and maintained to ensure they are in good working order and clean for use in a sensitive environment. This maintenance is to take place off site if possible or only at designated areas within the Scheme compound. Only construction equipment and vehicles free of all oil/fuel leaks will be permitted on the DCO Site. Drip trays will be placed below static mechanical plant;
 - All washing down of vehicles and equipment will take place in designated areas and wash water will be prevented from passing untreated into watercourses;



- All refuelling, oiling and greasing will take place above drip trays or on an impermeable surface which provides protection to underground strata and watercourses, and away from drains as far as reasonably practicable. Vehicles will not be left unattended during refuelling;
- As far as reasonably practicable, only biodegradable hydraulic oils will be used in equipment working in or over watercourses;
- All fixed plant used on the DCO Site will be self-bunded;
- Mobile plant is to be in good working order, kept clean and fitted with plant 'nappies' at all times;
- The WMP which will be produced post consent will include details for pollution prevention and will be prepared and included alongside the final CEMP. Spill kits and oil absorbent material will be carried by mobile plant and located at high risk locations across the DCO Site and regularly topped up. All construction workers will receive spill response training and tool box talks;
- The DCO Site will be secure to prevent any vandalism that could lead to a pollution incident;
- Construction waste/debris are to be prevented from entering any surface water drainage or water body;
- Surface water drains on public roads trafficked by plant or within the construction compound will be identified and, where there is a risk that fine particulates or spillages could enter them, the drains will be protected (e.g. using covers or sand bags) or the road regularly cleaned by road sweeper;
- Suitable facilities for concrete wash water (e.g. geotextile wrapped sealed skip, container or earth bunded area) will be adequately contained, prevented from entering any drain, and removed from the Site for appropriate disposal at a suitably licenced waste facility; and
- Water quality monitoring of potentially impacted watercourses will be undertaken to ensure that pollution events can be detected against baseline conditions and can be dealt with effectively.
- 9.9.16 In addition, any site welfare facilities will be appropriately managed, and all foul waste disposed of by an appropriate contractor to a suitably licensed facility if it is not possible to connect to the public sewer.

Management of Flood Risk

- 9.9.17 The Framework CEMP will incorporate measures to prevent an increase in flood risk or pollution during the construction works, in addition to the provision of temporary settlement and drainage measures as detailed above.
- 9.9.18 Construction works undertaken adjacent to, beneath and within watercourses will comply with relevant guidance, including Environment Agency and Defra guidance documents.



- 9.9.19 The CEMP will incorporate measures aimed at preventing an increase in flood risk during the construction works. Examples of measures that could be implemented include:
 - Topsoil and other construction materials will be stored outside of the 1 in 100 year floodplain extent where feasible. If areas located within Flood Zone 2/3 are to be utilised for the storage of construction materials, this would be done in accordance with the applicable flood risk activity regulations, if required;
 - Connectivity will be maintained between the floodplain and the adjacent watercourses, with no changes in ground levels within the floodplain as far as practicable;
 - During the construction phase, the contractor will monitor weather forecasts on a monthly, weekly and daily basis, and plan works accordingly. For example, works in the channel of any watercourse will be avoided or halted were there to be a significant risk of high flows or flooding; and
 - The construction laydown area site office and supervisor will be notified of any potential flood occurring by use of the Floodline Warnings Direct or equivalent service.
- 9.9.20 The contractor will be required to produce an Emergency Response Plan following receipt of DCO consent and prior to construction, which will provide details of the response to an impending flood and include:
 - A 24-hour availability and ability to mobilise staff in the event of a flood warning;
 - The removal of all plant, machinery and material capable of being mobilised in a flood for the duration of any holiday close down period where there is a forecast risk that the site may be flooded;
 - Details of the evacuation and site close down procedures;
 - Arrangements for removing any potentially hazardous material and anything capable of becoming entrained in floodwaters, from the temporary works areas;
 - The contractor will sign up to Environment Agency flood warning alerts and describe in the Emergency Response Plan the actions it will take in the event of a flood event occurring. These actions will be hierarchical meaning that as the risk increases the contractor will implement more stringent protection measures;
 - If water is encountered during below ground construction, suitable dewatering methods will be used. Any groundwater dewatering required in excess of the exemption thresholds will be undertaken in line with the requirements of the Environment Agency (under the Water Resources Act 1991 as amended) (Ref 9-66) and the Environmental Permitting Regulations (2016) (Ref 9-79); and



 Safe egress and exits are to be maintained at all times when working in excavations. When working in excavations a banksman is to be present at all times.

Grid Connection Route: River Trent Crossing (Horizontal Directional Drill or Similar)

- 9.9.21 It is proposed to install the high voltage cable beneath the River Trent using underground techniques such as horizontal directional drilling beneath the bed of the channel. The cable would be installed 10-15m beneath the bed. A maximum depth would be finalised based on site specific risk assessment at each crossing location in order to minimise groundwater interactions where possible. Information will be sought from the Environment Agency on the construction details of the flood defence embankments that may need to be crossed. This will inform the approach for directional drilling beneath the River Trent and associated flood defences. Where possible construction activity will avoid flood defence embankments. This will be confirmed at ES stage.
- 9.9.22 In addition to the control and management measures for site runoff and spillage risk noted above, the methodology of the drilling, or other trenchless techniques, would include measures to minimise the risk to the environment. There are risks associated with the use of drilling muds and plant close to the channel. For example, although rare, without due care there is a risk that drilling muds can 'break out' into watercourses leading to pollution (known as 'hydraulic fracture' or 'frac-out'). A site-specific hydraulic fracture risk assessment would be developed prior to construction following further investigation of specific ground conditions at the crossing locations, and appropriate mitigation developed in line with best construction practice. There is also a need to manage drilling muds and wastewater so that this would not be spilt into the channel when working close to the banks of a watercourse.
- 9.9.23 The send and receive pit excavations for drilling/boring will be located at least 10m from the watercourse edge (the definition of which is to be defined in consultation with the Environment Agency and confirmed at the ES stage) under which they would be directional drilled.
- 9.9.24 The exact dimensions of the send and receive pits would be determined by site and ground conditions but will be kept to a safe minimum in terms of length, width and depth. The intention is for maximum parameters for the pit dimensions to be outlined at the ES stage. A shoring system appropriate to the ground conditions would be used as appropriate to minimise water ingress into the pits. This may be timbers, sheet piling, or a modular system and would be chosen based on suitability for the site conditions. The ingress of any groundwater will be carefully managed through design of the send or receive pit, shoring method, and a pumping and treatment system. Excessive ingress of water would make the pit unsafe and thus it is important that ingress is minimised and that a suitable system of managing that water is implemented.
- 9.9.25 Once the cable is installed beneath the watercourse the pits and any cable trenches will be backfilled to the original ground level and seeded to reduce the risk of runoff and fine sediments entering the watercourse. The drill fluids used within the drilling machine would be water based, such as naturally occurring bentonite clay. The fluid component of the drilling mud would be



mains water, obtained from a nearby supply and tankered to site when required. There would be some recycling of drilling muds by the drilling plant used.

9.9.26 The bentonite within the drilling fluid is a naturally occurring mineral and enables the fluid to have sufficient viscosity to carry the cutting chips back to the surface machine whilst lubricating and keeping cool the drilling bit. Directional drilling, or other trenchless techniques, would be undertaken by a specialist contractor and the water column above the drill path would be continuously monitored during drilling. It is acknowledged that drill fluid leakage into a watercourse is not a common problem, particularly given the proposed depths. However, where there is an increased perceived risk (i.e. lack of drilling mud returns) the drilling/boring operation would be suspended, remediation action implemented, and subsequently the methodology for that crossing re-evaluated.

Grid Connection Route: Management of Risk to Morphology of Waterbodies

- 9.9.27 At the time of writing, the Grid Connection Route watercourse crossings aside from the River Trent are assumed to use intrusive using open-cut techniques. In total, there are expected to be in the order of ten watercourse crossings other than the Trent. Three of these are WFD designated, namely Marton Drain (approximate NGR of crossing SK 8399 8105) and Seymour Drain (approximate NGR SK 8199 8049), which is crossed twice. The remaining seven would be crossings of unnamed ditches. The Grid Connection Route for PEI Report purposes is necessarily wide to allow further option analysis and it is expected it will be constrained at the ES stage, when a more definite route for the Grid Connection Route will be defined, and at which point the number of required crossings will be re-appraised.
- 9.9.28 A pre-works morphology survey of the channel of each watercourse to be crossed will be undertaken prior to construction. The pre-works survey is to ensure that there is a formal record of the condition of each watercourse prior to commencement of works to install cables beneath the channel. The survey is a precautionary measure so that should there be any unforeseen adverse impacts there is a record against which any remedial action can be determined.
- 9.9.29 At this stage it is assumed that where open-cut crossings are required that water flow would be maintained by damming and over pumping. Works should be carried out in the drier months where possible as this would reduce the risk of pollution propagating downstream, particularly in the case of ephemeral watercourses. Once the watercourses are reinstated, silt fences, geotextile matting or straw bales should be used initially to capture mobilised sediments until the watercourse has returned to a settled state. It will be a requirement that the watercourses are reinstated as found and water quality monitoring will be undertaken prior to, during, and following on from the construction activity. Regular observations of the watercourses will also be required post-works during vegetation re-establishment of the banks, especially following wet weather, to ensure that no adverse impacts have occurred. These requirements will be described in the WMP.



Access Track Crossings of Watercourses

- 9.9.30 Access tracks will be constructed across the Solar and Energy Storage Park which will typically be 3.5m to 6m wide compacted stone tracks with 1:2 gradient slopes on either side. The internal road layout has been designed to avoid drainage ditch and watercourse crossings wherever possible. As a design principle, culverts will be avoided wherever possible. Where a drainage ditch crossing is required, where possible, an open span bridge will be used with the abutments set back from the top of the bank surrounding the watercourse. Open span bridges will use non-intrusive pad foundations.
- 9.9.31 Depending on the design of any watercourse crossings, floodplain compensation may be required on a 'like for like' and 'level for level' basis. Alterations to surface water flow pathways will also need to be considered and, if necessary, mitigated. This will include consideration of the span and soffit height of any works to existing crossings to ensure no increase in flood risk.
- 9.9.32 The expected locations of these crossings (13 identified at this stage) are shown in **PEI Report Volume 2**: **Figure 9-1** and are found at NGRs SK 85469 84096, SK 84954 83943 (existing farm crossing), SK 85133 83137 (existing farm crossing), SK 85524 82977 (existing farm crossing), SK 86064 83350, SK 84059 85163 (existing crossing), SK 84980 82590, SK 85274 82877, SK 86331 83492, SK 86526 83464, SK 86856 83350, SK 86994 83337, and SK 86654 83227. Locations will be reviewed and updated within the ES, with further details on the crossing design provided as the design evolves.
- 9.9.33 As stated above, the intention is to use open span crossings and not introduce any new culverts for temporary or permanent access routes wherever possible. Tracks should be permeable, and localised SuDS, such as swales and infiltration trenches, should be used to control runoff. Should there be any need for culverts identified that is unavoidable, then equivalent watercourse improvement would be provided (i.e. on a length for length basis) although no culverting is expected to be required at this stage.

Design

- 9.9.34 Detailed information on Scheme design and infrastructure is provided in **Chapter 2: The Scheme**.
- 9.9.35 The Solar and Energy Storage Park is mostly located within Flood Zone 1 with the minimum height of the lowest part of the solar PV Panels to be 0.8m above ground level. Where flood depths exceed this, the panel height may be raised further, or area avoided. Mounting poles will generally be driven or screwed into the ground to an indicative depth of 2m. Location of the BESS, on site substation, and other infrastructure will be located based on flood risk.
- 9.9.36 The solar PV Panels will be off set from watercourses. The point of measurement will be agreed with the Environment Agency through further consultation, but for the purposes of the assessment it is assumed for all watercourses other than the Trent to be measured from the centre line of the watercourse as determined from Ordnance Survey mapping.



9.9.37 Indicative foundation depths associated with the development include maximum depths of 1.6m for the Solar and Energy Storage Park, maximum trench depth of 1.2m for low voltage distribution cables, maximum depth of 1m for the BESS Compound and a depth of 2m for open trench excavation associated with the Grid Connection Route.

Drainage Strategy

- 9.9.38 An Outline Surface Water Drainage Strategy will be submitted with the DCO Application which will provide for the attenuation of surface water runoff from the operational Solar and Energy Storage Park, whilst minimising flood risk to the DCO Site and surrounding areas. In accordance with planning policy guidance (as outlined in Section 9.3) runoff from the Solar and Energy Storage Park would be attenuated to ensure no increase in surface water discharge rates and to provide water quality treatment of runoff water. This will be secured through a detailed drainage strategy which would be a requirement of the DCO.
- 9.9.39 Individual PV Panels will be held above the ground surface on mounting structures (see **Chapter 2: The Scheme**). This will avoid sealing the ground with impermeable surfaces. As a result, it is assumed that the DCO Site's impermeable area will remain largely consistent with its pre-development state. However, runoff from the PV Panels will alter the existing routing of runoff. To prevent ponding occurring around the PV Panels, a series of boundary and routing swales will be constructed to convey surface water runoff away from the PV Panels and towards receiving watercourses. However, these will be grassed and will have the minimum gradient to provide conveyance but not to encourage scour and soil erosion.
- 9.9.40 Additional attenuation in the form of SuDS will be incorporated to control any increase in the rate of flow towards receiving watercourses, and to provide treatment for any contaminants collected on areas of hardstanding. The rate of runoff from each development location within the whole Solar and Energy Storage Park would ensure nil detriment in terms of no increase in runoff rate from the Site to receiving watercourses.
- 9.9.41 Transformers will be installed with suitable bunds to contain any oil spillage in case of an oil-leakage event. Bunds will be designed to contain at least 110% of the volume of the oil to ensure there is some tolerance to prevent breaching of the bund. Under normal conditions any rainwater collected within the bund will be removed by use of special pump, which automatically switches off if it detects the smallest presence of oil in the water. Pumps will be linked to control and monitoring equipment to raise alarms if oil is detected.
- 9.9.42 In the unlikely event of a malfunction to one of the battery arrays, there is a range of integrated controls that will activate depending on the extent and severity of the event. In case the malfunction progresses to a catastrophic fire event and so long as there are no lives under threat, the fire brigade would ensure surrounding elements and structures (intact battery arrays nearby, other electrical equipment, trees etc.) are kept adequately wet and cool to prevent the fire from expanding any further but the battery infrastructure would be allowed to burn within the controlled area. Consultation with the emergency



services will be undertaken as part of the applicant's pre-application work. Further details regarding management of firewater will be outlined in the outline drainage strategy to be submitted with the DCO Application.

Drainage Outfalls

9.9.43 The location, position and orientation of any new drainage outfalls required by the drainage strategy will be carefully determined and informed by a hydromorphological survey to minimise any adverse local impacts on river processes. Appropriate micro-siting of the outfall will minimise loss of bank habitat, the need for bed scour or hard bank protection, and localised flow disturbance or disruption to sediment transport processes. It will also avoid the creation of 'dead' spaces with sedimentation and vegetation blockage risks and to that effect it is not proposed that outfalls are recessed into the bank.

Foul Drainage

- 9.9.44 At this point in time it is not confirmed how any wastewater will be managed but it is expected that the low volumes of foul drainage generated (related to four operational staff) will be self-contained in independent non-mains domestic storage and / or a treatment system. These would be regularly emptied under contract with a registered recycling and waste management contractor.
- 9.9.45 Should a connection to a foul sewer be required as an alternative option, Anglian Water would be consulted at the appropriate time.
- 9.9.46 As there would be no discharge of foul water to a watercourse, and only small volumes would either be discharged to a foul sewer indirectly via a suitable waste management contractor, or directly with Anglian Water consent, no further assessment of foul waste from the Scheme is proposed. This will be reviewed as the EIA progresses.

Permits and Consents

- 9.9.47 Various water-related permissions may be required where it is not agreed with the relevant regulating authority to disapply them through the DCO. These permissions may include:
 - Land drainage consent(s) under section 23 of the Land Drainage Act 1991 (Ref 9-5) for works affecting the flow in ordinary watercourses;
 - Flood risk activity permit(s) from the Environment Agency under the Environmental Permitting Regulations (England and Wales) 2016 (Ref 9-79) in connection with drainage outfall installation;
 - Water activity permit(s) from the Environment Agency under the Environmental Permitting Regulations (England and Wales) 2016 (Ref 9-79) for temporary construction and permanent operational discharges;
 - Trade effluent consent under the Water Industry Act 1991 (Ref 9-80) for the purposes of discharging trade effluent from welfare facilities during construction;



- Full or temporary water abstraction licence(s) under section 24 of the Water Resources Act 1991 (Ref 9-6) (if more than 20m³/d is to be dewatered / over-pumped and exemptions do not apply) – see further detail below; and
- Temporary water impoundment licence under section 25 of the Water Resources Act 1991 (Ref 9-6) in connection with the laying of cables.
- 9.9.48 There is the potential for the need for either full or temporary water abstraction licence(s) from the Environment Agency for the abstraction of water from the send and receive pits associated with the underground watercourse crossings or other excavations where groundwater may be encountered, other than where exemptions apply. A full licence is required when more than 20m³ per day of water may need to be abstracted for more than 28 days. A temporary licence is applicable where the abstraction is less than 28 days. Where less than 20m³ per day of water needs to be abstracted, no licence is required. However, in all circumstances it may be necessary to obtain a water activity permit(s) from the Environment Agency to discharge the water to ground or a watercourse if the water is considered to be 'unclean'.

Monitoring

- 9.9.49 The WMP will set out details of water quality monitoring to be undertaken during construction. Due to the level of risk posed by the construction works, this monitoring will consist of visual and olfactory observations plus in-situ testing using hand-held water quality meters only.
- 9.9.50 It is important that during the Scheme operation phase that there is a requirement for regular inspection and maintenance of the drainage systems, proposed SuDS and watercourse crossings. This will be carried out in accordance with good practice guidance. The drainage system will be designed in accordance with current guidance to ensure that the potential for siltation and blockages is minimised under normal operation. If there is any evidence of excessive erosion or sedimentation associated with new structures further actions will be considered to remedy that impact in as sustainable a way as possible.

9.10 Assessment of Likely Impacts and Effects

- 9.10.1 Taking into account the standard and embedded mitigation measures as detailed in Section 9.9 above, the potential for the Scheme to generate effects was assessed using the methodology as detailed in Section 9.6 of this Chapter.
- 9.10.2 The effects have been assessed following consideration of the potential impacts outlined in Section 9.8 and the standard and embedded mitigation measures in Section 9.9.



Construction (2025 to 2027-28) and Decommissioning (2088 to 2089-2090)

Surface Waterbodies - Construction Assessment

- 9.10.3 The DCO Site crosses the River Trent WFD watercourse, with the Solar and Energy Storage Park located to the east of the Trent and which extends as far as the Tributary of the Till WFD waterbody. The Grid Connection Route crosses beneath the River Trent and continues to the west to Cottam Substation, and would require crossings of the WFD designated waterbodies Marton Drain and Seymour Drain. There are numerous ponds and agricultural ditches across the DCO Site (refer to **PEI Report Volume 2: Figure 9-1**).
- 9.10.4 Construction activities such as earthworks, excavations, site preparation, levelling and grading operations result in the disturbance of soils. Exposed soil is more vulnerable to erosion during rainfall events due to loosening and removal of vegetation to bind it, compaction, and increased runoff rates. Surface runoff Impact from such areas can contain excessive quantities of fine sediment, which may eventually be transported to watercourses where it can result in adverse impacts on water quality, flora and fauna.
- 9.10.5 Construction works within, along the banks and across watercourses can also be a direct source of fine sediment mobilisation. Other potential sources of fine sediment during construction works include water runoff from earth stockpiles, dewatering of excavations (surface and groundwater), mud deposited on site and local access roads, and that which is generated by the construction works themselves or from vehicle washing.
- 9.10.6 Generally, excessive fine sediment in runoff is chemically inert and affects the water environment through smothering riverbeds and plants, temporarily changing water quality (e.g. increased turbidity and reduced photosynthesis) and causing physical and physiological adverse impacts on aquatic organisms (such as abrasion or irritation).
- 9.10.7 During construction, fuel, hydraulic fluids, solvents, grouts, paints and detergents and other potentially polluting substances will be stored and/or used on-site. Leaks and spillages of these substances could pollute the nearby surface watercourses if their use or removal is not carefully controlled and spillages enter existing flow pathways or waterbodies directly. Like excessive fine sediment in construction site runoff, the risk is greatest where works occur close to and within waterbodies.
- 9.10.8 The majority of construction works across the DCO Site are buffered from watercourses and on relatively flat topography. As such, the risk to watercourses from construction activities is considered generally low. The greater risks of adverse impacts are where direct works are required within a watercourse.
- 9.10.9 Direct works to agricultural ditches are required at 13 locations: NGRs SK 85469 84096, SK 84954 83943 (existing farm crossing), SK 85133 83137 (existing farm crossing), SK 85524 82977 (existing farm crossing), SK 86064 83350, SK 84059 85163 (existing crossing), SK 84980 82590, SK 85274 82877, SK 86331 83492, SK 86526 83464, SK 86856 83350, SK 86994



- 83337, and SK 86654 83227 (locations shown on **PEI Report Volume 2**: **Figure 9-1**). Locations will be reviewed and updated within the ES, with further details on the crossing design provided as the design evolves. However, open span crossings are to be used and no new culverts will be introduced for temporary or permanent access routes.
- 9.10.10 The affected agricultural ditches are ephemeral/intermittently flowing and when visited on site in September 2021 they were generally dry or had ponded standing water that was not flowing at the crossing locations. Nevertheless, when flowing the potential for adverse water quality impacts exists from runoff containing fine sediments and chemical spillages relating to use of plant adjacent to the watercourses, and structural works to install crossings in the riparian margins and over the watercourses. Given the limited potential for conveyance in these generally dry watercourses, any impact would be expected to remain very localised. In addition, where possible works should be timed to coincide with drier periods.
- 9.10.11 The drainage strategy for the Scheme remains under development (see Section 9.9), but it is anticipated that there may be a need for outfalls to drain surface water runoff to watercourses. Soft green ditch connections to watercourses are to be used where possible. However, there would be potential to cause reduction in water quality through sediment disturbance and mobilisation from site clearance and works to install the outfall channels and/or structures (e.g. headwalls if necessary), and the risk of chemical spillages from plant, equipment and materials. Should concrete headwalls be required for these outfalls these will be pre-fabricated where possible to avoid the need to pour wet concrete into formwork close to a watercourse. For both the installation of open span crossings and outfalls, best practice mitigation measures as outlined in the final CEMP and WMP would be implemented.
- 9.10.12 The Grid Connection Route will be constructed beneath the channel of the River Trent. Drilling or boring techniques are proposed to be used which would not disturb the watercourse bed. However, launch and receiving pits would be required for drilling (no closer than 10m from the water's/channel edge) and there would be need for plant movements in the vicinity of the channel during construction. As such, there would be a risk of sediment mobilisation in runoff and for chemical spillages to occur that could enter the channel if not managed accordingly. There is also a chance of 'frac-out' events (i.e. hydraulic fluid break out) from drilling to the watercourse if not appropriately mitigated for site specific conditions. A site-specific hydraulic fracture risk assessment will be produced prior to commencing works to define the mitigation required based on ground conditions. Water quality monitoring will also be undertaken prior to, during, and following on from the construction activity to ensure any spillages or other pollution is identified. These mitigation requirements will be outlined in a WMP. Given the large size of the River Trent and therefore its large dilution and dispersal capacity, as well as the non-intrusive nature of the works, the risk to the water quality during cable installation is considered negligible.
- 9.10.13 It is currently anticipated that between 10 and 15 crossings are required of watercourses for the Grid Connection Route to Cottam Substation. This includes one crossing of the WFD designated Marton Drain and two crossings



of the WFD designated Seymour Drain. A pre-works morphology survey of the channel of each watercourse to be crossed will be undertaken. During construction flow would be maintained by damming and over pumping. Works should be carried out in the drier months where possible as this would reduce the risk of pollution propagating downstream, particularly in the case of ephemeral watercourses. Once the watercourses are reinstated, silt fences, geotextile matting or straw bales should be used initially to capture mobilised sediments until the watercourse has returned to a settled state. It will be a requirement that the watercourses are reinstated as found and water quality monitoring will be undertaken prior to, during, and following on from the construction activity. These requirements will be described in the WMP.

- 9.10.14 Aside from direct works for watercourse crossings, the Scheme design includes a buffer around all watercourses (expected to be measured from the centre line of the watercourse as marked on Ordnance Survey mapping, but this is to be confirmed with the Environment Agency for the ES stage) and 10m around ponds. With the exception of the Grid Connection Route cable crossings, access track crossings and any required outfalls there should be no further requirement to work in immediate proximity to watercourses or ponds.
- 9.10.15 During construction, all works will be carried out in accordance with the mitigation measures set out in the Framework CEMP (which will accompany the ES) which will be developed into a final CEMP and WMP by the appointed contractor. The implementation of standard mitigation measures will help avoid or reduce any potential adverse effects on surface water quality during construction.
- 9.10.16 With regard to the River Trent, there is considered to be negligible potential for impact from works to install a cable beneath it given the mitigation measures in place, the distance of the launch/receiving pits from the banks and the size of the watercourse which would dilute and disperse any pollutants. For the very high importance River Trent, a negligible magnitude impact results in a temporary slight adverse effect (not significant).
- 9.10.17 For the intrusive open cut crossings for the Grid Connection Route there is likely to be unavoidable short term, temporary adverse impacts on the channel morphology, their riparian habitats, and the hydrological and sediment regimes during construction. However, given mitigation measures in place, including over-pumping or fluming of the flow, reinstatement as found and implementation of best practice measures which will be outlined in the Framework CEMP and WMP, this would be a temporary and localised minor adverse impact in terms of water quality. For the high importance Marton Drain and Seymour Drain this would give a slight adverse effect (not significant). For the low importance agricultural ditches this would result in a neutral effect (not significant).
- 9.10.18 At this stage the locations, or need for, drainage outfalls are not known and so any impact related to outfalls will be assessed within the ES.
- 9.10.19 The potential for adverse impacts on surface water quality of the low importance agricultural ditches due to construction of open span crossings



- across them is considered a short term and temporary minor adverse impact in terms of water quality, given the mitigation measures outlined above. This results in a **neutral** effect (**not significant**).
- 9.10.20 Given that no other watercourses or waterbodies will be directly affected by the construction works, and that the Scheme has buffer zones around watercourses and ponds, a negligible indirect impact is predicted for all other surface water receptors in the study area from site runoff and chemical spillages (as they may receive runoff indirectly from permitted site discharges of treated runoff). For the high importance River Till, Tributary of the Till and Skellingthorpe Main Drain this gives a temporary slight adverse effect (not significant). For the medium importance Padmoor Drain, Mother Drain, Causeway Drain, Littleborough Lagoon, Coates Wetland and Cottam Wetland this gives a neutral effect (not significant). For the low importance agricultural drainage ditches (those that aren't directly crossed) and small ponds, this results in a neutral effect (not significant).

Groundwater - Construction Impact Assessment

- 9.10.21 As indicated in **Chapter 2: The Scheme** the Solar PV Panels will be attached to a PV Mounting Structure which combine to form PV Tables. The PV Mounting Structures would be piled to an indicative maximum depth of 2m. Indicative foundation depths associated with the development include maximum depths of 1.6m for the solar station, maximum trench depth of 1.2m for low voltage distribution cables, maximum depth of 1m for the BESS Compound and a depth of 2m for open trench excavation associated with the Grid Connection Route cables.
- 9.10.22 On the basis of existing borehole scans available on the Geoindex website (Ref 9-47), groundwater levels are variable across the area, with some groundwater encountered at relatively shallow levels less than 2m below the ground, for instance towards Kexby and Cottam (see Section 9.7). Alluvium deposits may also carry water at relatively shallow depths, although these are predominantly around watercourses where there will be no construction aside from the crossings for access tracks and cable routes.
- 9.10.23 As no continuous foundations are in the design and given that groundwater is anticipated to be below 2m across the majority of the DCO Site, the shallow, regularly spaced discrete strut PV Panel foundations, and the substation and BESS foundations are considered to have a negligible impact on groundwater flow. As such, no impediment to baseflow in the River Trent, River Till, Tributary of the Till, Marton Drain, Seymour Drain, Skellingthrope Main Drain or their tributaries are anticipated.
- 9.10.24 Cable routes beneath watercourses are anticipated to be below the water table over part of their routes. The profile of the cable ducting is considered to be small compared to the spatial and vertical extent of the secondary aquifers, and therefore is considered to have a negligible impact on groundwater flow. As such, no impediments to baseflow in the River Trent or small watercourses on the DCO Site are anticipated.
- 9.10.25 Details of groundwater abstractions and PWS have been requested and will be presented at the ES stage. Should there be any abstractions within the



Solar and Energy Storage Park there is not considered a likelihood of impact given limited requirement for widespread, continuous foundations. Overall, as a medium importance receptor, a negligible impact on groundwater flow is a **neutral** effect (**not significant**).

- 9.10.26 Construction works to install cables beneath the River Trent using drilling or boring techniques would involve a temporary pit either side of the watercourse (>10m measured from the water's/channel edge under normal flows) as well as regularly spaced jointing pits along the length of the Grid Connection Route. Maximum parameters for the pit dimensions will be outlined at the ES stage.
- 9.10.27 As outlined above there may be shallow groundwater in parts of the DCO Site, and so there is potential for groundwater ingress to the pits. This would be managed following standard construction techniques potentially including pumping, damming or shoring up the pits with sheet piling. A temporary abstraction licence is required from the Environment Agency when abstracting more than 20 m³/day of water per day lasting less than 28 days. Any discharge of groundwater to the watercourse may also require a discharge consent from the Environment Agency if it is considered to be 'unclean' and the conditions of the Environment Agency's Regulatory Position Statement 'Temporary dewatering from excavations to surface water' (April 2021) (Ref 9-81) cannot be met.
- 9.10.28 The pits would be backfilled with the original excavated material upon completion and would not affect groundwater flow in the longer term. Given the potential to encounter groundwater temporarily during construction, but that it would be appropriately managed in line with any required permit conditions and best industry practice as outlined in the Framework CEMP, there is the likelihood of a short term, temporary minor adverse impact on groundwater flow. For the medium importance groundwater aquifer this results in a **slight adverse** effect (**not significant**).
- 9.10.29 The DCO Site 1km study area is not known to have a significant history of potentially contaminating land uses such as landfill, although there are areas of infilled land and made ground associated with historic quarries and pits. The installation of the module structures to a maximum depth of 2m below ground, and other foundations depths as outlined above (maximum 2m depth) are not considered at this stage to create a significant risk of mobilising contaminants, creating a contaminant pathway or risking infiltration to the water table. A standalone, site specific hydraulic fracture risk assessment will be produced prior to drilling the cable crossings, as is standard practice, to mitigate any water quality deterioration from the drilling process. This will be secured through the Framework CEMP. Consequently, water quality impacts to rivers receiving baseflow, and groundwater abstractions down gradient are considered to be negligible, and a **neutral** effect (**not significant**). This will be reviewed at the ES stage.

Solar and Energy Storage Park: Flood Risk

9.10.30 A Flood Risk Assessment is included in PEI Report Volume 3: Appendix 9-B. A summary of flood risk to the Solar and Energy Storage Park is outlined below.



Fluvial Flood Risk

- 9.10.31 The majority of the Solar and Energy Storage Park is in Flood Zone 1 (See PEI Report Volume 2: Figure 9-2) and considered to be at low risk from fluvial flooding (Table 9-10). However, construction activity in the northwest and western side of the site will involve works in areas of Flood Zone 2 and 3. Should a fluvial flood event occur during construction, this could be a potential high risk to construction workers in the immediate vicinity (very high importance receptors). The baseline flood risk could be exacerbated during construction works by the temporary increase in the rate and volume of surface water runoff from an increase in impermeable areas such as compacted soils and the presence of stockpiled materials and equipment may also be washed downstream where it may block the channel and lead to or increase the risk of flooding.
- 9.10.32 With the implementation of standard construction methods and mitigation as described in Section 9.9, this fluvial flood risk can be effectively managed (for example by monitoring weather forecasts and Environment Agency flood warnings, by undertaking works close to watercourses during periods of dry weather by ensuring an adequate temporary drainage system is in place and maintained throughout the construction phase and avoiding stockpiling material on floodplains).
- 9.10.33 As such, the magnitude of flooding from these sources during construction, on site and further downstream, is considered to be very low resulting in a negligible impact, which as construction workers are a very high importance receptor gives a **slight effect** (**not significant**).

Surface Water (Pluvial) Flood Risk

- 9.10.34 The Solar and Energy Storage Park is in general at a very low risk of surface water flooding, although in some areas (mainly associated with watercourses and localised shallow patches) there are areas of low, medium and high risk as outlined in the baseline and shown in **PEI Report Volume 2: Figure 9-2**.
- 9.10.35 During construction, the following adverse impacts may occur:
 - Existing surface water flow paths may be disrupted and altered due to site clearance, earthworks, and excavation work. The exposure and compaction of bare ground and the construction of new embankments and impermeable surfaces may increase the rates and volume of runoff and increase the risk from surface water flooding.
 - Temporary changes in flood risk from changes in surface water runoff (e.g. exacerbation of localised flooding due to deposition of silt, sediment in drains, ditches); and
 - Changes in flood risk due to the construction of solar PV panels and site compound and storage facilities, which alter the surface water runoff from the site.
- 9.10.36 As stated within Section 9.9, Embedded Design Mitigation, the surface water drainage strategy will ensure that any alteration of surface water runoff as a result of the construction of the solar PV panels, compounds and battery



- storage units will be mitigated by the construction of SuDS (e.g. swales and detention basins).
- 9.10.37 Construction activities will take place with the Final CEMP in place (building on the Framework CEMP which will accompany the ES) to ensure no exacerbation of localised flooding from deposition of silt or sediment in drainage and ditches.
- 9.10.38 Therefore, the impact during construction on surface water flooding and flood risk, to and from the Scheme to other developments outside of the Scheme extents, is considered to result in no change, which would result in a **neutral** effect to very high importance construction workers (**not significant**).

Flood Risk from Artificial Sources

- 9.10.39 It is not envisaged the flood risk from drainage infrastructure (e.g. sewers) will increase from the existing situation with the construction of the Scheme. Foul water arrangements have yet to be determined, and this will be reviewed at the ES stage when further details on treatment of foul water for the four permanent operatives on site will be available.
- 9.10.40 There is not envisaged to be any impact on flood risk from artificial sources either on or off site during construction (i.e., no change), and so no effect to on-or off-site receptors (e.g. ecological or heritage receptors). As such, there is a **neutral** effect (**not significant**) to very high importance construction workers from flood risk from drainage infrastructure and artificial sources.

Grid Connection Route: Flood Risk

9.10.41 A Flood Risk Assessment is included in PEI Report Volume 3: Appendix 9-B. A summary of flood risk to the Grid Connection Route is outlined below.

Fluvial Flood Risk

- 9.10.42 The majority of the Grid Connection Route is in Flood Zone 3 and considered to be at high risk (Table 9-10 and PEI Report Volume 2: Figure 9-2). Should a fluvial flood event occur during construction, this could be a potential high risk to construction workers in the immediate vicinity (very high importance receptors). The baseline flood risk could be exacerbated during construction works by the temporary increase in the rate and volume of surface water runoff from an increase in impermeable areas such as compacted soils and the presence of stockpiled materials and equipment may also be washed downstream where it may block the channel and lead to or increase the risk of flooding.
- 9.10.43 With the implementation of standard construction methods and mitigation as described in Section 9.9, this fluvial flood risk can be effectively managed as outlined above. There is also a low likelihood of significant flooding during construction occurring. The probability of a 1% AEP event occurring over the 48 month construction period can be determined using the risk of exceedance equation (Ref 9-82). Based on this, there is a 2% chance of the 1% AEP event occurring (i.e. a 98% chance of it not occurring) and therefore the flood risk during the construction period is considered low.



- 9.10.44 As stated within Section 9.9 Embedded Design Mitigation, the Grid Connection Route will cross under the River Trent. This will ensure there will be no impact on the banks and bed of the watercourse, and therefore no effect on the flow regime or flooding potential of the watercourse.
- 9.10.45 Overall, the magnitude of flooding from fluvial sources during construction, on site and further downstream, is considered to be very low resulting in a negligible impact, and a slight effect (not significant) to very high importance construction workers.

Surface Water (Pluvial) Flood Risk

- 9.10.46 The Grid Connection Route is in general at a very low risk of surface water flooding, although in some areas (mainly associated with watercourses and localised shallow patches) there are areas of low, medium and high risk as outlined in the baseline and shown in **PEI Report Volume 2: Figure 9-3**. During the construction phase the following adverse impacts may occur:
 - Temporary changes to flood risk from changes in surface water runoff (e.g. disruption of stream flows due to deposition of silt, sediment in drains, ditches); and
 - Changes in flood risk due to the construction of the Grid Connection Route crossing the River Trent.
- 9.10.47 Construction activities in the area of the river will take place with the CEMP in place to ensure no exacerbation of localised flooding from deposition or silt or sediment in drainage and ditches.
- 9.10.48 The FRA (**PEI Report Volume 2: Appendix 9-C**) considers pluvial flood risk from the Grid Connection Routes and will be considered in more detail at the ES stage. However, at this stage, with the mitigation in place, flood risk is considered low.
- 9.10.49 Therefore, the impact of construction of Grid Connection Route on pluvial flood risk, from and to the development, is considered to result in a temporary no change impact, which results in a **neutral** effect (**not significant**) on very high importance construction workers.

Artificial

9.10.50 There is not envisaged to be any impact on flood risk from artificial sources either on or off site, and so no adverse effect to on-or off-site receptors (e.g. ecological or heritage receptors). Overall, there is a **neutral** effect (**not significant**) on very high importance construction workers from drainage infrastructure and artificial sources.

Operation

Surface Waterbodies – Operation Impact to Water Quality

9.10.51 The provisional drainage arrangements propose to attenuate surface water runoff and contain spillages from the operational DCO Site, whilst minimising flood risk to the site and surrounding areas (see Section 9.9). More detailed proposals will be presented in an outline drainage strategy at the ES stage.



- 9.10.52 Surface water runoff would mainly be low risk roof or panel runoff. In addition to permanent structures, there would be runoff from hardstanding areas such as the BESS, onsite substation, permanent plant storage buildings, office/warehouse buildings, access tracks and car park.
- 9.10.53 The DCO Site's impermeable area will remain largely consistent with its predevelopment state as PV Panels are elevated above ground. Runoff from the PV Panels will alter the existing routing of runoff. To prevent ponding occurring around the panels, a series of boundary and routing swales will be constructed to convey surface water runoff away from the panels and towards receiving watercourses or soakaways/infiltration basins to ground (dependent on the outcomes of the drainage strategy development). Additional SuDs attenuation such as ponds will be incorporated to control any increase in the rate of flow towards the receiving watercourses, and to provide treatment for any contaminants collected on areas of hardstanding. At this stage outfall locations have not been determined but will be confirmed at the ES stage.
- 9.10.54 The SuDS Manual's Simple Index Approach (0) has been applied to demonstrate the suitability of an indicative SuDS treatment train for surface water runoff and spillages. The Medium Pollution Hazard Index has been adopted to assess runoff from the Scheme as a worst case scenario, as this is described in the SuDS Manual as, "Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospitals, retail), all roads except low-traffic roads and trunk roads/motorways". While not directly applicable to the Scheme, given that there will be storage of batteries on site, this is deemed the most appropriate hazard index available. However, this is precautionary and in reality, there will be little traffic on site with infrequent change (i.e. estimated four workers in total). The battery storage area will have a specific drainage design and mitigation in case of fire (see Section 9.9).
- 9.10.55 Table 9-13 shows the pollutant hazard index score for different pollutants (total suspended solids, metals, and hydrocarbons) for the Medium Pollution Hazard Level, as outlined in the SuDS Manual (Ref 9-29).
- 9.10.56 An indicative treatment of swales and an attenuation pond for the higher risk areas (e.g. car parks) for conveyance and treatment of surface water flows is included in Table 9-13 by way of an example. Table 9-13 shows the treatment potential of the SuDS solution when compared against the medium pollution hazard index. To achieve a pass the total mitigation index must meet or surpass the pollution hazard index. Under the Simple Index Approach the effectivity of the second treatment component (i.e. attenuation pond) is considered to be 50% compared to the first treatment component (i.e. the swale). On this basis, the mitigation index (swale + pond at 50% efficiency) passes the indicative assessment for total suspended solids, metals, and hydrocarbons. This process will be repeated at the ES stage for each element of the Scheme that has drainage requirements.

Table 9-13: Pollution Hazard Indices and the Total Pollutant Mitigation Index for each pollutant

Proposed
Development
Land Use

SuDS Train

Total Suspended Metals Solids

Hydrocarbons



Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospitals, retail), all roads except low-traffic roads and trunk roads/motorways	Swale	0.5	0.6	0.6
	Pond at 50% efficiency	0.35	0.35	0.25
	Pollution Hazard Index	0.7	0.6	0.7
	Total Mitigation Index	0.85 (Pass)	0.95 (Pass)	0.85 (Pass)
	Comment	The proposed treatment train passes the assessment in all cases. However, appropriate maintenance of the SuDS features will be required to ensure that they remain effective in the long term.		

- 9.10.57 As outlined in Section 9.9, transformers will be installed with suitable bunds to contain any oil spillage in case of an oil-leakage event. Bunds will be designed to contain at least 110% of the volume of the oil within the transformers. Should a spillage occur oil would be collected for off-site disposal at a licensed waste facility.
- 9.10.58 During operation, the DCO Site would operate using best practice and comply with environmental legislation through the application of an Outline Landscape and Ecological Management Plan (OLEMP) (to be developed at the ES stage), including appropriate maintenance of SuDS and other drainage infrastructure.
- 9.10.59 It is anticipated that with the embedded mitigation of an appropriate drainage strategy mimicking natural flow status there would be no effect on flow pathways from runoff from the Scheme.
- 9.10.60 Overall, given the implementation of a Drainage Strategy including SuDS provision, there would be negligible impact to any receiving waterbodies (surface or groundwater) from routine runoff. Final outfall locations have not yet been determined, but on the Solar and Energy Storage Park the receptors are likely to be the Tributary of the Till WFD waterbody (high importance) or the low importance drainage ditches that are ubiquitous across the area. For the Tributary of the Till this would result in a **slight adverse** effect (**not significant**). For the low importance ditches across the DCO Site, this would be a **neutral** effect (**not significant**).
- 9.10.61 As the land is being taken out of agricultural usage, it is considered there would a decrease in surface water runoff of agricultural additives to the land (be that nutrients in the form of phosphates and nitrates, or from pesticides, herbicides or insecticides). Taking land out of arable production may also have other benefits by reducing the risk of soil erosion and the need for local water abstraction for crop irrigation. However, although a beneficial impact, in the context of the whole catchment, it is considered this would not be a sufficiently large change to result in an effect on the watercourses. Therefore, there is considered to be no change in future baseline conditions to any watercourse resulting in a neutral effect in all cases, which is not significant.



Surface Waterbodies – Morphological Assessment

- 9.10.62 For the agricultural ditches on the Solar and Energy Storage Park that are to be crossed by open span crossings for access tracks, there may be very localised and minor impacts to the waterbody riparian and bank habitat for installation of the structures, and localised shading effects to the watercourse bed habitat. Shading reduces light intensity, photosynthesis, metabolic activity and biochemical cycling within the watercourse, thereby impacting on the aquatic ecosystem, albeit for a short length for each crossing, assumed to be a maximum of 6m (based on access track dimensions outlined in **Chapter 2:**The Scheme). However, these are ephemeral/intermittently flowing channels without functional flows and so the extent of impact is expected to be only minor as a worst case. For these low importance receptors (in terms of morphology) this results in a neutral effect (not significant).
- 9.10.63 The Scheme may require new surface water outfalls for operational drainage. Locations will be determined at the ES stage following development of the drainage strategy. Soft green ditch connections will be used where possible, and the final location, position and orientation of any new outfall will be carefully determined and informed by a hydromorphological survey to minimise any adverse local impacts on river processes. If headwalls are required, appropriate micro-siting of the outfalls will minimise loss of bank habitat, the need for bed scour or hard bank protection, and localised flow disturbance or disruption to sediment transport processes. It is anticipated that only the Tributary of the Till watercourse and/or agricultural drainage ditches would be impacted by outfalls from the Solar and Energy Storage Park. These are low importance receptors in terms of morphology. Given appropriate design a minor impact would be expected, resulting in a **neutral** effect to all affected watercourses (**not significant**). This will be considered again at the ES stage when full details of the drainage strategy are available.
- 9.10.64 The open-cut installation of the cable for the Grid Connection Route will require intrusive works across Marton Drain, Seymour Drain and seven drainage ditches, all of which are of low importance for morphology due to being artificially straight, trapezoidal channels lacking significant geomorphic and bedform features. For open-cut crossings, the cables will be buried at sufficient depth to prevent exposure and the flow over-pumped or flumed during the works to minimise the risk of water pollution being carried downstream. However, there will unavoidably be short term, temporary adverse impacts on the watercourse and riparian habitats, and the hydrological and sediment regimes during construction. These impacts would be very localised and short in duration, with the channels reinstated. Overall, physical works are considered to give a localised moderate adverse impact against hydromorphological status. As low importance receptors this results in a **slight** effect (**not significant**), although this impact would be minimal at the scale of the wider waterbody once installation of the cables and reinstatement of the watercourse is complete.

Groundwater – Operation Impact Assessment

9.10.65 No risks to the groundwater receptors are anticipated during operation of the Scheme, provided that operation is conducted in accordance with the



- embedded mitigation outlined in Section 9.9 and which will be secured in the DCO via the Framework CEMP, including adoption of best industry practice to manage the risk of chemical spillages.
- 9.10.66 It is likely that the reduction in arable farming across the DCO Site will reduce the need for irrigation of crops. However, details requested from the Environment Agency on abstraction licenses in the area have yet to be received, and so the impact of this will be considered further at the ES stage.
- 9.10.67 It is anticipated that swales around the PV Panels will collect runoff which is expected to partly infiltrate to the underlying aquifer, whilst the portion that does not have opportunity to infiltrate may be conveyed towards watercourses. As such, there may be negligible localised changes in the spatial distribution and quantity of recharge of groundwater across the DCO Site.
- 9.10.68 Construction of building foundations and areas of new hardstanding will prevent recharge of rainfall directly under their footprint, with runoff again being managed appropriately using SuDS. These areas of hardstanding are very limited in size in comparison to the large scale of the DCO Site, the majority of which will remain permeable.
- 9.10.69 The change in distribution of groundwater recharge locally is expected to be negligible in terms of its effect on water abstraction and baseflow to rivers. As groundwater is a medium importance receptor this results in a **neutral** effect (**not significant**). This will be reviewed at the ES stage should any further data be available following the Environment Agency data request (including details of groundwater abstractions in the study area).

Solar and Energy Storage Park: Flood Risk

Fluvial Flood Risk

- 9.10.70 The majority of the Solar and Energy Storage Park is in Flood Zone 1 (See **PEI Report Volume 2**: **Figure 9-2**) and considered to be at low risk from fluvial flooding (Table 9-10). However, in the northwest and western side of the site will potentially involve works in areas of Flood Zone 2 and 3.
- 9.10.71 On-site flood risk will be mitigated by raising on the PV panels a minimum of 800mm above ground level (and potentially higher where required), and sequential location of compounds and battery storage facilities. The site will implement mitigation provided in the surface water drainage strategy in order to ensure no detriment to off-site flooding. It is, therefore, considered that there would be no change to the current scenarios, resulting in a **neutral** effect (**not significant**).

Surface Water (Pluvial) Flood Risk

9.10.72 The Solar and Energy Storage Park is in general at a very low risk of surface water flooding, although in some areas (mainly associated with watercourses and localised shallow patches) there are areas of low, medium and high risk as outlined in the baseline and shown in **PEI Report Volume 2: Figure 9-2**.



9.10.73 On-site flood risk will be mitigated by raising on the PV panels a minimum of 800mm above ground level (and potentially higher where required), and sequential location of compounds and battery storage facilities. The Solar and Energy Park will implement mitigation provided in the surface water drainage strategy in order to ensure no detriment to off-site flooding. It is, therefore, considered that there would be no change to the current scenarios, resulting in a neutral effect (not significant).

Groundwater Flood Risk

9.10.74 The Solar and Energy Storage Park is considered to be at a very low to low risk of flooding from groundwater sources. It is considered that groundwater flood risk is unlikely to increase from the Solar and Energy Storage Park as the majority of the infrastructure will be above the ground surface. Infiltration into the soil and underlying geology will remain as existing conditions. As such, there is a **neutral** effect (**not significant**) from flood risk from groundwater.

Artificial Sources

- 9.10.75 It is not envisaged the flood risk from drainage infrastructure (e.g. sewers) will increase from the existing situation during the operation of the Scheme. Foul water arrangements have yet to be determined, and this will be reviewed at the ES stage when further details on treatment of foul water for the four permanent operatives on site will be available.
- 9.10.76 There is not envisaged to be any impact on flood risk from artificial sources either on or off-site during operation (i.e., no change), and so no effect to onor off-site receptors (e.g. ecological or heritage receptors). As such, there is a neutral effect (not significant) from flood risk from drainage infrastructure and artificial sources.

Grid Connection Route: Flood Risk

9.10.77 No part of the Grid Connection Route is above ground; therefore, it is considered there would be a no change to future baseline conditions once the cable is installed and the land reinstated. As such, there would be **neutral** effect in terms of flood risk on and off site from all sources (**not significant**).

Decommissioning (2087 to 2088-89)

- 9.10.78 Potential impacts from the decommissioning of the Solar and Energy Storage Park are similar in nature to those during construction, as some ground works would be required to remove infrastructure installed. A detailed Decommissioning Environmental Management Plan will be prepared prior to decommissioning to identify required measures to prevent pollution and flooding during this phase of the development
- 9.10.79 As a result, it is considered the decommissioning impacts and effects would mirror those of the construction phase. This will be reviewed at the ES stage.

Summary of Effects

9.10.80 There are no residual significant effects on the water environment expected following the implementation of mitigation.



9.10.81 Non-significant effects are listed in **PEI Report Volume 3: Appendix 9-D.**

9.11 Residual Effects and Conclusions

- 9.11.1 This section summarises the residual significant effects of the Scheme on surface water, groundwater and flood risk following the implementation of embedded mitigation as outlined in Section 9.9, including best practice measures secured via the CEMP (which will accompany the ES). As no significant effects have been identified, no additional mitigation has been outlined at this stage.
- 9.11.2 Effects for decommissioning are considered to be the same as those identified for construction. However, decommissioning activities will be reviewed at the ES stage, and more detailed assessment provided if appropriate.
- 9.11.3 There are considered to be no significant residual effects for surface water, groundwater or flood risk during the construction, operation and decommissioning phases of the Scheme. The assessment will be reviewed and revised where necessary at the ES stage when further design detail is available and further consultation has been undertaken with statutory bodies.

9.12 Cumulative Assessment

- 9.12.1 The cumulative schemes are currently being agreed in consultation with Lincolnshire and Nottinghamshire County Council, and as such the cumulative effects will be reviewed following statutory consultation and fully addressed in the ES.
- 9.12.2 At this stage of the PEI Report, developments that may give rise to cumulative effects on the water environment with the Scheme have not yet been fully assessed. A list of relevant developments is presented in **Chapter 16: Cumulative Effects and Interactions**. The cumulative assessment methodology is presented within **Chapter 5: EIA Methodology**. Cumulative effects will be assessed in the ES.
- 9.12.3 It is therefore not possible to definitely state the significance of cumulative impacts, however based on an initial review of the list and their nature and distance from the DCO Site, it is not expected that cumulative schemes would elevate any of the residual effects identified in this assessment.



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10. Landscape and Visual Amenity

10.1 Introduction

- 10.1.1 This chapter of the Preliminary Environmental Information (PEI) Report presents the initial findings of an assessment of the likely significant effects on landscape and visual receptors as a result of the DCO Site, which is defined as comprising both the Solar and Energy Storage Park and the Grid Connection Route. For more details about the DCO Site, refer to **Chapter 2: The Scheme** of this PEI Report.
- 10.1.2 This chapter identifies measures to address the potential impacts and likely significant effects of the DCO Site on the landscape and visual resource of the study area, during the construction, operation, and decommissioning phases.
- 10.1.3 For the purposes of this landscape and visual impact assessment (LVIA), a clear distinction is drawn between landscape and visual impacts as follows:
 - Landscape Effects: relate to changes to the landscape as a resource, including physical changes to the fabric or individual elements of the landscape, its aesthetic or perceptual qualities, and landscape character.
 - **Visual Effects:** relate to the changes arising from the proposed Scheme to visual receptors (people) with views of the landscape or townscape (e.g. local residents, users of public rights of way (PRoW), or passing motorists).
- 10.1.4 The LVIA has been undertaken by Chartered Landscape Architects and with reference to **Chapter 7: Cultural Heritage** and **Chapter 8: Ecology and Nature Conservation** in this PEI Report, which should be read in combination with this chapter.
- 10.1.5 This chapter is also supported by the following figures in **PEI Report Volume 2**:
 - Figure 10-1 LVIA Study Area;
 - **Figure 10-2** Landscape Character Assessment Topography;
 - Figure 10-3 Public Rights of Way:
 - Figure 10-4 National Landscape Character Areas;
 - Figure 10-5 Regional Landscape Character Areas;
 - Figure 10-6 County and District Landscape Character Areas;
 - Figure 10-7 Local Landscape Character Areas;
 - Figure 10-8 Areas of Great Landscape Value;
 - Figure 10-9 ZTV Bare Earth:
 - Figure 10-10 ZTV Barrier;
 - Figure 10-11 Viewpoint Locations on OS Mapping; and
 - **Figure 10-12** Viewpoint Locations in Aerial Photography.



- 10.1.6 This chapter is supported by the following appendices in **PEI Report Volume 3**:
 - Appendix 10-A Legislation and Planning Policy;
 - Appendix 10-B LVIA Methodology;
 - Appendix 10-C Landscape Baseline;
 - Appendix 10-D Visual Baseline;
 - Appendix 10-E Visual Assessment; and
 - Appendix 10-F Existing Viewpoint Photography (Winter 2022).

10.2 Consultation

- 10.2.1 A request for an EIA Scoping Opinion was sought from the Secretary of State through the Planning Inspectorate in 2021 as part of the EIA Scoping Process and a Scoping Opinion was issued on 20 December 2021. Consultation responses in relation to landscape and visual amenity, to date, are presented in **PEI Report Volume 3: Appendix 1-C**.
- 10.2.2 Initial consultation has been undertaken with Lincolnshire County Council, Bassetlaw District Council and a number of local residents. In March 2022, the proposed locations of viewpoints were scoped with Lincolnshire County Council and Nottinghamshire County Council. Additional viewpoints recommended by Lincolnshire County Council are still subject to verification and photography on site. These additional viewpoints will be fully assessed as the Environmental Impact Assessment (EIA) progresses. All selected viewpoints are presented in **PEI Report Volume 2: Figures 10-11 and 10-12**.



Table 10-1 Summary of consultations

Consultee or Organisation	Date and nature of consultation	Summary of Response	How comments have been addressed in this Chapter
Via East Midlands Ltd	1 st March 2022 Online presentation & Discussion	No additional viewpoints required unless proposed substation design features change	No further viewpoints have been added based on the response
Lincolnshire County Council via AAH Consultants	1 st March 2022 Online presentation & Discussion	General comments on viewpoints, ZTVs and substation Proposal to add viewpoints to the already selected viewpoints	Online meeting with AAH Consultants on 30th March 2022 to review and discuss details of the additional viewpoints A Scheme visit to verify additional viewpoints on site and to take viewpoint photography will be carried out as the Environmental Impact Assessment (EIA) progresses.

10.3 Legislation and Planning Policy

10.3.1 The following section provides a summary of legislation and planning policy which is of direct relevance to the assessment of the landscape and visual effects. Further detail is provided in **PEI Report Volume 3: Appendix 10-A Legislation and Planning Policy**.

National Planning Policy

Overarching National Policy Statement for Energy (EN1), adopted 2011 (Ref 10-1)

- 10.3.2 EN1 sets out the Government's policy for the delivery of major energy infrastructure, to help deliver the Government's climate change objectives. It clearly sets out the need for new low carbon energy infrastructure to contribute to climate change mitigation.
- 10.3.3 EN1 explains that "new energy infrastructure is likely to have some negative effects on landscape/visual amenity... and the impacts on landscape/visual amenity will sometimes be hard to mitigate". Projects should be "designed carefully, taking account of the potential impact on the landscape".



NPS for Renewable Energy Infrastructure (EN3), adopted 2011 (Ref 10-2)

10.3.4 EN3 provides the primary basis for recommendations by the Planning Inspectorate on applications it receives for nationally significant renewable energy infrastructure. EN3 states that "proposals for renewable energy infrastructure should demonstrate good design in respect of landscape and visual amenity".

NPS for Electricity Networks Infrastructure (EN5), adopted 2011 (Ref 10-3

10.3.5 EN5 provides the primary basis for recommendations made by the Planning Inspector on applications it receives for electricity networks infrastructure. EN5 sets out that "local landscape, topography and screening" should be considered, and that new planting for screening can reduce the impacts on visual receptors.

Draft Overarching National Policy Statement (NPS) for Energy (Draft EN1), 2021 (Ref 10-4)

- 10.3.6 In the energy White Paper: 'Powering our Net Zero Future' (2020) the government committed to completing a review of the existing energy NPS to ensure they reflect current energy policy and that the policy framework can deliver investment in the infrastructure needed for the transition to net zero. Draft EN1 was issued for consultation in September 2021 to identify whether the revised document is fit for purpose.
- 10.3.7 Draft EN1 states that "applicants need to consider the importance of 'good design' criteria" and identifies key considerations for a landscape and visual assessment.

Draft National Policy Statement for Renewable Energy Infrastructure (Draft EN3) (Ref 10-5)

- 10.3.8 Draft EN3 was also issued for consultation in September 2021. It includes a new section on Solar Photovoltaic Generation and landscape, visual and residential amenity including the following relevant statements:
- 10.3.9 "Applicants should follow the criteria for good design set out in Section 4.6 of EN-1 when developing projects and will be expected to direct considerable effort towards minimising the landscape/visual impact of solar PV arrays. Whilst there is an acknowledged need to ensure solar PV installations are adequately secured, required security measures such as fencing should consider the need to minimise the impact on the landscape and visual impact".
- 10.3.10 "The applicant should have regard in both the design layout of the solar farm, and future maintenance plans, to the retention of growth of vegetation on boundaries, including the opportunity for individual trees within the boundaries to grow on to maturity. The landscape and visual impact should be considered carefully at the pre-application stage. Existing hedges and established vegetation, including mature trees, should be retained wherever possible. Trees and hedges should be protected during construction. The



impact of the proposed development on established trees and hedges should be informed by a tree survey or a hedge assessment as appropriate".

10.3.11 "Applicants should consider the potential to mitigate landscape and visual impacts through, for example, screening with native hedges. Efforts should be made to minimise the use and height of security fencing. Where possible projects should utilise existing features, such as hedges or landscaping, to screen security fencing and use natural features, such as vegetation planting, to assist in site security. Projects should minimise the use of security lighting. Any lighting should utilise a passive infra-red (PIR) technology and should be designed and installed in a manner which minimises impact".

Draft National Policy Statement for Electricity Network Infrastructure (Draft EN5) (Ref 10-6)

10.3.12 Draft EN5 includes reference to "a degree of flexibility in the location of the development's associated substations, and applicants should consider carefully their placement in the local landscape."

National Planning Policy Framework (NPPF), July 2021 (Ref 10-8)

10.3.13 The NPPF sets out the Government's planning policies for England and how these should be applied, and the environmental role of sustainable development. The NPPF sets out that development should be "visually attractive and sympathetic to local character".

Planning Practice Guidance (PPG) (Ref 10-20)

- 10.3.14 PPG 'Natural Environment' sets out the benefits of landscape character assessments and the importance of considering Green Infrastructure in the early stages of schemes.
- 10.3.15 The section on 'Renewable and Low Carbon Energy' sets out that:

"The deployment of large-scale solar farms can have a negative impact on the rural environment, particularly in undulating landscapes. However, the visual impact of a well-planned and well-screened solar farm can be properly addressed within the landscape if planned sensitively."

Local Planning Policy

Central Lincolnshire Local Plan (Ref 10-28)

- 10.3.16 The Central Lincolnshire Local Plan, adopted in 2017, sets out a planning framework to meet development needs between 2017 2036. The Local Plan covers the City of Lincoln, North Kesteven and West Lindsey.
- 10.3.17 The Local Plan includes policies to protect and enhance the value of the landscape, preserve or enhance key local views and requires development to help deliver new green infrastructure.
- 10.3.18 The Local Plan is under review since 2019. Consultation on the next stage of the Local Plan review, a Proposed Submission Local Plan, is taking place between 16th March and 9th May 2022.



Bassetlaw District Local Development Framework (BDLDF), 2011 (Ref 10-29)

- 10.3.19 The BDLDF covers the area of the proposed Grid Connection Route.
- 10.3.20 Adopted in 2011 the BDLDF comprises a series of documents that guide decision making across Bassetlaw. The documents included and the elements relevant to landscape and visual matters are set out below.

Bassetlaw District Core Strategy (the "Core Strategy") (Ref 10-30)

10.3.21 The Bassetlaw Core Strategy provides the overarching framework for all documents within the BDLDF. The Core Strategy details Bassetlaw District's requirements with regard to design and character, green infrastructure and the safeguarding of the natural environment.

Bassetlaw Local Plan: Publication Version 2020 – 2037 (Ref 10-31)

10.3.22 Bassetlaw District Council is producing a new Local Plan to guide development in the district from 2020 – 2037. The new Local Plan is scheduled for adoption in Spring 2023. The draft policies set out Bassetlaw District's requirements with regard to design quality, landscape character, green infrastructure and the need for renewable energy projects to demonstrate sensitive siting and scale within the landscape.

Neighbourhood Plans

- 10.3.23 Neighbourhood plans provide planning policy for some areas within the study area. These are listed below:
 - Gainsborough Neighbourhood Plan 2020-2036 (Ref 10-32);
 - Rampton and Woodbeck Neighbourhood Plan 2019-2037 (Ref 10-33);
 and
 - Lea Neighbourhood Plan 2017-2036 (Ref 10-34).

10.4 Assessment Assumptions and Limitations

- 10.4.1 This chapter forms an assessment based on available information at the time of preparation and represents a realistic worst case based on the Rochdale Envelope approach (refer to **Chapter 2: The Scheme**). The findings reported in this PEI Report may be subject to change as the design of the proposed Scheme is developed and refined through the EIA and consultation processes.
- 10.4.2 The assessment is based on, and limited to, the baseline conditions observed at the time of the initial landscape and visual field work in January and February 2022. Summer fieldwork will commence shortly after the PEI Report is submitted and will inform the detailed assessment of landscape and visual effects set out within the ES. All fieldwork to date has been undertaken from publicly accessible locations. Professional judgement has been used to assess residents' views and views from main roads, aided by aerial photography and fieldwork observations from the surrounding area.



- 10.4.3 ZTV modelling was initially undertaken within the red line Scheme boundary and a 3km radius outside of the red line Scheme boundary to inform the definition of the study area for the LVIA. It should be noted that this represents 'theoretical' visibility. The results will be tested through fieldwork and further ZTV modelling as the design develops and this will be detailed within the ES. Further information on this is provided in Section 10.5 below.
- 10.4.4 Consideration of the following elements has been deferred to the preparation of the ES:
 - Lighting A lighting design will be developed as the Environmental Impact Assessment (EIA) progresses. However, it is assumed that lighting will be used temporarily during construction. During operation it is assumed that no areas will be permanently lit, but sensor activated lighting will be deployed around plant buildings and the battery energy storage system ("BESS"). Based on these assumptions, no lasting significant effects on landscape character or visual amenity are anticipated as a result of lighting. This will be further reviewed as the lighting design is developed prior to the preparation of the ES.
 - Glint and Glare the visual assessment has considered the orientation of the PV Panels. The proposed tilt of the PV Panels will be confirmed prior to the preparation of the ES. This will inform a standalone glint and glare assessment, the findings of which will be cross-referenced in the LVIA.
 - Cumulative schemes the number, location and extent of cumulative schemes (in particular West Burton Solar Farms and Cottam Solar Farms) are currently being agreed in consultation with Lincolnshire and Nottinghamshire County Councils, and as such the cumulative effects will be reviewed following statutory consultation and will be fully addressed in the ES. Other similar proposed schemes, in combination with the DCO Site, may increase the level of effects identified for landscape and visual receptors due to the scale of cumulative schemes, resulting in likely significant landscape and visual effects. This will be considered in full in the preparation of the ES.
- 10.4.5 With reference to **Chapter 5: EIA Methodology** the construction phase assessment is based on peak activity in 2026, as anticipated.
- 10.4.6 The assumptions for the construction phase assessment are:
 - Construction activity is assumed to be undertaken during a 24 36 month period;
 - For the Grid Connection Route, the construction spread is expected to be 30-40m in width with wider areas up to 60m to support installation of the HDD launch and exit pits. Detailed assessment will be contained within the ES:
 - Construction plant will include concrete mixers, piling rigs, ground levellers, ground compressors, forklift trucks, excavators and cranes;
 - Up to three temporary construction compounds will be established as well as temporary roadways to facilitate access to all land within the Solar and Energy Storage Park;



- The perimeter fence around the operational areas will be implemented early in the construction phase to secure the DCO Site. It will consist of an approximately 2.5m to 3m high deer proof fencing expected to comprise of posts and hi-tensile wire mesh. This will also prevent construction activity in proximity to retained vegetation and, where required, specific protection measures will be implemented, including fencing or solid hoardings and construction exclusion zones; and
- Stripping of topsoil in sections for the cable connection, sub-station and BESS area only.
- 10.4.7 For the purposes of this PEI Report, it has been assumed that PRoW will remain open so the potential effects on people's views are considered. The assumptions for the Year 1 operation assessment are:
 - The DCO Site will be operational across the whole area, during winter, when deciduous vegetation is not in leaf. This represents a worst-case scenario.
 - The PV Panels will be on a PV Mounting Structure (most likely to be galvanised steel or anodised aluminium). The PV Panels will be angled with their highest edge up to a maximum of 3.5m above ground level and all panels will be fixed in a south facing orientation and will not rotate to follow the sun:
 - A Solar Station will comprise an inverter, a transformer and switchgear.
 The maximum height of inverters, switchgear and transformers will be up
 to a maximum of 3.5m and therefore this height has been assumed for
 the LVIA as the worst case;
 - The BESS will be up to 4.5m tall;
 - The substation will be a maximum height of 11m;
 - The permanent plant buildings will be up to 7.2m tall;
 - Grassland and wildflower meadows will have been sown beneath the panels and species rich grassland in the Landscape Works Area. This grassland will not have fully established at year 1;
 - Proposed native hedgerows will be between 0.6m and 0.8m in height with tree planting between 1m and 3.5m in height dependant on available plants and natural variation in heights; and
 - All new planting will be implemented and managed in accordance with the Outline Landscape Ecology Management Plan ('OLEMP') which will be provided as the EIA progresses.
- 10.4.8 The assumptions for the Year 15 operation assessment are:
 - The DCO Site will be operational across all of the area in summer, such that existing vegetation and new planting will be in leaf. As set out in the following methodology section, this accords with the Guidelines for Landscape and Visual Impact Assessment, 3rd, 2013 (Ref 10-10);
 - All new planting will have successfully established such that there will be a consistent grassland sward and wildflower meadow beneath the PV Panels;
 - Trees planted as part of the DCO Site will have grown by an assumed 3m in height (equating to 20 centimetres per year) to range between 4m and 6.5m in height; and



- New and existing hedgerows will be maintained at 3m tall.
- 10.4.9 The assumptions for the decommissioning assessment are:
 - The DCO Site will no longer be operational, and the PV Panels and associated structures and equipment will be removed in a manner similar to the construction phase, requiring machinery and localised excavation;
 - The proposed planting will remain with hedgerows remaining at a height of 3m and proposed trees between 7m and 9.5m in height resulting overall in lesser visual effects when compared to the construction stage;
 - The assessment is undertaken for the summer season with the duration of the decommissioning phase being between 24 and 48 months; and
 - With reference to Chapter 2: The Scheme the underground cable within the Grid Connection Route will either be left in-situ or removed and the ground reinstated. In order to consider the worst case scenario it has been assumed that the cable will be removed for the purposes of the LVIA.

10.5 Study Area

- 10.5.1 The extents of preliminary, computer-generated ZTV modelling have been used to help determine the potential visibility of the DCO Site from the wider landscape, as advocated in the Guidelines for Landscape and Visual Impact Assessment, 3rd Edition GLVIA3 (Ref 10-9). The extent of the study area has been informed by the ZTV and is based on initial findings of the desktop study, later verified on site during fieldwork surveys. This includes desk-based reviews of published landscape character assessments and the wider landscape setting to determine the area which the DCO Site may influence. This also includes consideration of other related environmental aspects, including biodiversity where relevant to informing landscape character, including designated Schemes and notable species and habitats. Examples in the local landscape include the Gate Burton Ancient Woodland, other large stands of ancient woodland and the River Trent floodplain.
- 10.5.2 A study area radius of 3km has been determined from the boundary of the Solar and Energy Storage Park and the Grid Connection Route corridor for the assessment of landscape and visual effects. This study area has been selected with reference to the ZTV submitted with the Scoping Report, which provided an indication of the likely visibility of the Scheme across the surrounding landscape. Initial fieldwork suggests that beyond 3km there are not likely to be significant landscape or visual effects. Further fieldwork will be undertaken to validate the 3km radius and refine the study area, if necessary, as the design evolves. The study area is presented on **PEI Report Volume 2: Figure 10-1** with reference to the bare earth and screened (barrier) ZTVs at this scale and shown also on **PEI Report Volume 2: Figure 10-9** and **Figure 10-10**.

Grid Connection Route

10.5.3 The Grid Connection Route has been included in the 3km study area as shown on **PEI Report Volume 2: Figure 10-1**.



Wider study area

10.5.4 A specific designated viewpoint, Tillbridge Lane Viewpoint, is located approximately 9.5km southeast of the DCO Site boundary providing panoramic views across the landscape to the west. This and another elevated viewpoint along the B1398 Middle Street near Ingham have also been considered outside of the study area and within 10km from the DCO Site boundary. Assets at that distance may be considered, where identified as necessary by the professional judgement or consultees, in order to determine the significance of landscape and visual effects at that distance.

10.6 Assessment Methodology

Sources of Information

- 10.6.1 The following sources inform the scope and content of this chapter:
 - Published and unpublished literature (including a detailed review of reports for previous fieldwork carried out within the proximity to the DCO Site boundary);
 - Available aerial photography; and
 - Local Planning Authority Plans, Guidance and Lists.

Impact Assessment Methodology

- 10.6.2 The landscape and visual assessment methodology is set out in full in **PEI Report Volume 3: Appendix 10-B**. This includes the methodology for the ZTVs and the verifiable views (existing baseline situation).
- 10.6.3 The methodology for the LVIA has been developed with reference to the following sources:
 - Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (GLVIA3), (Ref 10-9);
 - Landscape Institute Technical Guidance Note 06/19: Visual Representation of Development Proposals, (Ref 10-11);
 - An Approach to Landscape Character Assessment, (Ref 10-12);
 - Landscape Institute Technical Guidance Note 04/20: Infrastructure, (Ref 10-13);
 - Landscape Institute Technical Information Note 01/17: Tranquillity, (Ref 10-14);
 - Landscape Institute Technical Guidance Note 02/19: Residential Visual Amenity Assessment, (Ref 10-15);
 - Landscape Institute. (Revised 2018): Townscape Character Assessment, Technical Information Note 05/2017 (Ref 10-16);
 - Landscape Institute Technical Guidance Note 02/21: Assessing landscape value outside national designations, (Ref 10-17); and
 - Council of Europe Landscape Convention, 2000 (Ref 10-35).
- 10.6.4 The landscape assessment identifies the existing physical fabric or individual features of the landscape, including patterns of land use, land cover and aesthetic and perceptual qualities. The landscape baseline identifies



landscape character areas defined in published landscape character assessments from the national to district scales. Where necessary local landscape character areas will be defined to add further detail to the published studies. These landscape receptors have been assessed in terms of their landscape value and susceptibility to change (based on the criteria presented in **PEI Report Volume 3: Appendix 10-B**) to determine their sensitivity to the DCO Site. Landscape receptor sensitivity is defined as either very high, high, medium, low or very low, by combining judgements on landscape value and susceptibility to change.

- 10.6.5 The visual assessment relates to the potential changes to existing views of identified visual receptors e.g., residents, PRoW users or motorists, as a result of the addition or loss of features to their existing view. The visual receptors have been identified through interrogation of the ZTV and fieldwork. The value attached to the view and their susceptibility to change (as set out in **PEI Report Volume 3: Appendix 10-D** has been assessed to determine their sensitivity to the DCO Site. Visual receptor sensitivity is defined as either very high, high, medium, low or very low, by combining judgements on the value attached to views and susceptibility to change.
- 10.6.6 The visual assessment presented in the ES will be supported by photomontages of the DCO Site to assist in describing its effects. The methodology for the preparation of photomontages is derived from the Landscape Institute's Technical Guidance Note (TGN) 06/19: Visual Representation of Development Proposals, 2019 (Ref 10-11).
- 10.6.7 The magnitude of effect (change) resulting from the DCO Site is assessed in relation to each receptor for each assessment phase (i.e. construction, operation year 1 and year 15 and decommissioning). The magnitude of impact considers the size and scale, duration and reversibility of the effect and is determined upon a scale of high, medium, low, very low and none. In addition, consideration will be given to the conclusions of the Glint & Glare Assessment as the EIA progresses.
- 10.6.8 In accordance with GLVIA 3, the construction phase assessment considers the construction activities and the location of construction equipment, access and hauls routes; the type of machinery being used and the position and scale and working areas. The construction phase is assessed at winter when existing deciduous vegetation is not in leaf to soften or screen views and therefore represents a worst-case assessment scenario.
- 10.6.9 The year 1 of opening assessment considers the location, scale and design of the DCO Site structures, access and traffic, changes in land use and planting, as set out above in the assumptions section. In accordance with GLVIA 3, the year 1 opening assessment is undertaken at winter, to represent a worst-case assessment scenario.
- 10.6.10 The year 15 post opening assessment is based on the same parameters as the year 1 assessment, but with the establishment of the proposed planting and in summer, to reflect the seasonal change. This assumes that the planting is taller, and vegetation is in leaf (as set out in the assumptions



- section) and is in accordance with GLVIA 3. As such, the DCO Site may be less visible, due to softening or screening of views.
- 10.6.11 The decommissioning phase of the DCO Site is based on all structures (i.e. solar panels, solar stations) being removed and the proposed landscape planting remaining. The assessment is undertaken in winter and therefore represents a worst-case assessment scenario.
- 10.6.12 For all of the above phases, the relationship between the sensitivity of the receptor and the magnitude of impact have been combined to determine the significance of effect for each receptor.
- 10.6.13 Table 10-2 is used as a guide to inform judgements on the significance of effect. This judgement process and terminology is specific to LVIA and therefore differs from the methodology of other ES topics.

Table 10-2 Guide to the Landscape and Visual Significance of Effect

Sensitivity or value of resource/receptor	Magnitude of Effect				
	High	Medium	Low	Very Low	None
Very High	Major	Major or Moderate	Moderate or Minor	Minor or Negligible	Neutral
High	Major or Moderate	Moderate	Moderate or Minor	Minor or Negligible	Neutral
Medium	Major or Moderate	Moderate or Minor	Minor or Negligible	Negligible	Neutral
Low	Moderate or Minor	Minor	Minor or Negligible	Negligible	Neutral
Very Low	Minor	Minor or Negligible	Negligible	Negligible	Neutral

- 10.6.14 With reference to the above table, major and moderate effects are considered 'significant'. Effects of minor, negligible and neutral are considered 'not significant'.
- 10.6.15 Where the above table allows for two levels of significance (e.g., major / moderate or minor / negligible) professional judgement has been used on a case by case basis to determine the appropriate level of significance.
- 10.6.16 Where professional judgement considers that the assessment of significance of effect should differ from the guide in the table, then a reasoned justification is provided in the assessment narrative.

Relationship to Residential Amenity Visual Assessment

10.6.17 The LVIA assesses the potential visual effects to different types of visual receptors including residential receptors. This assessment refers to representative viewpoints located within the study area that have been subject to consultation with Lincolnshire and Nottinghamshire County Council.



- 10.6.18 With reference to the Landscape Institute's Technical Guidance Note 02/19: 'Residential Visual Amenity Assessment' (RVAA) (Ref 10-15), the Residential Visual Amenity Threshold is considered to be whether: "the effect of the development on Residential Visual Amenity is of such nature and / or magnitude that it potentially affects 'living conditions' or Residential Amenity."
- 10.6.19 The RVAA guidance is based upon a 'four' stage approach. Stages 1 to 3 accord with the methodology for the LVIA set out above, whereby, in line with GLVIA 3, visual receptors are identified, along with the magnitude of impact and the significance of effect after mitigation has been considered.
- 10.6.20 The fourth step is a more detailed examination of views from residential properties, where appropriate, when the highest 'significance of effect' levels are identified via stages 1 to 3. Although, as stated by the guidance, there are no 'hard and fast rules' as to making a judgement on whether the residential amenity threshold has been breached.

10.7 Baseline Conditions

Existing Baseline

10.7.1 This section describes the baseline characteristics for the DCO Site and the study area. Baseline information on topography and hydrology, vegetation patterns, settlement and land use, movement and connectivity, tranquillity and designations are presented in **PEI Report Volume 3: Appendix 10-C**.

Study area

- 10.7.2 The DCO Scheme is located within the District Council administrative areas of West Lindsey in Lincolnshire and Bassetlaw in Nottinghamshire. **Chapter 2: The Scheme** provides a description of the DCO Scheme and its surroundings, which mainly consists of agricultural fields under arable production, interspersed with individual trees, hedgerows, tree belts (linear), small woodland blocks and farm access tracks. Several small rural villages are located adjacent or within the vicinity of the DCO Site. These include:
 - Gate Burton approximately 50m to the west;
 - Knaith approximately 200m to the west;
 - Marton approximately 500m to the south west; and
 - Willingham by Stow 700m to the east and Kexby 1.8km to the east.
- 10.7.3 Gate Burton Estate is located adjacent to the west of the Solar and Energy Storage Park. Apart from large farms, there are limited industrial or commercial land uses within the immediate vicinity of the DCO Site.
- 10.7.4 The town of Gainsborough is located outside of the study area approximately 4km north of the DCO Site. The western section of the study area includes 400kV overhead transmission line infrastructure extending from Cottam Substation. Some of these structures are located within the Grid Connection Route.



Landform and hydrology

- 10.7.5 Gate Burton Estate and the western section of the Solar and Energy Storage Park is located on a ridgeline, which runs in a north-south direction through the study area and along the eastern side of the River Trent. The majority of the DCO Site is located within a gently undulating landform, which becomes flatter to the east.
- 10.7.6 The topography of the study area is generally flat. The elevation ranges from 30m above ordnance datum (AOD) to <10m AOD (Ref 10-21). The topographical highs (~30m AOD) are found within the north of the study area (north of Knaith Park) and the topographical lows are associated with the River Trent waterbody and its floodplain, resulting in a gentle slope from north-east to south-west across the DCO Site boundary. Land rises very gently away from the River Trent on its western bank along the Grid Connection Route, with the majority of the study area on this western side of the river being <10m AOD.
- 10.7.7 Land to the west of the ridgeline is sloping quickly to the River Trent. The topography west of the River Trent is a flat or very gently undulating floodplain. The River Trent forms the boundary between Lincolnshire to the east and Nottinghamshire to the west.

Land use and settlement

- 10.7.8 The land use within the study area is generally a mosaic of arable farmland and, with patches of woodland, drains and ponds scattered across the area. The River Trent bisects the study area, with the Solar and Energy Storage Park located east of this river. There is a large, decommissioned power station (Cottam Power Station) adjacent to the southern extent of the Grid Connection Route, next to Cottam Substation, which is the proposed connection point to the National Grid. The study area also includes several small villages such as Gate Burton, Willingham by Stow, and Knaith Park. The A156 (Gainsborough Road) runs almost parallel to the River Trent waterbody through the study area, and a railway line passes across the Solar and Energy Storage Park in an approximately north-south orientation. Lincoln Golf Course lies within the study area to the southeast of the DCO Scheme.
- 10.7.9 The influence of the River Trent is strong within the western and southern part of the study area including the large power stations of West Burton and Cottam, which are both prominent features in the skyline and can become dominating in views when travelling within the floodplains of the River Trent. The powers stations are a feature in available views within the study area and beyond. The power stations add a significant industrial component into the existing landscape character, which is otherwise rural.
- 10.7.10 Although settlement within the study area consists of the main town of Gainsborough north, with the southern extent of the town located to the very north of the study area, a number of small villages, hamlets and individual properties are clustered throughout the study area. Overall, the study area is sparsely populated. There are a number of settlements, which are all generally small and embedded in an agricultural landscape, which reinforces the appearance of a sparingly inhabited landscape. The settlements of



Sturton-le-Steeple, North Leverton with Habblesthorpe and South Leverton form a line parallel to the west of the River Trent, occupying a localised and indistinct ridge of higher ground. To the east of the River Trent, Lea and Knaith as well as Gate Burton Estate occupy the more wooded section of the north-western study area. The small villages of Marton and Brampton, located in the southern section of the study area, are situated on lower land which is part of the River Trent floodplains. As the land rises up from the floodplains of the River Trent to the east, settlements include Sturton by Stow, Normanby by Stow, Willingham by Stow, Kexby and Upton. Apart from these villages there are a number of smaller hamlets and individual farmsteads interspersed between these settlements. The villages are small and long established, and several include historic elements of note such as manor houses, scheduled monuments and windmills.

10.7.11 The agricultural landscape extends further east and includes the quickly rising topography between the villages of Hemswell in the north and Burton (north of Lincoln) in the south. A number of other villages are located along the foothills of this ridge including Scampton, Aisthorpe, Brattleby, Cammeringham, Ingham and Fillingham. The airbase of RAF Scampton is a prominent and distinct feature, with overflying aircraft a feature within this otherwise rural landscape.

Movement and connectivity

- 10.7.12 The main road network includes the A156, which traverses the western part of the study area in a north-south alignment. The A1500 crosses the southern part of the study area in a northwest-southeast alignment. The B1241 traverses the eastern and northern section of the study area.
- 10.7.13 There is also a network of roads that connect small hamlets and villages. Other infrastructure within the study area includes the Sheffield to Lincoln railway line which runs in a north/north-western south/south-eastern alignment through the centre of the study area. A number of high voltage overhead transmission lines, which are associated with the West Burton and Cottam Power Stations, are located west of the River Trent.
- 10.7.14 The location of PRoW within the study area is mapped in **PEI Report Volume**2: Figure 10-3. The majority of PRoW within the study area are located west of the River Trent, between the River Trent and in and around the villages of Sturton le Steeple, North Leverton with Habblesthorpe, South Leverton, Treswell, Rampton and Woodbeck.
- 10.7.15 PRoWs within the southern section of the study area are located in and around the villages of Laneham, Torksey, Brampton and Cottam.
- 10.7.16 PRoW within the eastern section of the study area are located in and around of the villages of Sturton by Stow, Stow, Willingham by Stow and Kexby.
- 10.7.17 PRoW within the northern section of the study area are located in and around of the villages Upton and Lea, which includes the southern catchment area of Gainsborough.



10.7.18 The following PRoW are located along the Solar and Energy Storage Park boundary or within or along the Grid Connection Route:

PRoW along Solar and Energy Storage Park boundary:

- LL|Knai|44/2 (footpath) between Station Road / Knaith Hill (west) and the Sheffield to Lincoln railway line (east) along the northern boundary of Park Plantation. It connects to LL|Knai|44/1 east of the railway line, which ends at Kexby Lane; and
- LL|Upto/53/1 (footpath) borders for approximately 350m along a section of the northern Scheme boundary between Upton Road in the west and High Street / Upton Road in the east, south of Upton.

PRoW within or along the Grid Connection Route:

- LL|Mton|69/1 (footpath), northeast of Marton connecting Willingham Road to Stow Park Road. Approximately 220m of the northern section of this PRoW is located along the Grid Connection Route;
- LL|Mton|68/1 (footpath) south of Marton connecting High Street to Stow Park Road. Approximately 670m are located within or along the Grid Connection Route of the Grid Connection Route;
- LL|Bram|66/1 (footpath) south of Trent Port connection between Trent Port Road and the A156 (High Street). Approximately 720m are located within the Grid Connection Route:
- NT|Cottam|FP1 (footpath) which runs along the River Trent and forms part of a wider footpath network. Approximately 1.3km are located within the Grid Connection Route;
- NT|Treswell|FP1 (footpath) which runs along the River Trent connecting south to NT|Cottam|FP1. Approximately 330m are located within the Grid Connection Route;
- NT|Cottam|BW7 (bridleway) connecting between NT|Treswell|FP1 along the River Trent to NT|Treswell|BW21 (bridleway) to the west. Approximately 210m are located within the Grid Connection Route;
- NT|Treswell|BW6 (bridleway) connecting between NT|Treswell|FP1 along the River Trent to NT|Treswell|BW18 to the west. Approximately 250m are located within the Grid Connection Route;
- NT|Cottam|FP3 (footpath) connecting Headstead Bank (west) to NT|Cottam|FP1 (east). All of this footpath (approx. 1.1km) is located within the Grid Connection Route;
- NT|Cottam|RB4 (restricted byway) connecting Broad Land (north) to Overcoat Lane (south). Approximately 530m are located within the Grid Connection Route;
- NT|Cottam|RB6 (restricted byway), along Overcoat Lane (starting east at Town Street), is located along the Grid Connection Route for approximately 180m;
- NT|South Leverton|BOAT16 (Byway Open to All Traffic) is located from approximately 650m along Cow Pasture Lane within the Grid Connection Route. Approximately 130m are located along the boundary of the Grid Connection Route and crossed a railway line servicing the nearby Cottam Power Station;



- NT|Treswell|FP4 (footpath) connecting between Torksey Ferry Road at the eastern edge of Rampton and NT|Treswell|FP5 at the western boundary of Cottam Power Station. Approximately 1.1km are located within the Grid Connection Route;
- NT|Treswell|FP5 (footpath) and NT|Treswell|FP6 (footpath) are connected to each other and run along the western boundary of Cottam Power Station and within the Grid Connection Route for approximately 790m. Approximately 330m of NT|Treswell|FP5 run along the boundary of the Grid Connection Route;
- NT|Rampton|BOAT13 (Byway Open to All Traffic), along Torksey Ferry Road, is located south of Cottom Power Station. Approximately 1.6km are located within the Grid Connection Route;
- NT|Rampton|FP20 (footpath) extends south from Torksey Ferry Road for approximately 240m within the Grid Connection Route; and
- NT|Rampton|BOAT12 (Byway Open to All Traffic) extends south from Torksey Ferry Road for approximately 160m along Shortleys Road within the Grid Connection Route.

Tranquillity

- 10.7.19 Within the study area there are pockets designated as 'Most Tranquil' in accordance with the CPRE tranquillity mapping. At a more Scheme specific level, tranquillity increases eastwards across the DCO Site due to the reduction of pylons and views of the power stations located in the west. The large fields boundaries provide a sense of quintessential countryside.
- 10.7.20 However, there is not a sense of remoteness or wildness across the DCO Site due to settlements or farms, pylons, the prominence of power stations with large cooling towers and chimneys, vehicles on roads and lanes as well as due to the noise created by overflying Royal Air Force aircraft belonging to the nearby Scampton RAF base.

Vegetation patterns

- 10.7.21 There are five areas of ancient woodland identified within 2km of the DCO Scheme which are presented in **PEI Report Volume 2: Figure 8-2**. These are:
 - Burton Wood within DCO Scheme;
 - Stag Wood approximately 190m to the north of the DCO Scheme;
 - Thurlby/Castors Wood approximately 825m to the north of the DCO Scheme;
 - An unnamed ancient woodland, approximately 1.9km to the north of the DCO Scheme; and
 - Lea Wood approximately 1.9km to the north of the DCO Scheme.
- 10.7.22 Overall, the vegetation patterns within the DCO Site are representative of those across the study area, consisting of woodlands, hedgerows and trees, as well as open field patterns.
- 10.7.23 The River Trent valley is well vegetated, being bordered by narrow belts of riverside trees. The edges of roads and lanes across the study area are



generally well vegetated and enclosed, either by hedgerows, scrub or individual trees.

Landscape Designations

- 10.7.24 Neither the study area, nor the DCO Site boundary is covered by any national landscape designations, i.e. National Parks or Areas of Outstanding Natural Beauty (AONB).
- 10.7.25 West Lindsey District Council has designated several Areas of Great Landscape Value which are present within the study area which has been summarised in **PEI Report Volume 3: Appendix 10-A** and shown on **PEI Report Volume 2: Figure 10-8**. It is cited within the West Lindsey Local Plan that; "Areas of Great Landscape Value are felt to be of distinctive value to the character of the District as a whole and development that may impact on their character will detrimentally affect the overall character of West Lindsey. These AGLVs follow landscape features which run through towns and villages, therefore the AGLV designation washes over those settlements."
- 10.7.26 The villages retain their essential historic character and include listed buildings and conservation areas, which can be found summarised in Chapter 7: Cultural Heritage. There are several ancient woodlands within the study area, including the Gate Burton Ancient Woodland which is located within the DCO Site boundary.

Published landscape character assessments

- 10.7.27 The study area is covered by published landscape character assessments and related studies at national, regional, county, and district levels. These studies have been reviewed to provide context and to inform the definition of landscape receptors, against which the effects of the DCO Site will be assessed.
- 10.7.28 Local planning authorities use published landscape character assessments as part of their planning policy evidence base and the published assessments often provide specific guidance or recommendations on managing landscape change.
- 10.7.29 The following section summarises the relevant landscape character assessments that cover the study area. Detailed descriptions of the landscape character areas (LCA) defined in these studies are provided in **PEI Report Volume 3: Appendix 10-C.**

National Level Published Landscape Character Assessments

10.7.30 National Character Areas (NCA) have been defined and described by Natural England. These are broad scale and provide context to more detailed studies of local landscape character and effects on these NCA will not therefore be assessed in the LVIA.



National Character Area 48: Trent and Belvoir Vales (2013)

- 10.7.31 With reference to **PEI Report Volume 2: Figure 10-4**, NCA 48 covers the entirety of the study area.
- 10.7.32 The key characteristics of NCA 48 are summarised as a gently undulating and low-lying landform in the main, with low ridges dividing shallow, broad river valleys, vales and flood plains. Vegetation across the NCA is characterised as a regular pattern of medium to large fields enclosed by hawthorn hedgerows, and ditches in low-lying areas, which dominates the landscape.
- 10.7.33 The NCA Profile notes that "A predominantly rural and sparsely settled area with small villages and dispersed farms linked by quiet lanes, contrasting with the busy market towns of Newark and Grantham, the cities of Nottingham and Lincoln, the major roads connecting them and the cross-country dual carriageways of the A1 and A46" and that "Immense coal-fired power stations in the north exert a visual influence over a wide area, not just because of their structures but also the plumes that rise from them and the pylons and power lines that are linked to them. The same applies to the gas-fired power station and sugar beet factory near Newark, albeit on a slightly smaller scale."
- 10.7.34 The published study includes the following relevant Statements of Environmental Opportunity (SEO), including:
 - SEO 1 "Maximise the use of sustainable agricultural practices that protect and enhance ecological networks in order to help safeguard the long-term viability of farming in the area while benefiting biodiversity, landscape character, carbon storage as well as water quality, availability and flow..."
 - SEO 2 "Enhance the woodland and hedgerow network through the planting of small woodlands, tree belts, hedgerow trees and new hedgerows to benefit landscape character, habitat connectivity and a range of ecosystem services, including the regulation of soil erosion, water quality and flow..."
 - SEO 4 "Maintain and enhance the character of this gently undulating rural landscape. Promote and carefully manage the many distinctive elements that contribute to the overarching sense of place and history of the Trent and Belvoir Vales."

Regional Level Published Landscape Character Assessments

10.7.35 The Regional Level Published Landscape Character Assessments are broad scale and provide context to more detailed studies of local landscape character and effects on these LCA's will not therefore be assessed in the

East Midlands Regional Landscape Character Assessment (2009)

10.7.36 The East Midlands Regional Landscape Character Areas includes the administrative counties of Derbyshire, Leicestershire, Lincolnshire, Northamptonshire, Nottinghamshire and Rutland, 30 district and borough



authorities and the unitary authorities of Derby, Leicester and Nottingham. The assessment identifies a variety of Landscape Character Types (LCT), including limestone and chalk hills, ancient, forested hills, productive rolling farmlands interspersed with rural villages, remote lowland heaths and areas noted for their rich mining heritage. The following LCTs are within the study area

Group 3A: Floodplain Valleys

10.7.37 This is a landscape with deep alluvium and gravel deposits mask underlying bedrock geology to create wide, flat alluvial floodplains surrounded by rising landform of adjacent Landscape Character Types. There is limited woodland cover; however, steep riverside bluffs and areas close to settlement or on former gravel extraction Schemes are notable for a higher level of woodland cover. Hedgerow and riverside trees are also important components of landscape. Alder, Willow and Poplar are typical riverside trees.

Group 4A: Unwooded Vales

10.7.38 These are extensive, low lying rural landscapes underlain by Triassic and Jurassic mudstones and clays and widespread superficial deposits. Expansive long distance and panoramic views from higher ground at the margin of the vales gives a sense of visual containment. Limited woodland cover; shelter belts and hedgerow trees gain greater visual significance and habitat value as a result.

Group 4B: Wooded Vales

10.7.39 Gently undulating landform formed over soft mudstone and clay geology, sharing many characteristics with the wider Unwooded Vales Landscape Character Type. Low hills and ridges gain visual prominence; elevated landform fringing vales give broad sense of containment. Sparsely settled with small villages and dispersed farms linked by quiet rural winding lanes often flanked by tall hedgerows and tree belts.

County Published Landscape Character Assessments Nottinghamshire County Landscape Character Assessment

- 10.7.40 The Nottinghamshire County Landscape Character Assessment describes the landscape character areas of Nottinghamshire.
- 10.7.41 Within each County Character Area, Landscape Description Units (LDU) are defined and further subdivided into manageable survey units known as Landscape Character Parcels (LCPs). Each LCP is assessed in terms of its individual landscape character in accordance with the methodology.
- 10.7.42 The study boundary of the DCO Site traverses the Trent Washlands Landscape Character Area (LCA), this LCA has been subdivided into 30 Landscape Description Units (LDUs) as shown in **PEI Report Volume 2: Figure 10-6**. These LDUs were then subdivided into 34 Landscape Character Parcels (LCPs) as shown on **PEI Report Volume 2:** Figure 10-6.
- 10.7.59 The following LCUs & LCP's are found within the Trent Washlands LCA:



- River Meadowlands LCT;
- TW30 LCP;
- TW31 LCP;
- TW32 LCP; and
- TW33 LCP.

LCA: Trent Washlands

- 10.7.43 The Trent Washlands is principally formed from the broad valleys of the River Trent. The region is defined by alluvial and river terrace drift deposits and occupies around 10 % of the County. The Trent flows in a great arc through a number of counties including Staffordshire, Derbyshire and Nottinghamshire before eventually discharging into the North Sea, via the Humber.
- 10.7.44 As previously mentioned, The Trent Washlands Regional Character Area has been divided by the desk-based character assessment into 30 Landscape Description Units. These units fall into two distinct landscape types: Village Farmlands and River Meadowlands. The study boundary traverses the River Meadowlands landscape character type which is summarised below.

River Meadowlands LCT

10.7.45 These landscapes are located on flat, low-lying alluvial floodplains within the Trent river valleys, and the lower reach of the Devon. Few buildings are found in these sparsely settled landscapes because of the risk of inundation by flood waters. The River Meadowlands are characterised by areas of alluvial meadow and riverside pasture, flood meadows, extensive common grasslands, meandering river channels and steep wooded bluffs. The character and unity of the river corridors have broken down in recent decades, largely as a result of flood protection works which have allowed the arable conversion of large tracts of alluvial meadowland. Significant areas of intact river corridor have survived along various sections of the Trent.

Landscape Character Parcel TW30

10.7.46 This is a predominantly large-scale arable landscape. Small scale pastoral landscape around Cottam, Rampton and Church Laneham. Views dominated by power stations and pylons. Well-trimmed mature hedgerows to internal field boundaries, with trees. Landscape Condition is defined as good. There is a coherent pattern of landscape elements with few detracting features within the PZ, the detractors include power lines and freight traffic on mineral lines. Overall, this gives a visually unified area.

Landscape Character Parcel TW31

10.7.47 This is a flat landscape composed of arable fields to the west and pasture fields along the course of the River Trent and to the south. Views are dominated by Cottam power station. Mature trees are confined to the riverside and wetland areas and the hedgerows of pasture fields in particular. Areas of scrub and aquatic vegetation close to the river. There are long



distance views along the River Trent to the North and South, views are bounded by elevated wooded ridgelines to the east.

Landscape Character Parcel TW32

10.7.48 This is a flat landscape less than 5m AOD. Views are dominated by West Burton and Cottam Power Stations to the north and South. Mature trees are limited and confined to small woodlands and field access tracks. The PZ is largely uninhabited except for isolated properties. Field access track hedgerows are mature and of mixed species with mature trees. Roadside hedges and field boundaries are more fragmented and gappy.

Landscape Character Parcel TW33

10.7.49 This is a flat landscape composed of arable fields and permanent and improved pasture to the north and south. Views are dominated by West Burton power station. Mature trees are confined to the riverside and hedgerows to tracks, as well as Littleborough village. Areas of scrub and aquatic vegetation close to the river. There are long distance views to the north and south, views are bounded by elevated ridgelines to the east.

Table 10-3 County Landscape Character Areas

County Landscape Character Area	Value	Susceptibility to change	Sensitivity
River Meadowlands LCP	Medium	Medium	Medium
TW30	Low	Medium	Medium
TW31	Low	Low	Low
TW32	Low	Low	Low
TW33	Low	Low	Low

District Published Landscape Character Assessments

West Lindsey Landscape Character Assessment:

10.7.50 The study area of the DCO Site traverses a number of the Landscape Character Areas defined in the West Lindsey Landscape Character Assessment, which are summarised below.

Trent Valley

10.7.51 This area is primarily rural in character. The eastern edge is formed by the scarps of the Northern and Southern Cliff. The western edge of the area is formed by the River Trent in the north, and by the county boundary in the south. The entire area is characterised by nucleated settlements and isolated farmsteads. The nucleated settlements to the north of Lincoln are arranged in two distinct north-south lines: aligned along the eastern Trent bank and, to the east, along the line of the shallow ridge which leads up to the Northern Cliff scarp. The character of the nucleated settlements to the south of Lincoln fall into two distinct categories: those to the immediate west and south of



Lincoln are much more scattered, of smaller size and less frequent in nature than those to the north of Lincoln; those in the far south of the zone are larger in size and more frequent forming a crescent following the edge of the low lying ground through which the River Witham flows. Isolated farmsteads are found throughout the area, with equal distribution, but, due to the lower frequency of nucleated villages, appear more dominant in the central part of the area.

TVL1 - The Northern Cliff Foothills

10.7.52 The landscape of this zone is largely flat, with a gentle upward slope from the River Trent in the west to the foot of the Northern Cliff in the east. The level topography allows wide views of large features the landscape, especially the large power stations on the west bank of the Trent whose exhaust plumes can be seen across the zone. A line of settlements, aligned approximately north to south, runs through the middle of the zone from Messingham in the north to Sturton-by-Stow in the south. The settlements retain much of their historic character, with organic infill development on vacant plots and occasional large-scale modern development at their edges. There are also, scattered across the zone, several isolated farmsteads the majority of which have expanded significantly from their original size to include modern barns and animal pens.

Table 10-4 District Landscape Character Areas

District Landscape Character Area	Value	Susceptibility to change	Sensitivity	
Trent Valley LCA	Medium	Medium	Medium	

Local Landscape Character Areas (LLCAs)

- 10.7.53 The published landscape character assessments at the county and district level date from October 2021 and April 2022 respectively. The extent of published LCAs is large and the geographic areas which they cover is varied. Paragraph 5.16 of GLVIA 3 states that "even where there are useful and relevant existing Landscape Character Assessments and historic landscape characterisations, it is still likely that it will be necessary to carry out specific and more detailed surveys of the Scheme itself and perhaps its immediate setting or surroundings".
- 10.7.54 A local landscape character assessment has therefore been undertaken in preparation for the ES. This provides a current and more defined analysis of the landscape character within the study area, and in comparison to the published studies at a scale proportionate to the DCO Site and the likely significant effects.
- 10.7.55 The LLCAs have been identified based on the prevalent characteristics of the landscape informed by desk-study and based on the existing LCTs and LCAs defined in published assessments. The boundaries of these LLCAs may be further refined during summer fieldwork to inform the DCO application.



10.7.56 A baseline description of each LLCA is provided in **PEI Report Volume 3: Appendix 10-C.** The LLCAs identified, and their sensitivity, are listed in the table below.

Table 10-5 Local Landscape Character Areas

Local Landscape Character Area	Value	Susceptibility to change	Sensitivity
LLCA 01	High	Medium	Medium
LLCA 02	Medium	Medium	Medium
LLCA 03	Low	Low	Low
LLCA 04	Low	Medium	Medium
LLCA 05	Medium	Medium	Medium
LLCA 06	Low	Medium	Medium
LLCA 07	Low	Low	Low
LLCA 08	Low	Medium	Medium
LLCA 09	Low	Medium	Medium
LLCA 10	Low	Low	Low
LLCA 11	Medium	Medium	Medium
LLCA 12	Low	Low	Low
LLCA 13	Low	Low	Low

Visual baseline

Zone of Theoretical Visibility (ZTV) analysis

- 10.7.57 The assessment of visual effects is structured around the identification of visual receptors within the study area. The identification of visual receptors is a two-staged process, starting with the production of baseline mapping and preliminary ZTVs. This is followed by fieldwork to refine and ascertain the actual inter-visibility between the DCO Site and potential visual receptors.
- 10.7.58 **PEI Report Volume 2: Figure 10-9** and **PEI Report Volume 2: Figure 10-10** present initial bare earth and screened (barrier) ZTVs for the DCO Site. These were used to inform a selection of visual receptors with potential visibility of the DCO Site. The current viewpoint selection is shown in **PEI Report Volume 2: Figure 10-11** and **Figure 10-12**.

Visual receptors and representative viewpoints

- 10.7.59 Fieldwork was undertaken in January and February 2022 to verify the assessed visibility of the DCO Site. The ZTVs were subsequently updated to reflect design iterations.
- 10.7.60 Visual receptors likely to experience views of the construction, operation or decommissioning of the DCO Site were identified through interrogation of the ZTVs and fieldwork and subsequently categorised into the following types:
 - Residents;



- People travelling through the area on roads and public transport;
- Recreational users, including those visiting specific viewpoints;
- Visitors; and
- Employment and Institutional users.
- 10.7.61 With reference to **PEI Report Volume 2: Figure 10-11** and **Figure 10-12**, viewpoints have been identified as representative of views experienced by people within the study area. Viewpoints have been selected to demonstrate the experience of the receptor groups identified above and to show a variety of distances and orientation towards the DCO Site.
- 10.7.62 The locations of these viewpoints were presented to Lincolnshire County Council and Nottinghamshire County Council via an online presentation on 1st March 2022.
- 10.7.63 Nottinghamshire County Council responded stating that "No additional viewpoints are required within Nottinghamshire other than those presented at the meeting, we consider that the visual effects of the Park in Nottinghamshire are unlikely to be significant". However, it is noted that if the final layout and design of the on-Scheme substation and any potential off-Scheme substation option at Cottam may raise concern, additional viewpoints may be requested at a later stage.
- 10.7.64 Additional viewpoints recommended by Lincolnshire County Council are still subject to verification and photography on site. These additional viewpoints will be fully assessed as the Environmental Impact Assessment (EIA) progresses.
- 10.7.65 The following table sets out the receptor groups covered by the visual assessment:

Table 10-6 Visual receptors

Visual receptor groups

Typical description

Residents

There are a number of residents located either within, adjacent or within close proximity to the DCO Site boundary as follows:

Residences within the DCO Site boundary include:

- Clay Farm, including residential accommodation; and
- 2 terraces of houses south of Clay Lane along the A156 (Gainsborough Road)

Residences adjacent or in close proximity to the DCO Site boundary including the following:

• Northern section of the study area: Residences along the eastern and western boundaries of Knaith Park (within approximately 300m from the DCO Site boundary), Residences along the eastern extends of Knaith (adjacent to the DCO Site boundary), Park Farm North and Park Farm South (within approximately 150m from the DCO Site boundary), residents along sections of Station Road (adjacent to the DCO Site) and Kexby Lane (within approximately 50m from the DCO Site boundary), Stephenson's Hill Farm and Central Park Farm (both



Visual receptor groups

Typical description

adjacent to the DCO Site boundary), Residences along A156 / Gainsborough Road south of Knaith (adjacent to the DCO Site boundary) as well as Park Farm (adjacent to the DCO Site boundary).

- Eastern section of the study area: Residences at Willingham by Stow located west of Marton Road (within approximately 450m from the DCO Site boundary), Residences south of Willingham by Stow and north of Normanby by Stow along the western side of the B1241 (within approximately 650m from the DCO Site boundary), Sandebus Farm along Marton Road (adjacent to Scheme boundary), Residences along Willingham Road (adjacent to Scheme boundary) and Sort Hills Farm (within approximately 200m from the DCO Site boundary) as well as Marton Grange along the A1500 / Stow Park Road (adjacent to the DCO Site).
- Southern section of the study area: Residences north of Brampton (adjacent to the DCO Site) including residences along the A156 / Brampton Lane (within approximately 150m from the DCO Site boundary), Residences at Cottam village (within approximately 250m from the DCO Site boundary), Residences along the eastern edge of Rampton (within approximately 300m from the DCO Site boundary), Residences south of Marton along the A156 / High Street (adjacent to the DCO Site boundary), Brampton Grange and Rectory Farm (adjacent to the DCO Site boundary).
- Western section of the study area: Residences along Westbrecks
 Lane and Cow Pasture Lane (within approximately 200m from the
 DCO Site boundary), Residences along Coates Road close to the
 River Trent (within approximately 300m from the DCO Site boundary),
 Residences along the southern and eastern edge of Marton (adjacent
 to the DCO Site boundary), Residences at Gate Burton / Gate Burton
 Hall (adjacent to the DCO Site boundary).

A number of **residences in the wider study area** in villages, farms, hamlets and small clusters of residences including the following (incl. approximate distances):

- Northern section of the study area: Upton (1.6km), Lea (1.6km) and the southern catchment area of Gainsborough north of Lea (3.4km).
- Eastern section of the study area: Sturton by Stow (3.2km), Stow (1.6km), Normanby by Stow (1km) and Kexby (1.5km)
- Southern section of the study area: Stow Park, Torksey (700m), Torksey Lock (1.8km), Laneham (2km), Stokeham (2.4km) and Woodbeck (2.7km).
- Western section of the study area: Treswell (1.9km), South Leverton (2km), North Leverton with Habblesthorpe (2.5km) and Littleborough (1.4km).

The settlements of Sturton-le-Steeple (outside of the study area, distance to Scheme boundary approximately 3.8km), North Leverton with Habblesthorpe and South Leverton form a line parallel to the Trent, occupying a localised and indistinct ridge of higher ground.

The villages are long established, and several include historic elements of note such as manor houses, scheduled monuments and windmills. Individual farmsteads are located interspersed between these settlements.



Visual receptor groups

Typical description

People travelling on roads and public transport

The main road network along which visual receptors travel includes the following:

- The A156, which traverses the western part of the study area in a north-south alignment.
- The A1500 which crosses the southern part of the study area in a northwest-southeast alignment.
- The B1241 which traverses the eastern and northern section of the study area.

There is also a network of lanes and local roads that connect small hamlets and villages along which visual receptors will travel.

The Sheffield to Lincoln railway line runs in a north/north-western – south/south-eastern

alignment through the centre of the study area. Visual receptors on trains will experience transient views within the study area.

Recreational users

The majority of recreational users will use access to PRoW as described and listed in further detail in the 'Existing Baseline' above. The majority of these walk and bridleways are located west of the River Trent and outside the study area. A number of PRoW are located east and north of the DCO Site in the vicinity of the villages of Sturton by Stow, Stow, Willingham by Stow, Kexby, Upton and Lea.

Further recreational users will be members of Lincoln Golf Club between Torksey and Brampton.

Recreational users of caravan facilities around Torksey Lock

Visitors

Visitors to the area include visitors to the Tillbridge Lane Viewpoint, south of Scampton.

Visitors of Sundown Adventureland east of Treswell.

10.7.66 GLVIA 3 (Ref 10-9) distinguishes between different types of viewpoints as follows:

- "Representative viewpoints, selected to represent the experience of different types of visual receptor, where larger numbers of viewpoints cannot all be included individually and where significant effects are unlikely to differ".
- "Specific viewpoints, chosen because they are key and sometimes promoted viewpoints within the landscape..., viewpoints in areas of particularly noteworthy visual and/or recreational amenity..., or viewpoints with particular cultural landscape associations".
- "Illustrative viewpoints, chosen specifically to demonstrate a particular effect or specific issues".
- 10.7.67 A total of 43 viewpoints have been identified to date to represent the views of the visual receptors described above. The locations of the proposed 43 viewpoints selected are shown on **PEI Report Volume 2: Figure 10-11** and **Figure 10-12**. A description of the existing baseline for 29 of these viewpoints are presented in **PEI Report Volume 3: Appendix 10-D** The remaining 14 (Viewpoints A I) will be added As the EIA progresses as explained above.



- 10.7.68 A description of the baseline and sensitivity of these viewpoints as well as the identification of what receptor groups these viewpoints represent is included in **PEI Report Volume 3: Appendix 10-D**.
- 10.7.69 A booklet with existing viewpoint photography (Winter 2022) is located in **PEI Report Volume 3: Appendix 10-F** illustrating views from 29 viewpoints. The remaining photography for Viewpoints A-I will follow as the EIA progresses once the exact location and orientation has been confirmed on site.
- 10.7.70 The locations of the proposed viewpoints have also been established with regard to public accessibility, the number and sensitivity of viewers who may be affected, the viewing direction, distance and elevation, the nature of the viewing experience and the view type.
- 10.7.71 With regard to the nature of the viewing experience, GLVIA 3 notes the difference between "static" (e.g., residents at home) and "sequential" views (e.g., views from a road or PRoW), which will be set out as the EIA progresses for all viewpoints.
- 10.7.72 The potential for cumulative visual effects has been considered as far as reasonably practicable at this stage in the selection of viewpoints.

Summary of the visual baseline

10.7.73 This section provides a summary of the winter visual context across the study in relation to the DCO Site and should be read in combination with **PEI Report Volume 3: Appendix 10-D**, which provides a description of the view from each viewpoint. Supporting existing winter photography is presented in **PEI Report Volume 3: Appendix 10-F**.

West of the DCO Site

- 10.7.74 Views of the DCO Site from within the valley west of the River Trent are typically screened by a ridgeline (with a north south alignment) east of the River Trent and located between the observer and the DCO Site. Views of the cooling towers and chimneys at West Burton and Cottam power stations are prominent features in most views.
- 10.7.75 Viewpoint 14 will illustrate the potential visibility of the DCO Site in this section of the study area. It is not anticipated that the DCO Site will become visible in this view due to intervening mature vegetation.
- 10.7.76 Settlements in proximity of the River Trent such as Littleborough and Coates are screened by the landform as illustrated by Viewpoints 14, 21, 22, and 23. Further west across the Trent Vale settlements such as South Leverton, North Leverton with Habblesthorpe, Sturton le Steeple have no visibility of the DCO Site. Lines of overhead pylons crossing from north to south are prominent in the view in the direction of the DCO Site.
- 10.7.77 Towards the western edge, the landform rises with an escarpment running north/south with the broad ridge separating the Trent Vale from the remainder of Nottinghamshire. Higher elevations at settlements such as Nether Headon, Grove, Little Gringley, Clarborough, and Hayton can have open, long-distance views from their eastern extents if not curtailed by undulating



- landform. The power stations at West Burton and Cottam are prominent in available views. The DCO Site will be barely perceptible in the background of the view.
- 10.7.78 Close range views of the DCO Site from the west are represented by viewpoint 13. The rising landform between the A156 and the DCO Site heavily screens views such that it is barely perceptible.
- 10.7.79 Gate Burton and Knaith are located on elevated or rising ground above the River Trent. Viewpoints 3, 15 and 16 will illustrate the DCO Site in the vicinity of Gate Burton Estate.

North of the DCO Site

- 10.7.80 The settlement of Knaith Park is located between the 2 northern sections of the DCO Site. Viewpoint 11 will illustrate a view from the eastern boundary of Knaith Park.
- 10.7.81 Viewpoint 12 will show a view from Station Road adjacent to the DCO Site boundary.
- 10.7.82 Viewpoint 10 will illustrate a view from Kexby Lane adjacent to residential properties located along this road.
- 10.7.83 Public footpath PRoW (Knai/44/2) runs adjacent to the DCO Site boundary. Views are heavily screened to one side by the mature woodland (Park Plantation). To the other side, views will afford immediate views of panels. An additional viewpoint along this PRoW is planned as the EIA progresses as a response to a request from Lincolnshire County Council.
- 10.7.84 Further north, views of the DCO Site will be experienced from Upton Lane. PRoW Upto/53/1 runs parallel and adjacent to part of the northern boundary of the DCO Site. Views into the DCO Site from this PRoW are partially filtered by hedgerow vegetation and intermittent trees along the path boundary. However, due to the proximity of the DCO Site it will be a noticeable element within the view south. Additional viewpoints from these locations are subject to verification on site and will be included as the Environmental Impact Assessment (EIA) progresses.
- 10.7.85 Settlements in this area are becoming sparse. Views will be screened quickly by intervening vegetation and landform, particularly when reaching the village of Lea close to the northern boundary of the study area.
- 10.7.86 The section of railway line running to the north of the DCO Site has limited views due to multiple cuttings and vegetation flanking both sides of the railway line corridor.

East of the DCO Site

10.7.87 Views toward the eastern boundary of the DCO Site from the B1241 are generally open. An additional viewpoint (refer to Viewpoint I) will be included as the EIA progresses. There is little change in topography between the DCO Site and the settlements along this road with views partially filtered by existing field boundary vegetation and mature trees that flank the road.



- 10.7.88 Properties along the western extents of Upton, Kexby, and Willingham by Stow all have open views across arable fields to the DCO Site as illustrated by viewpoints 9, 19, and 20. The DCO Site will be noticeable due to the wide, long-distance views offered. The power stations at West Burton and Cottam are prominent on the horizon, occasionally screened by intervening woodlands.
- 10.7.89 The landform remains flat with intervening smaller farmsteads having heavily filtered views of the DCO Site due to intervening vegetation.
- 10.7.90 Further east, the land rises sharply toward the prominent upland limestone ridge that runs through Greater Lincolnshire (the northern Lincolnshire Edge). To the eastern side of the DCO Site, this ridge runs between Lincoln and is the route of the B1398 taking in the settlements of Scampton, Aisthorpe, Brattleby, Cammeringham, Ingham, Fillingham, Glentworth, and Harpswell. The elevated perspective of these settlements affords open long-distance views across the valley from the western extents. Where immediate vegetation doesn't filter views the DCO Site will be visible across the background of the view. The cooling towers and chimneys at West Burton and Cottam power stations are prominent features on the skyline. These long-distance views are illustrated by Viewpoints 7 and C5.
- 10.7.91 Beyond this ridge, the landform falls away screening views further east including the Lincolnshire Wolds.

South of the DCO Site

- 10.7.92 There are few visual receptors to the south of the DCO Site between Willingham Road and Till Bridge Lane. Undulation in the landform between Normanby by Stow and Stow limits views from Stow making the DCO Site barely perceptible. Several properties at the western extent along Stow Park Road have open views are represented by Viewpoint 6. Further views along the southern boundary of the DCO Site are represented by Viewpoints 4, 8, 17 and 18. Additional viewpoints showing a view from PRoW LL|Stow|70/1 as well as from LL|Stow|71/2 are subject to verification on site and will be included as the Environmental Impact Assessment (EIA) progresses.
- 10.7.93 Landform around Marton limits views of the DCO Site to the properties along the northern side of Stow Park Road and Mount Pleasant Close where views are partially filtered by intervening hedgerows. Viewpoint 5 will illustrate a view from A1500 (Stow Park Road). A view from LL|Mton|69/1 is subject to verification on site and will be included as the Environmental Impact Assessment (EIA) progresses.
- 10.7.94 Views further south from Brampton, Torksey Lock, Bransby, and Sturton by Stow are heavily filtered by landform, intervening vegetation, and buildings. Lines of overhead pylons crossing from west to east are prominent in the view in the direction of the DCO Site.
- 10.7.95 The section of railway line running to the south of the DCO Site has limited views due to multiple cuttings and vegetation flanking both sides of the infrastructure corridor.



Views within the DCO Site

- 10.7.96 Views are typically middle distance and open, looking across open agricultural land. A series of individual properties are located along the DCO Site boundary as described below:
- 10.7.97 Sandebus Farm and the Old Nursery on Willingham Road along the southern boundary. Views toward the DCO Site are partially filtered by mature intervening garden vegetation. Where direct views exist, viewpoints 4, 17, and 18 will be illustrative.
- 10.7.98 Prospect Farm on Clay Lane along the western boundary. Intervening rising landform in the direction of the DCO Site heavily screens views from the buildings for this property. Views from the boundary edge of the farm are illustrated by viewpoints 3 and 16.
- 10.7.99 St Helen Church, Gate Burton along the western boundary. Fieldwork did not include access to the curtilage of the church. Views northeast from the church in the direction of Burton Wood are filtered by intervening mature vegetation along the churchyard boundary apart from the eastern boundary of the adjacent graveyard. Viewpoints 3 and 15 will be representative of views along the eastern boundary of Gate Burton estate.
- 10.7.100 Gate Burton Hall along the western boundary. Fieldwork did not include access to the curtilage of the Hall. Views from the main buildings in the direction are heavily filtered by intervening mature trees and garden vegetation.
- 10.7.101 Central Park Farm, along the western boundary. Views from this farm are heavily filtered by woodland to the south and east. A strip of mature trees also heavily filters views to the north. Views in these directions are limited to glimpses between intervening vegetation and agricultural buildings. Views to the west are open with views of panels as they recede down the sloping landform.
- 10.7.102 Pembroke House, along the western boundary. This property is surrounded to all sides by the DCO Site. Views to the north, south, and west are partially filtered by mature trees in the curtilage boundary. However, the view east is more open across the DCO Site.
- 10.7.103 Park Farm South, along the northern boundary. The agricultural buildings at the farm have sparse intervening vegetation around them affording open views across the DCO Site. The farmhouse buildings are partially enclosed to the south and west by mature vegetation in the curtilage boundary partially filtering views. The view east is partially filtered by intervening agricultural buildings.
- 10.7.104Park Farm, along the eastern boundary. The property and agricultural buildings are unbound by vegetation affording open, middle-distance views in all directions across the DCO Site.
- 10.7.105 One of the properties set within the DCO Site boundary, Clay Farm, is situated at the eastern end of Clay Lane has open views across the DCO Site to the north, south, and east. The view west is screened by the



intervening vegetation that flanks the embanked railway infrastructure. Viewpoint 4 is indicative of views of the DCO Site around Clay Farm and Viewpoints 2 and 3 are representative of travelling to and from this property.

10.7.106 Recreational users crossing the DCO Site by rail experience a variety of views due to the numerous sections of cuttings and embankments along this section of railway line. Oblique views to the east include views of Lincoln Cathedral and Stow Church. Oblique views to the west include numerous woodlands that filter views of the power stations at West Burton and Cottam that otherwise dominate the view.

Future Baseline

10.7.107In the absence of the DCO Site, the future landscape and visual baseline across the DCO Site will be anticipated to remain broadly similar as stated above. Agriculture will remain the predominant use, interspersed by woodland blocks. The power stations at West Burton and Cottam along with the associated overhead power lines will continue to dominate the view.

10.8 Mitigation Measures

Embedded Design Mitigation

- 10.8.1 The DCO Site has been designed, as far as possible, to avoid adverse effects on the landscape and views through consideration of options, appraisal and refinement, as described in **Chapter 3: Alternatives and Design Evolution**. This process will continue through preparation of the ES.
- 10.8.2 The following embedded and additional mitigation measures have been incorporated into the DCO Site design, with detailed proposals and locations to be submitted as the EIA progresses.

Table 10-7 Mitigation Categories

Category	Assessment	Description	Gate Burton Examples
Embedded	Factored into determining significant effects.	These form an integral, committed and deliverable part of the DCO Site design or standard construction practices and will be included within the DCO application.	 Buried grid connection to avoid permanent impacts to landscape and visual receptors. Selection of Grid Connection Route to minimise impact to sensitive landscape and visual receptors Siting of transformers to minimise change to the setting of the baseline landscape. Siting of converter station to minimise change to the landscape and visual receptors Screening and planting design Solar panel exclusion zones to reduce impacts through change to the setting of heritage assets
Additional	Factored into determining	Additional measures where standard (embedded)	Additional hedgerow planting



Category	Assessment	Description	Gate Burton Examples
	residual significant effects.	measures are not sufficient to avoid significant effects. Committed and deliverable as part of the DCO Site and will be included within the DCO application.	 Tree & shrub belt planting Improvement of existing hedgerows

10.8.3 Design principles, set out below, have been embedded in the design and the parameter plans to date, in order to mitigate potential adverse effects and maximise the delivery of local landscape benefits:

Residential offsets:

An offset from residential properties was included in the initial design.
The form and extent of this offset has been adjusted through design
development in order to respond to the existing character of views from
residential properties. A bespoke approach has been taken to the
arrangement of the proposed PV Panels close to residential properties.

Battery storage:

 The proposed BESS will be located in a visually contained section of the DCO Site and adjacent to the substation. The location will take advantage of partial screening provided by topography, Burton Wood and the woodland of Long Nursery.

Existing vegetation:

- The design has incorporated offsets from existing landscape features.
 This includes:
 - Offsets from Ancient Woodland,
 - Offsets from woodland;
 - Offsets from hedgerows;
 - Offsets from PRoW; and
 - Offsets from watercourses.

Relevant offsets are indicated in **PEI Report Volume 2: Figure 2-2**.

Fencing design:

 The proposed fencing has been designed to minimise its visual prominence. The fence is likely to be a deer fence or other mesh security fencing approximately 2.5m -3m in height.

Overall layout:

- The overall layout has undergone extensive review in order to respond to the landscape character baseline.
- An exclusion zone for solar panels has been established east around Gate Burton estate and in sections of the northern part of the DCO Site.
- Exclusion zones or offsets from residential properties along Willingham Road and Marton Road located adjacent to the DCO Site has also been included.



Green infrastructure:

- The DCO Site will be designed to integrate with the local green infrastructure network, improving ecological and recreational connectivity across the Site. Current landscape proposals are indicated in PEI Report Volume 2: Figure 2-2 and will be fully detailed as the EIA progresses.
- Embedded mitigation measures for the construction phase include construction and exclusion zones in relation to retained vegetation, ensuring a tidy and neat working area, covering stockpiles and storing topsoil in accordance with good practice measures.

Landscape strategy

- 10.8.4 The LVIA is informing the iterative design process guided by design principles and in response to policy requirements, published landscape character assessment guidance and fieldwork analysis:
 - The recommendations contained within relevant landscape guidelines, including Natural England Statements of Environmental Opportunity (SEO) outlined in the profiles for NCA 48 and NCA 45; and
 - Guidance contained within the Landscape Institute's Infrastructure Technical Guidance Note 04/20.
- 10.8.5 The design mitigation embedded in the DCO Site will minimise effects on landscape character and visual amenity.
- 10.8.6 The design is developed in collaboration with the wider design team and other specialists to achieve a solution that achieves this objective whilst maximising opportunities to deliver net gains in biodiversity. Accordingly, the landscape design aims to achieve the following:
 - To integrate the DCO Site into the existing landscape pattern as far as possible by retaining and following existing features, including vegetation, where practicable.
 - To replace vegetation lost because of construction of the DCO Site through areas of new planting.
 - To filter and screen more prominent components of the DCO Site in views from visual receptors by appropriate siting to take advantage of existing screening or through additional planting of hedgerow or bands of trees while not undermining the current landscape pattern.

Careful siting in the landscape

- 10.8.7 Offsets from residential properties have been incorporated across the design, including a c. 70m offset from Gate Burton, with a c.260m development free corridor between the settlement and Burton Wood, retaining visual link to the woodland.
- 10.8.8 The proposed substation and BESS have been placed in a visually contained part of the DCO Site, away from residential properties and footpath and maximising existing screening; with Burton and Quilter's Woods to the south, Long Nursery woodland to the north, and the railway extending through the DCO Site to the east.



Conserving the existing vegetation patterns

10.8.9 The layout of the DCO Site has been designed to minimise the loss of, and avoid significant impacts on, existing landscape features. The existing hedgerow network that defines the scale and pattern of fields will be retained, as will existing blocks of woodland. Minimum offsets from existing vegetation have been incorporated and will continue to inform design development to ES.

Sensitive design in relation to form, colour, and materials

- The use of tracker panels has been discounted. Panels which track the sun across the sky will require additional equipment and will typically be taller than those proposed as part of the DCO Site. They will introduce moving features into the landscape and into people's views.
- The proposed fencing has been designed to minimise its visual prominence. The fence will be similar to a deer fence or other wire mesh security fencing approximately 2.5m to 3m in height.

Enhancement

- 10.8.10 The LVIA has, and still is, informing the iterative design process, incorporating design principles in response to policy requirements, published landscape character assessments and fieldwork analysis.
- 10.8.11 The DCO Site design has undergone a series of design iterations to embed mitigation measures into the design during the PEI Report process, as outlined in Section 10.9.40. The design development will be completed during the EIA process.
- 10.8.12 The residual significant landscape and visual effects are due to the change in land use and the massing of the panels and associated structures. Whilst long term, the residual significant effects will be temporary. It will not be possible to mitigate all adverse effects due to the requirements and the scale of the DCO Site, and in order to retain the overall vegetation pattern within the study area. Additional enhancement measures are outlined in the table below:

Table 10-8 Mitigation Enhancement Measures

Category	Assessment	Description	Gate Burton Examples
Enhancement	Not factored into determination of residual significant effects. However, the potential additional benefits can still be identified.	Aspirational measures which will have additional beneficial outcomes.	Retention of newly planted field boundaries beyond the decommissioning phase will reinstate elements of the historic landscape character



Monitoring

10.8.13 Measures to protect the retained vegetation and monitoring requirements to ensure the successful establishment of the proposed planting will be outlined at ES stage.

10.9 Assessment of Likely Impacts and Effects

- 10.9.1 The LVIA is preliminary and will be further developed based on further desk studies, continued fieldwork and consultations. Preliminary findings are discussed below for construction and operation, taking account of embedded mitigation. No photomontages have been produced for the PEI Report. Likely impact and effects are therefore preliminary and based on knowledge gained during site visits, research of relevant information sources, published material by planning authorities, and the current Scheme layout. The likely impacts and effects identified are therefore subject to review as the detailed assessment and design develop in preparation of the DCO Application.
- 10.9.2 The assessment of likely impacts and effects should be read in conjunction with PEI Report Volume 3: Appendix 10-C, Appendix 10-D, Appendix 10-E and Appendix 10-F.

Construction Impacts

Landscape

County Level Published Landscape Character Areas

10.9.3 Construction will not likely result in significant effects to the LCAs defined at county level (refer to Section 10.6 above for LCA details). The level of effect will range from minor adverse to neutral and is considered to be temporary and short term due to the scale of the NLCA in relation to the scale and nature of the project.

District Level Published Landscape Character Areas

- 10.9.4 The majority of the DCO Site is located within LCA Trent Valley and The Northern Cliff Foothills LCT (refer to Section 10.6 above for LCA details). There will be localised changes to landform, including excavation of a trench for cabling, topsoil stripping and temporary storage of materials. Sensitive features such as areas of ancient woodland will be protected, through the implementation of protective buffers. The overall structure of the LCA will remain unchanged.
- 10.9.5 The presence and movement of construction machinery, including boring and lifting equipment and associated features (e.g. topsoil piles) will degrade the condition of the landscape locally.
- 10.9.6 There will be the perception of construction activity in the parts of the LCA adjacent to the DCO Site, reducing the level of tranquillity locally. Construction is likely to result in **moderate adverse** effect, which is considered **significant** albeit temporary, lasting for the duration of the construction works.



10.9.7 Construction will result in negligible adverse or neutral effects to the remaining district level LCAs. These effects are not considered to be significant.

Local Landscape Character Areas (defined by author)

- 10.9.8 At the local level, the DCO Site is located in LLCA 02: Ancient Woodland Plateau, LLCA 05: Somberby & Knaith Woodlands and LLCA 06:Clay Farmlands (refer to Section 10.6 above for LLCA details).
- 10.9.9 There will be localised changes to landform across the three LLCAs, including linear excavation of a trench for cabling. The majority of landscape features will remain unchanged.
- 10.9.10 Construction of the proposed BESS and Substation will take place along the northern section of LLCA 02.
- 10.9.11 Construction plant, including boring equipment and lifting machinery will be introduced, and typical construction features such as fencing/hoarding and satellite construction compounds. The presence and activity of construction machinery and associated features (e.g. topsoil piles) will degrade the condition of the LLCAs.
- 10.9.12 The introduction of these features will be temporary, short to medium term and reversible.
- 10.9.13 Whilst construction activity will physically alter up to half of each of the LLCAs, construction activity will be perceptible from the wider LLCA. Construction will not result in the permanent loss of key features.
- 10.9.14 Construction will result in **major adverse effects** to LLCA 02, LLCA 05 and 06, which are considered **significant** albeit temporary, lasting for the duration of the construction works.
- 10.9.15 Construction will result in **minor adverse**, **negligible adverse or neutral effects** to the remaining LLCAs. These effects are not considered significant.

Visual

10.9.16 Construction activity will not be visible to all of the visual receptors, as identified in the visual baseline of this chapter and in **PEI Report Volume 3: Appendix 10-D,** due to intervening landform, vegetation and distance from the DCO Site. Effects on these receptors during construction are detailed in **PEI Report Volume 3: Appendix 10-E.** Visibility of construction will typically extend up to approximately 1km north and east of the DCO Site due to the rising landform at Gate Burton and Knaith in west and northwest and the quick descend to the River Trent and its floodplains where visibility will be limited to the grid connection works and upper sections of cranes or other tall construction machinery related to the solar farm / substation / battery storage development east of Gate Burton.

Residents

10.9.17 Visibility from settlements can be limited by intervening built structures or adjacent vegetation and will therefore affect mainly residents located along



- the fringes of these settlements facing the DCO Site or face in the general direction of the DCO Site.
- 10.9.18 The highest visual effects are expected for residents located within the DCO Site, adjacent to the boundary or in close proximity to the DCO Site as listed in Table 10-6 Visual Receptors in Section 10.6 above.
- 10.9.19 Construction effects for residential receptors in these locations will typically result in high visual effects. These effects are considered **major or moderate adverse** and **significant** and will result from the introduction of construction activity at close range across a wide extent of a view. This will include in particular residents at Clay Farm, Park Farm, along Willingham Road, sections of Marton Road, Station Road, Knaith Hill and Kexby Lane for the DCO Site, and residents along the A1500 / Stow Park Road, individual properties located between Marton and Brampton as well as in Cottam and Rampton facing the grid connection corridor.
- 10.9.20 Significant visual effects for residents located in the wider study area will reduce quickly to **minor**, **negligible and neutral** with increasing distance from the DCO Site. This includes residents located within settlements located in the study area or residents facing away from the DCO Site as listed in Table 10-6 Visual Receptors in Section 10.6 above. This is due to intervening vegetation, landform and built structures as well as to the gently undulating or flat nature of the landform of the Solar and Energy Storage Park and surroundings to the north, northeast, east and sections of the south.
- 10.9.21 Elevated views of the construction site are only available from considerable distance. The locations include high ground to the east and outside of the 3km study area at Tillbridge Lane Viewpoint and east of Ingham and Fillingham and north of Glentworth. Visual effects are considered to be Very Low and their significance **negligible neutral** considering the distance (ranging between approximately 8-10km), intervening vegetation and gently undulating landform.
- 10.9.22 Views from the western section of the study area, west of Gate Burton and the A156 (Gainsborough Road) will be either barely discernible, or confined to upper sections of cranes or indeed fully screened by intervening landform and vegetation. Visual effects are estimated to range from Very Low to None and their significance will range from **negligible to neutral**.

Recreational Users

- 10.9.23 People walking PRoW LL|Knai|44/2, sections of LL|Upto|53/1 will experience high visual effects. The significance of these effects will be **major adverse** due to construction located adjacent along the footpath; this is considered to **significant**.
- 10.9.24 Visibility from LL|Mton|69/1 north of the A1500 (Stow Park Road), LL|Stow|70/1 south of Willingham by Stow joining Marton Road, and LL|Knai|44/1 will be limited due to filtered or screened views due to intervening landform and vegetation. Visual effects are considered to range between Medium-Low and their significance **moderate to minor adverse**.



10.9.25 People walking on the wider PRoW network beyond the DCO Site in the wider study area will not experience significant effects resulting from construction due to intervening landform, vegetation and existing built structures.

Road users and public transport

- 10.9.26 Views of construction from the local road network will be highest along sections of A156 (Gainsborough Road (west of the DCO Site), Clay Lane (west of the DCO Site and within the DCO Site), Willingham Road, Marton Road (south and east of the DCO Site) and sections of Kexby Lane and Station Road (north of the DCO Site). Roadside vegetation can filter open views of the site or screen views of the DCO Site depending on the season. Occasional views of construction will be available through gaps in vegetation, but they will be fleeting and oblique to the direction of travel. Where more open views from the road network are available (sections of Willingham Road, Marton Road, Kexby Lane, Station Road and Clay Lane), construction will be adjacent to sections of these roads resulting in Medium and High visual effects and in a moderate-major adverse significance. Visual effects along the remaining road network will reduce from Medium-Low to Very Low resulting in a minor-negligible adverse-neutral significance.
- 10.9.27 The DCO Site will be one of several elements in the far distance in elevated panoramic views from the B1398 (High Street) close to Scampton and the B1398 (Middle Street) east of Ingham, Fillingham and Glentworth. It will be discernible in the distance during clear weather conditions. However, it will not be a point of focus during the construction phase due to the effects of distance and the screening effects of intervening vegetation and built structures. Visual effects are considered Very Low and the significance negligible neutral.
- 10.9.28 The majority of the train line is accompanied by trackside vegetation or embankments filtering or screening views across the DCO Site. Sections of the train line in the vicinity of Clay Lane are on embankment with elevated views across sections of the site. Visual effects for train passengers will range from Medium to Low and their significance moderate-minor adverse in available views. Visual effects will be fleeting and oblique to the direction of travel.

Visitors

- 10.9.29 Visitors to Tillbridge Lane Viewpoint will likely experience Very Low visual effects with a **negligible neutral** significance due to the effects of distance and intervening screening provided by vegetation and local landforms.
- 10.9.30 Visitors of Sundown Adventureland east of Treswell and users of Lincoln Golf Club located between Torksey and Brampton will not experience significant effects due to the distance from the site and screening provided by intervening vegetation and landform.

Construction effects on receptors in relation to the Grid Connection

10.9.31 The Grid Connection will be underground. The Grid Connection Route is indicated in **PEI Report Volume 2: Figure 1-2**. It represents the current



- maximum extent of land being considered. The actual location of the cable route will be finalised during the ES. The cable route is expected to require a 30m to 40m wide working area with a small number of wider areas up to 60m.
- 10.9.32 Construction effects will likely be significant adverse locally due to required excavations, material transport and storage, construction compounds, machinery and potential impacts on sections of existing vegetation. Receptors affected will include recreational users of PRoWs located within or near the cable route as well as road users. Residents, potentially facing the cable route, and located at the outskirts of Marton, Cottam and Rampton as well as individual dispersed residences along the cable route may experience significant adverse effects. However, visual effects from construction works will be temporary. A detailed assessment of visual effects will be included in the ES.

Operation Impacts

Landscape

County Level Published Landscape Character Areas

10.9.33 The DCO Site will not result in significant effects to the LCAs defined at the County level. The level of effect will range from minor adverse to neutral and is considered to be temporary and short term due to the scale of the NLCA in relation to the scale and nature of the project.

District Level Published Landscape Character Areas

- 10.9.34 The DCO Site will not result in significant effects to the LCAs defined at the District level. The level of effect will range from minor adverse to neutral.
- 10.9.35 The level of effect on LCA Trent Valley will be reduced from year 1. The proposed and strengthened hedgerows will be established and maintained at 3m tall, providing an improved landscape structure and sense of enclosure to the DCO Site. The new belts of woodland will also be established. Collectively, the new planting will reduce the perception of the DCO Site from the wider LCA and also respond positively to land management guidelines in the published assessments, enhancing the existing hedgerow pattern and managing the ecological connectivity of woodlands. On balance the DCO Site will result in a minor adverse effect. These effects are not considered to be significant.
- 10.9.36 Operation will result in **negligible** or **neutral** effects to the remaining district level LCAs. This is not considered to be significant.

Local Landscape Character Areas (defined by author)

- 10.9.37 At the local level, the DCO Site is within LLCA 02, LLCA 05 and LLCA 06.
- 10.9.38 The perception of change across the area will reduce as the proposed planting establishes. The established planting will strengthen landscape structure and improve ecological connectivity, in particular through the ancient woodland with the Gate Burton estate. This will positively respond to the key characteristics of the LLCAs, strengthening the field pattern structure



- marked by hedgerows acrossboth LLCAs reinforcing the sense of enclosure from large deciduous woodlands in LLCA 02.
- 10.9.39 The DCO Site will result in effects ranging from minor adverse, negligible adverse and neutral across the remaining LLCAs. Whilst the establishment of planting will be beneficial, the overall level of effect to LLCA 02 will remain **moderate adverse** given the extent of the LLCA that will be altered by the DCO Site. These effects are considered to be significant.
- 10.9.40 The establishment of the mitigation planting will reduce the overall level of effect on LLCA 05 and LLCA 06 to **moderate adverse**, given the greater enclosure provided by the new woodland and the associated positive response to key characteristics. This is considered significant.

Visual Effects – Winter Year 1

10.9.41 The PV arrays, substation, battery storage and associated infrastructure will not be visible in their entirety in views identified for the visual receptors due to intervening landform, vegetation, the distance from the DCO Site and the angle of views available. Visual effects in Year 1 are detailed in **PEI Report Volume 3: Appendix 10-E**. However, the visibility of the DCO Site in available views can be prolonged and expansive due to the extent of the DCO Site. The visibility and prominence of PV arrays can extend from the foreground across the middle ground to the background and include sections of the substation in the distance.

Residents

- 10.9.42 The highest visual effects are expected for residents located within the DCO Site, adjacent to the boundary or in close proximity to the DCO Site as listed in Table 10-6 Visual Receptors in Section 10.6 above. The DCO Site layout includes an offset from residential properties and proposes mitigation planting, but this will not be established at Year 1. The majority of visual effects will therefore relate to the visibility of PV arrays, which will be prominent in available close distance views for residents along Willingham Road and Marton Road, Clay Farm, Park Farm and a number of residents along Kexby Lane and Station Road. Residential receptors will typically experience Medium-High visual effects and a significance ranging between major or moderate adverse.
- 10.9.43 Significant visual effects for residents located in the wider study area will reduce to **minor**, **negligible and neutral** with increasing distance from the DCO Site. This includes residents located within settlements or residents facing away from the DCO Site as listed in Table 10-6 Visual Receptors in Section 10.6 above. This is due to intervening vegetation, landform and existing built structures as well as to the gently undulating or flat nature of the landform of the Solar and Energy Storage Park and surroundings to the east north, east and sections of the south.
- 10.9.44 Elevated views of the DCO Site are only available from considerable distance to the east and outside of the 3km study area. These locations include high ground at Tillbridge Lane Viewpoint and east of Ingham and Fillingham and north of Glentworth. Visual effects are considered to be Very Low and their



- significance **negligible neutral** considering the distance (ranging between approximately 8-10km), intervening vegetation and gently undulating landform.
- 10.9.45 Views from the western section of the study area, west of Gate Burton and the A156 (Gainsborough Road) will be either barely discernible and confined to upper sections of PV panels or fully screened by intervening landform and vegetation. Visual effects are estimated to range from Very Low to None and their significance will range from **negligible to neutral**.

Recreational Users

- 10.9.46 People walking PRoW LL|Knai|44/2, sections of LL|Upto|53/1 will experience high visual effects. The significance of these effects will be **moderate** adverse due to the PV arrays being introduced into the view in close proximity to the footpath (5m offset from PRoW).
- 10.9.47 Visibility from LL|Mton|69/1 north of the A1500 (Stow Park Road), LL|Stow|70/1 south of Willingham by Stow joining Marton Road, and LL|Knai|44/1 will be limited due to filtered or screened views due to intervening landform and vegetation. Visual effects are considered to range between **medium-low and** their significance **moderate to minor adverse**.
- 10.9.48 People walking on the wider PRoW network beyond the DCO Site in the wider study area will not experience significant visual effects during Year 1 due to intervening landform, vegetation and existing built structures.

Road users and public transport

- 10.9.49 Views of the DCO Site from the local road network will be highest along sections of Clay Lane (west of the DCO Site and within the DCO Site), Willingham Road, Marton Road (south and east of the DCO Site) and sections of Kexby Lane and Station Road (north of the DCO Site). Roadside vegetation can filter open views of the DCO Site. Occasional views of the DCO Site will be available through gaps in vegetation, but they will be fleeting and oblique to the direction of travel. Where more open views from the road network are available (sections of Willingham Road, Marton Road, Kexby Lane, Station Road and Clay Lane), the DCO Site will be adjacent to sections of these roads resulting in Medium and High visual effects. The significance will range between **moderate-major adverse**. Visual effects along the remaining road network will reduce from Medium-Low to Very Low resulting in a **minor-negligible adverse-neutral** significance.
- 10.9.50 The DCO Site will be barely discernible in elevated panoramic views from the B1398 (High Street) close to Scampton and the B1398 (Middle Street) east of Ingham, Fillingham and Glentworth. It will not be a point of focus in Year 1 due to the effects of distance and the screening effects of intervening vegetation and existing built structures. Visual effects are considered Very Low and the significance **negligible neutral**.
- 10.9.51 The majority of the train line is accompanied by trackside vegetation or embankments filtering or screening views across the DCO Site. Sections of the train line in the vicinity of Clay Lane are on embankment with elevated views across sections of the site. Visual effects for train passengers will range



from **medium to Low** and their significance **moderate-minor** in available views. Visual effects will be fleeting and oblique to the direction of travel.

Visitors

- 10.9.52 Visitors to Tillbridge Lane Viewpoint will likely experience Very Low visual effects with a **negligible neutral** significance due to the effects of distance and intervening screening provided by vegetation and local landforms.
- 10.9.53 Visitors of Sundown Adventureland east of Treswell and users of Lincoln Golf Club located between Torksey and Brampton will not experience significant expects due to the distance from the site and screening provided by intervening vegetation and landform.

Operational effects (Year 1) on receptors in relation to the Grid Connection

- 10.9.54 The Grid Connection will be underground. The Grid Connection Route is indicated in **PEI Report Volume 2: Figure 1-2**. It represents the current maximum extent of land being considered. The actual location of the cable route and width will be determined as the design process of the grid connection progresses during the ES.
- 10.9.55 Visual effects during the operational phase will be likely not significant and adverse. Considering the underground grid connection, the area around the cable route alignment will be reinstated to match existing conditions. Potential impacts on sections of vegetation will remain visible but are not considered significant. A detailed assessment of visual effects will be included in the ES.

Visual Effects – Summer Year 15

10.9.56 The proposed planting will be established. Existing and proposed planting will be in full leaf. This will reduce the visibility of the DCO Site in close range views and also in the wider study area. Effects on visual receptors, as identified in the visual baseline of this chapter, are detailed in **PEI Report Volume 3: Appendix 10-E**.

Residents

- 10.9.57 By Year 15, proposed planting within and along the boundaries of the DCO Site will have established. Additional, existing and existing strengthened hedgerows will be maintained at approximately 3m height. A new band of trees will begin to mature and provide substantive screening in views west from the western edge of Willingham by Stow along Marton Road as well as along the field boundary close to residences along Kexby Lane east of Knaith Park.
- 10.9.58 The establishment of new planting will change the composition of some residential views, screening agricultural fields that typically form the fore- and middle ground. However, the offset from curtilage boundaries and maintaining a hedgerow height of 3m will retain a sense of openness in the view. Native, locally characteristic species will be proposed, and will be inkeeping with the style of vegetation in the existing views, following a similar form and composition.



- 10.9.59 The majority of visual effects from residences will have reduced to not significant due to the establishment of the proposed planting. Medium visual effects with a **moderate adverse** significance will be experienced at Park Farm, sections of Willingham Road and Marton Road as well as Clay Lane and Clay Farm.
- 10.9.60 Visual effects for residents located in the wider study area will range between **minor**, **negligible and neutral** with increasing distance from the DCO Site.
- 10.9.61 Elevated views at Tillbridge Lane Viewpoint and east of Ingham and Fillingham and north of Glentworth will remain largely unchanged as proposed landscape planting will not significantly alter the visibility of the site at that elevation and distance. Visual effects are considered to be Very Low and their significance is **negligible neutral**.
- 10.9.62 Views from the western section of the study area, west of Gate Burton and the A156 (Gainsborough Road) will not be discernible due to intervening landform and vegetation.

Recreational Users

- 10.9.63 People walking PRoW LL|Knai|44/2, sections of LL|Upto|53/1 will experience medium visual effects. The significance of these effects will be **moderate** adverse due to the PV arrays located close to the footpath.
- 10.9.64 Visibility from LL|Mton|69/1 north of the A1500 (Stow Park Road), LL|Stow|70/1 south of Willingham by Stow joining Marton Road, and LL|Knai|44/1 will be limited due to filtered or screened views due to intervening landform and vegetation. Visual effects are considered to range between **low** and their significance **minor Adverse**.
- 10.9.65 People walking on the wider PRoW network beyond the DCO Site in the wider study area will not experience significant visual effects during Year 15.

Road users and public transport

- 10.9.66 Visual effects along the majority of the local road network will reduce to not significant due to the establishment of proposed tree planting and maintenance of existing and new hedgerows at 3m height. However, some sections will allow for filtered or open views for example at field gates etc. The roads include Clay Lane, Kexby Lane, Willingham Road and sections of Marton Road. Visual effects are considered **medium** resulting in a **minor-moderate adverse** significance.
- 10.9.67 The visibility from elevated locations at a distance will remain largely unchanged as localised planting within or around the DCO Site will not affect long distance views materially. The DCO Site will therefore still be barely discernible in elevated panoramic views from the B1398 (High Street) close to Scampton and the B1398 (Middle Street) east of Ingham, Fillingham and Glentworth. Similar to Year 1, the DCO Site will not be a point of focus in Year 15 due to the effects of distance and the screening effects of intervening vegetation and built structures. Visual effects are considered Very Low and the significance **negligible neutral**.



10.9.68 Visual effects for train passengers will remain similar and range from **medium to low** and their **significance moderate-minor** in available views. Visual effects will be fleeting and oblique to the direction of travel.

Visitors

- 10.9.69 Visitors to Tillbridge Lane Viewpoint will likely experience **very low visual effects** with a **negligible neutral** significance due to the effects of distance and intervening screening provided by vegetation and local landforms.
- 10.9.70 Visitors of Sundown Adventureland east of Treswell and users of Lincoln Golf Club located between Torksey and Brampton will not experience significant expects due to the distance from the site and screening provided by intervening vegetation and landform.

Operational effects (Year 15) on receptors in relation to the Grid Connection

- 10.9.71 The Grid Connection will be underground. The Grid Connection Route is indicated in **PEI Report Volume 2: Figure 1-2**. It represents the current maximum extent of land being considered. The actual location of the cable route and width will be determined as the design process of the grid connection progresses during the ES.
- 10.9.72 Considering the underground grid connection, the area around the cable route alignment will be reinstated to match existing conditions in Year 1. At Year 15, replacement planting (where required) will have established and will have integrated in the surrounding vegetation pattern, which was unaffected by construction works. Potential visual effects will not be significant and neutral. A detailed assessment of visual effects will be included in the ES.

Decommissioning Effects

- 10.9.73 Decommissioning effects on the landscape and visual amenity are likely to be similar to those temporary impacts experienced during construction of the DCO Site but reduced on account of the containment provided by landscape mitigation measures including proposed vegetation, which will have reached maturity, and general landscape management measures.
- 10.9.74 However, the decommissioning phase may result in localised significant adverse landscape and visual effects, like the construction phase, due to the presence of machinery and general activity to remove Scheme structures. Likely decommissioning effects will be further detailed in line the development of final landscape mitigation measures as the EIA progresses



10.10 Residual Effects and Conclusions

- 10.10.1 This section summarises the residual significant effects of the DCO Site on landscape and visual receptors following the implementation of mitigation.
- 10.10.2 Significant residual effects are defined as moderate or major. These are listed in Table 10-9 Summary of Significant Residual Effects (Construction and Decommissioning).
- 10.10.3 Significant residual effects during the operation are listed in Table 10-10 at Year 1 (winter) and Year 15 (summer).
- 10.10.4 The full list of residual visual effects, including non-significant, can be found in **PEI Report Volume 3: Appendix 10-E**.
- 10.10.5 The LVIA is still a work in progress and likely landscape and visual effects are therefore preliminary and based on knowledge gained during site visits, research of relevant information sources, published material by planning authorities, and the current Scheme layout. The likely impacts and effects identified are therefore subject to review as the detailed assessment and design develop in preparation of the DCO Application.



Table 10-9 Summary of Significant Residual Effects (Construction and Decommissioning)

Receptor	Sensitivity of Receptor	Description of impact	Mitigation/Enhancement measure	Residual effect after mitigation
Landscape Receptors (Construction)				
LLCA 01 – Gate Burton Estate	Medium	Partial alteration to the LLCA	Available mitigation measures will be embedded into the Scheme design.	Moderate Significant (temporary)
LLCA 02 – Ancient Woodland Plateau	Medium	Large alteration to the LLCA	As above	Major Significant (temporary)
LLCA 03 – Northern Trent Ridge	Low	No direct impact to the LLCA, potential indirect impacts	As above	Moderate Significant (temporary)
LLCA 04 – Gainsborough Fringe	Medium	No direct impact to the LLCA, potential indirect impacts	As above	Moderate Significant (temporary)
LLCA 05 – Somerby & Knaith Woodlands	Medium	Partial alteration to the LLCA	As above	Moderate - Major Significant (temporary)
LLCA 06 – Clay Farmlands	Medium	Large alteration to the LLCA	As above	Major Significant (temporary)
LLCA 07 – Stow Fringe	Low	No direct impact to the LLCA, potential indirect impacts	As above	Moderate Significant (temporary)
LLCA 08 – High Wood Plateau	Medium	Partial alteration to the LLCA	As above	Moderate Significant (temporary)



Receptor	Sensitivity of Receptor	Description of impact	Mitigation/Enhancement measure	Residual effect after mitigation
LLCA 09 – Trent Valley South	Medium	Partial alteration to the LLCA	As above	Moderate Significant (temporary)
LLCA 10 – Cottam Plateau	Low	Partial alteration to the LLCA	As above	Moderate Significant (temporary)
LLCA 11 – Rampton Fringe & Hawk Hills	Medium	Partial alteration to the LLCA	As above	Moderate Significant (temporary)
LLCA 12 – West Burton Valley	Low	No direct impact to the LLCA, potential indirect impacts	As above	Moderate Significant (temporary)
LLCA 13 – Mid-Trent Valley	Low	Partial alteration to the LLCA	As above	Moderate Significant (temporary)
Landscape Receptors (Decommissioning)				
LLCA 01 – Gate Burton Estate	Medium	Partial alteration to the LLCA	Available mitigation measures will be embedded into the Scheme design.	Moderate Significant (temporary)
LLCA 02 – Ancient Woodland Plateau	Medium	Large alteration to the LLCA	As above	Major Significant (temporary)
LLCA 03 – Northern Trent Ridge	Low	No direct impact to the LLCA, potential indirect impacts	As above	Moderate Significant (temporary)



Receptor	Sensitivity of Receptor	Description of impact	Mitigation/Enhancement measure	Residual effect after mitigation
LLCA 04 – Gainsborough Fringe	Medium	No direct impact to the LLCA, potential indirect impacts	As above	Moderate Significant (temporary)
LLCA 05 – Somerby & Knaith Woodlands	Medium	Partial alteration to the LLCA	As above	Moderate - Major Significant (temporary)
LLCA 06 – Clay Farmlands	Medium	Large alteration to the LLCA	As above	Major Significant (temporary)
LLCA 07 – Stow Fringe	Low	No direct impact to the LLCA, potential indirect impacts	As above	Moderate Significant (temporary)
LLCA 08 – High Wood Plateau	Medium	Partial alteration to the LLCA	As above	Moderate Significant (temporary)
LLCA 09 – Trent Valley South	Medium	Partial alteration to the LLCA	As above	Moderate Significant (temporary)
LLCA 10 – Cottam Plateau	Low	Partial alteration to the LLCA	As above	Moderate Significant (temporary)
LLCA 11 – Rampton Fringe & Hawk Hills	Medium	Partial alteration to the LLCA	As above	Moderate Significant (temporary)
LLCA 12 – West Burton Valley	Low	No direct impact to the LLCA, potential indirect impacts	As above	Moderate Significant (temporary)



Receptor	Sensitivity of Receptor	Description of impact	Mitigation/Enhancement measure	Residual effect after mitigation
LLCA 13 – Mid-Trent Valley	Low	Partial alteration to the LLCA	As above	Moderate Significant (temporary)
Visual Receptors (Construction)				
Commercial users of farmland (Viewpoint 1)	Medium	Pronounced change to the composition of the view	Available mitigation measures will be embedded into the Scheme design.	Major Significant (temporary)
Commercial users of farmland (Viewpoint 2)	Medium	Pronounced change to the composition of the view	As above	Major Significant (temporary)
Vehicle users along Clay Lane (Viewpoint 3)	Medium-High	Pronounced change to the composition of the view	As above	Major Significant (temporary)
Vehicle users along Willingham Road (Viewpoint 4)	Medium	Pronounced change to the composition of the view	As above	Major Significant (temporary)
Vehicle users along A1500 / Stow Park Road (Viewpoint 5)	Medium	Noticeable change to the composition of the view	As above	Moderate Significant (temporary)
Residents and vehicle users Manor Farm Stow (Viewpoint 6)	Medium	Noticeable change to the composition of the view	As above	Moderate Significant (temporary)
Recreational users and vehicle users along Marton Road (Viewpoint 8)	Medium	Noticeable change to the composition of the view	As above	Major Significant (temporary)



Receptor	Sensitivity of Receptor	Description of impact	Mitigation/Enhancement measure	Residual effect after mitigation
Recreational user, residents and vehicle users along Marton Road, Willingham by Stow (Viewpoint 9)	Medium	Noticeable change to the composition of the view	As above	Moderate Significant (temporary)
Vehicle users and residents along B1241 / Kexby Lane (Viewpoint 10)	High	Pronounced change to the composition of the view	As above	Major Significant (temporary)
Vehicle users, residents along B1241 / Kexby Lane at eastern entry to Knaith Park (Viewpoint 11)	Medium	Noticeable change to the composition of the view	As above	Moderate Significant (temporary)
Vehicle users and recreational users along Station Road west of Knaith Park (Viewpoint 12)	Medium-High	Pronounced change to the composition of the view	As above	Major Significant (temporary)
Residents of Gate Burton estate (Viewpoint 15)	Medium-High	Pronounced change to the composition of the view	As above	Major Significant (temporary)
Vehicle users of Clay Lane south of Gate Burton estate (Viewpoint 16)	Low-Medium	Noticeable change to the composition of the view	As above	Moderate Significant (temporary)
Vehicle users and residents along Marton Road (Viewpoint 17)	Low-Medium	Pronounced change to the composition of the view	As above	Major Significant (temporary)



Receptor	Sensitivity of Receptor	Description of impact	Mitigation/Enhancement measure	Residual effect after mitigation
Vehicle users along Marton Road (Viewpoint 18)	Low-Medium	Pronounced change to the composition of the view	As above	Moderate-Major Significant (temporary)
Vehicle users and residents along the B1241 / Gainsborough Road (Viewpoint 19)	Medium	Noticeable change to the composition of the view	As above	Moderate Significant (temporary)
Visual Receptors - Decommissioning				
Commercial users of farmland (Viewpoint 1)	Medium	Pronounced change to the composition of the view	Additional hedgerow planting and increase of existing hedgerow height to 3m	Moderate-Major Significant
Commercial users of farmland (Viewpoint 2)	Medium	Pronounced change to the composition of the view	No mitigation proposed as farm gate and Major access needs to be maintained Signific	
Vehicle users along Clay Lane (Viewpoint 3)	Medium-High	Pronounced change to the composition of the view	e No mitigation proposed as farm gate and Majaccess needs to be maintained Significations	
Vehicle users along A1500 / Stow Park Road (Viewpoint 5)	Medium	Noticeable change to the composition of the view	No mitigation proposed	Moderate Significant
Residents and vehicle users Manor Farm Stow (Viewpoint 6)	Medium	Noticeable change to the composition of the view	No mitigation proposed	Moderate Significant
Recreational users and vehicle users along Marton Road (Viewpoint 8)	Medium	Noticeable change to the composition of the view	Additional hedgerow planting and increase of existing hedgerow height to 3m	Moderate-Major Significant



Receptor	Sensitivity of Receptor	Description of impact	Mitigation/Enhancement measure	Residual effect after mitigation
Vehicle users and residents along B1241 / Kexby Lane (Viewpoint 10)	High	Pronounced change to the composition of the view	 Planting of band of tress along Scheme boundary, Increased offset of solar panels, Additional hedgerow planting and increase of existing hedgerow height to 3m 	Moderate Significant
Vehicle users, residents along B1241 / Kexby Lane at eastern entry to Knaith Park (Viewpoint 11)	Medium	Noticeable change to the composition of the view	Additional hedgerow planting and increase of existing hedgerow height to 3m	Moderate Significant
Residents of Gate Burton estate (Viewpoint 15)	Medium-High	Pronounced change to the composition of the view	Retention of open space between solar panels to retain viewing axis to Burton Wood	Moderate-Major Significant
Vehicle users and residents along Marton Road (Viewpoint 17)		Pronounced change to the composition of the view	Additional hedgerow planting and increase of existing hedgerow height to 3m	Moderate Significant
Vehicle users along Marton Road (Viewpoint 18)	Low-Medium	Pronounced change to the composition of the view	 Strengthening of existing hedgerows Additional hedgerow planting and increase of existing hedgerow height to 3m 	Moderate Significant
Vehicle users and residents along the B1241 / Gainsborough Road (Viewpoint 19)	Medium	Noticeable change to the composition of the view	No mitigation proposed	Moderate Significant



Table 10 10 Summary of Significant Residual Effects (Operation)

Receptor	Sensitivity of Receptor	Description of impact	Mitigation/Enhancement measure	Residual effect after mitigation (Year 15)
Landscape Receptors				
LLCA 01 – Gate Burton Estate	Medium	Partial alteration to the LLCA	Additional hedgerow planting and increase of existing hedgerow height to 3m	Minor - Moderate Significant
LLCA 02 – Ancient Woodland Plateau	Medium	Large alteration to the LLCA	n to the LLCA Retention of open space between solar panels to retain character and cultural heritage links to Burton Wood	
LLCA 03 – Northern Trent Ridge	Low	No direct impact to the LLCA, potential indirect impacts	No mitigation proposed due to distance of LLCA from Solar and Energy Storage Park	Moderate Significant
LLCA 04 – Gainsborough Fringe	Medium	No direct impact to the LLCA, potential indirect impacts	No mitigation proposed due to distance of LLCA from Solar and Energy Storage Park	Minor - Moderate Significant
LLCA 05 – Somerby & Knaith Woodlands	Medium	Partial alteration to the LLCA	 LLCA • Strengthening of existing hedgerows and tree belts Additional hedgerow planting and increase of existing hedgerow height to 3m. 	
LLCA 06 – Clay Farmlands	Medium	Large alteration to the LLCA	Additional hedgerow planting and increase of existing hedgerow height to 3m.	Major Significant
LLCA 07 – Stow Fringe	Low	No direct impact to the LLCA, potential indirect impacts	Planting of band of tress along Scheme boundary.	Moderate Significant



Receptor	Sensitivity of Receptor	Description of impact	Mitigation/Enhancement measure	Residual effect after mitigation (Year 15)
LLCA 08 – High Wood Plateau	Medium	Partial alteration to the LLCA	Additional hedgerow planting and increase of existing hedgerow height to 3m.	Moderate Significant
LLCA 09 – Trent Valley South	Medium	Partial alteration to the LLCA	Additional hedgerow planting and increase of existing hedgerow height to 3m	Moderate Significant
LLCA 10 – Cottam Plateau	Low	Partial alteration to the LLCA	No mitigation proposed due to distance of LLCA from Solar and Energy Storage Park	Minor - Moderate Significant
LLCA 11 – Rampton Fringe & Hawk Hills	Medium	Partial alteration to the LLCA	No mitigation proposed due to distance of LLCA from Solar and Energy Storage Park	Minor - Moderate Significant
LLCA 12 – West Burton Valley	Low	No direct impact to the LLCA, potential indirect impacts	No mitigation proposed due to distance of LLCA from Solar and Energy Storage Park	Minor - Moderate Significant
LLCA 13 – Mid-Trent Valley	Low	Partial alteration to the LLCA	No mitigation proposed due to distance of LLCA from Solar and Energy Storage Park	Minor - Moderate Significant
Visual Receptors				
Commercial users of farmland (Viewpoint 1)	Medium	Pronounced change to the composition of the view	Additional hedgerow planting and increase of existing and hedgerow height to 3m (new hedgerow planting will be maintained at a height of 3m as well once established)	Moderate-Major Significant
Commercial users of farmland (Viewpoint 2)	Medium	Pronounced change to the composition of the view	No mitigation proposed as farm gate and access needs to be maintained	Major Significant
Vehicle users along Clay Lane (Viewpoint 3)	Medium-High	Pronounced change to the composition of the view	No mitigation proposed as farm gate and access needs to be maintained	Moderate Significant



Receptor	Sensitivity of Receptor	Description of impact	Mitigation/Enhancement measure	Residual effect after mitigation (Year 15)
Recreational users and vehicle users along Marton Road (Viewpoint 8)	Medium	Noticeable change to the composition of the view	Additional hedgerow planting and increase of existing and hedgerow height to 3m (new hedgerow planting will be maintained at a height of 3m as well once established)	Moderate Significant
Residents of Gate Burton estate (Viewpoint 15)	Medium-High	Pronounced change to the composition of the view	Retention of open space between solar panels to retain viewing axis to Burton Wood	Moderate Significant
Vehicle users and residents along Marton Road (Viewpoint 17)	Low-Medium	Pronounced change to the composition of the view		
Vehicle users along Marton Road (Viewpoint 18)	Low-Medium	Pronounced change to the composition of the view	 Strengthening of existing hedgerows Additional hedgerow planting and increase of existing hedgerow height to 3m (new hedgerow planting will be maintained at a height of 3m as well once established) 	Moderate Significant

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10.11 Cumulative Effects

- 10.11.1 As stated in Section 10.4 Assessment Assumptions and Limitations above, the cumulative schemes are currently being agreed in consultation with Lincolnshire and Nottinghamshire County Council, and as such the cumulative effects will be reviewed following statutory consultation and fully addressed in the ES.
- 10.11.2 The Schemes identified in **Chapter 16: Cumulative Effects and Interactions** will be reviewed to determine if they give rise to cumulative landscape and visual effects. The assessment will be made with reference to the methodology and guidance set out in **Chapter 5: EIA Methodology** of the PEI Report.
- 10.11.3 At this stage, an initial review has been carried out for the West Burton Solar Farm Project¹ and the Cottam Solar Farm Project² which are being developed by Island Green Power (IGP) and are identified on **PEI Report Volume 2, Figure 13-6**. Discussions are currently on-going with IGP to allow a 'joined up' approach to be identified on the cumulative assessment methodology within the ES.
- 10.11.4 It should be noted that in addition to the above, the cumulative assessment within the ES will consider any other significant developments in the area. The cumulative assessment will identify for each receptor those areas where the predicted effects of the Scheme could interact with effects arising from other committed developments on a landscape and visual basis.
- 10.11.5 In summary, whilst a full cumulative assessment will be conducted within the ES, significant cumulative effects are anticipated at this stage.

West Burton Solar Farm

- 10.11.6 West Burton Solar Farm consists of four land parcels (as indicated by **PEI Report Volume 2**, **Figure 13-6**) and is expected to be constructed over a two-year period (starting in 2024 at the earliest), with a planned grid connection date of 2029.
- 10.11.7 West Burton Solar Farm parcels WB1, WB2 and WB3 are all located to the south of the A1500 Till Bridge Lane, towards Sturton-by-Stow, whereas WB4 is located to the south of the A631, to the east of Clayworth.
- 10.11.8 At this stage, it is anticipated that cumulative landscape and visual effects will likely arise in relation to parcel WB3 The level of effects identified for landscape and visual receptors due to the probable scale and location of this parcel may increase. This will be fully assessed as the ES progresses.
- 10.11.9 A summary of each parcel is set out below:

¹ https://infrastructure.planninginspectorate.gov.uk/projects/east-midlands/west-burton-solar-project/

² https://infrastructure.planninginspectorate.gov.uk/projects/east-midlands/cottam-solar-project/



Parcel WB1

10.11.10 Parcel WB1 is located to the south of the A1500 and is the smallest of the four parcels. It is located approximately 6.3km east / southeast of the DCO Site.

Parcel WB2

10.11.11 Parcel WB2 is located to the west of WB1 and to the south of the A1500. It is located approximately 3.3km east of DCO Site.

Parcel WB3

10.11.12 Parcel WB3 is located to the north-west of WB2, and to the south of the A1500. The Sheffield to Lincoln railway line dissects the land parcel in a south-east to north-west alignment. Parcel WB3 is located adjacent to the DCO Site, sections of the western parcel overlap with the Grid Connection Corridor of the DCO Site.

Parcel WB4

- 10.11.13 Parcel WB4 is located to the south of the A631, to the east of Clayworth. It is located approximately 9km northwest of DCO Site.
- 10.11.14 Further details related to West Burton Substation (point of connection into the National Grid) and the Grid Connection Route for West Burton Solar Farm will be provided within the ES when these details are available.

Cottam Solar Farm

- 10.11.15 Cottam Solar Farm consists of three land parcel sites (as indicated by **PEI Report Volume 2**, **Figure 13-6**) and is expected to be constructed over a two-year period (starting in 2024 at the earliest), with a planned grid connection date of 2028.
- 10.11.16 Cottam Solar Farm parcels C1, C2 and C3 are all located to the west of the A15 between Lincoln and Scunthorpe. At this stage, it is anticipated that cumulative landscape and visual effects will likely arise in relation to parcel C1. The level of effects identified for landscape and visual receptors due to the probable scale of this parcel may increase. This will be fully assessed in the ES.
- 10.11.17 A summary of each parcel is set out below:

Parcel C1

10.11.18 Parcel C1 is located to the north of the A1500 and is the largest of the three parcels. It is located approximately 1km east of DCO Site.

Parcel C2

10.11.19 Parcel C2 is located to the north of C1 and is located to the east of the village of Corringham, to the north of the A631. It is located approximately 6km northeast of DCO Site.



Parcel C3

- 10.11.20 Parcel C3 is located to the north of C2 and is split into two distinct areas, C3a is located around the village of Blyton (approximately 9.2km north / northeast of the DCO Site), whist C3b is located to the east of Pilham (approximately 8.2km north / northeast of the DCO site boundary).
- 10.11.21 Further details related to Cottam Substation (point of connection into the National Grid) and the Grid Connection Route for Cottam Solar Farm will be provided within the ES when these details are available.

Summary

10.11.22 In summary, whilst a full cumulative landscape and visual impact assessment will be provided within the ES. Significant cumulative landscape and visual effects may likely arise from West Burton Solar Farm parcel WB3 as well as Cottam Solar Farm parcel C1 due to their scale and location in relation to the DCO Site.



10.12 References

- Ref 10-1 Department of Energy and Climate Change (DECC), (2011) National Policy Statement for Energy (EN-1), Available at:

 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment data/file/47854/1938-overarching-nps-for-energy-en1.pdf
 [Date Accessed 12/04/2022]
- Ref 10-2 Department of Energy and Climate Change (DECC), (2011) National Policy Statement for Renewable Energy Infrastructure (EN-3). Available at:

 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/37048/1940-nps-renewable-energy-en3.pdf [Date accessed 26/04/2022]
- Ref 10-3 (DECC), (2011) National Policy Statement for Electricity Networks Infrastructure (EN-5), Available at:

 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/37050/1942-national-policy-statement-electricity-networks.pdf [Date Accessed: 12/04/2022]
- Ref 10-4 Department for Business, Energy and Industrial Strategy (2021) Draft Overarching National Policy Statement for Energy (EN1). Available at:

 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1015233/en-1-draft-for-consultation.pdf [Date Accessed: 26/04/2022]
- Ref 10-5 Department for Business, Energy and Industrial Strategy (2021) Draft National Policy Statement for Renewable Energy Infrastructure (EN-3). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment-data/file/1015236/en-3-draft-for-consultation.pdf [Date Accessed: 26/04/2022]
- Ref 10-6 Department for Business, Energy and Industrial Strategy (2021) Draft National Policy Statement for Electricity Networks Infrastructure (EN-5). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment-data/file/1015238/en-5-draft-for-consultation.pdf [Date Accessed: 26/04/2022]
- Ref 10-7 Not used.
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- Ref 10-9 MHCLG (2019) Planning Practice Guidance Natural Environment. Available at: https://www.gov.uk/guidance/natural-environment [Date Accessed: 21/04/2022].
- Ref 10-10 Landscape Institute and the Institute of Environmental Management and Assessment. (2013). Guidelines for Landscape and Visual Impact Assessment 3rd Edition.
- Ref 10-11 Landscape Institute (2019) Visual Representation of Development Proposals Technical Guidance Note 06/19. Available at:

 https://landscapewpstorage01.blob.core.windows.net/www-landscapeinstitute-org/2019/09/LI_TGN-06-19_Visual_Representation.pdf
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11. Noise and Vibration

11.1 Introduction

- 11.1.1 This chapter of the Preliminary Environmental Information (PEI) Report presents the findings of an assessment of the likely significant effects from Noise and Vibration as a result of the Scheme. For more details about the Scheme, refer to **Chapter 2: The Scheme** of this PEI Report.
- 11.1.2 This chapter assesses noise and vibration effects on human receptors and does not include the assessment of noise and vibration on ecological or heritage receptors. The impacts of noise and vibration on heritage receptors are assessed in **Chapter 7: Cultural Heritage** of the PEI Report. The impacts of noise and vibration on ecological receptors are assessed in **Chapter 8: Ecology and Biodiversity** of the PEI Report.
- 11.1.3 This chapter is supported by the following appendices in **PEI Report Volume** 3:
 - Appendix 11-A Legislation and Planning Policy;
 - Appendix 11-B Acoustic Terminology;
 - Appendix 11-C Baseline Noise Surveys;
 - Appendix 11-D Noise Modelling; and
 - Appendix 11-E Summary of Non-significant Effects.
- 11.1.4 This chapter is supported by the following figure in **PEI Report Volume 2**:
 - Figure 11-1 Site boundary, receptor locations and noise monitoring positions

11.2 Consultation

- 11.2.1 A request for an EIA Scoping Opinion was sought from the Secretary of State through the Planning Inspectorate in November 2021 as part of the EIA Scoping Process. Consultation responses in relation to Noise and Vibration, to date, are presented in **PEI Report Volume 3**: **Appendix 1-C**.
- 11.2.2 Consultation has been undertaken with West Lindsey District Council as the host authority. The following matters have been discussed:
 - The study area;
 - The approach to noise monitoring;
 - The construction noise and vibration assessment methodology; and
 - The operational noise assessment methodology.



11.3 Legislation and Planning Policy

- 11.3.1 Relevant policy documents are listed below. More detailed information regarding legislation and planning policy can be found in **PEI Report Volume** 3: Appendix 11-A.
- 11.3.2 Legislation to be considered includes:
 - Control of Pollution Act 1974 (Ref 11-1); and
 - Environmental Protection Act 1990 (Ref 11-2)
- 11.3.3 National planning policy and guidance to be considered includes:
 - National Planning Policy Framework (NPPF) (2021) (Ref 11-3);
 - National Planning Policy Statement EN-1 (2011) (Ref 11-4);
 - National Planning Policy Statement EN-3 (Ref 11-5);
 - Draft National Planning Policy Statement EN-1 (2021) (Ref 11-6);
 - Draft National Planning Policy Statement EN-3 (Ref 11-7);
 - National Policy Statement for England (NPSE) (Ref 11-8); and
 - Planning Practice Guidance Noise (PPGN) (Ref 11-9).
- 11.3.4 Local planning policy and guidance to be considered includes:
 - Central Lincolnshire Local Plan 2012-2036 (Ref 11-10);
 - Lincolnshire Minerals and Waste Local Plan including the Core Strategy & Development Management Policies Plan adopted in June 2006 (Ref 11-11):
 - Bassetlaw District Council Core Strategy and Development Management Policies DPD, adopted 22 December 2011 (Ref 11-12);
 - Nottinghamshire Minerals Local Plan (Ref 11-13); and
 - Nottinghamshire Waste Local Plan (Ref 11-14).

11.4 Assessment Assumptions and Limitations

11.4.1 This preliminary assessment is based on baseline and design information available at the time of writing this PEI Report. An initial assessment of the Solar and Energy Storage Park and the Grid Connection Route (together comprising the Scheme) has been undertaken as part of this PEI Report. The assessment will be developed and refined following statutory consultation and as additional information becomes available, with a final assessment presented within the Environmental Statement (ES).

Baseline Assumptions and Limitations

11.4.2 The measured ambient sound levels (taken in April 2022) have been considered as representative of the future baseline scenarios, with construction anticipated to commence in 2025 with a peak in 2026, operation to commence in 2028 and decommissioning to commence in 2088. No major developments (e.g. highway or railway schemes, industrial facilities) are assumed to be proposed in the area that are likely to notably alter the local baseline noise environment.



11.4.3 Any measurement of existing ambient or background sound levels will be subject to a degree of uncertainty. Environmental sound levels vary between days, weeks, and throughout the year due to variations in source levels and conditions, meteorological effects on sound propagation and other factors. Hence, any measurement survey can only provide a sample of the ambient levels. Every effort has been made such that measurements were undertaken in such a way as to provide a representative sample of conditions, such as avoiding periods of adverse weather conditions, and school holiday periods (which are often considered to result in atypical sound levels). However, a small degree of uncertainty will always remain in the values taken from such a measurement survey.

Construction Noise Assumptions and Limitations

- 11.4.4 The assessment of construction noise (and vibration) has considered construction activities that have the potential to result in significant effects on identified receptors, based on information presented in **Chapter 2: The Scheme** and previous experience of construction sites and professional judgement. These assessments are based on a reasonable representative worst-case scenario. The Applicant is considering further (a) whether design changes can be made to reduce these effects and the nature of those changes and (b) if additional mitigation can be provided to minimise or avoid significant effects. The results of this additional work will be presented in the ES.
- 11.4.5 Construction noise predictions have been undertaken using the computer modelling software CadnaA® (v2019) (Ref 11-15), based on an example schedule of plant items that are typically used in such developments for the purposes of carrying out a quantitative assessment at this stage. Construction plant are summarised in **PEI Report Volume 3: Appendix 11-D**.
- 11.4.6 Predictions have been undertaken using BS 5228:2014+A1:2019 'Code of practice for noise and vibration control on construction and open sites' (Ref 11-16) methodologies and AECOM library data of sound sources associated with the proposed construction activities. These sound sources are taken to be representative of the plant and/or activities that will be used during the construction process of the Scheme. Noise predictions were carried out to represent a conservative scenario where construction plant is operational nearest to the identified receptors and does not take into account quieter periods when limited activities take place or at further distances. Consequently, noise predictions may overestimate construction noise levels and are therefore considered to be a reasonable likely worst case.
- 11.4.7 As a piling method has not yet been finalised, it is assumed that piling will be to install auger piles, which is a typical approach in similar developments.
- 11.4.8 Noise effects during the decommissioning phase of the Scheme will be similar or less than noise effects during the construction phase. The noise assessment presented for the construction phase is therefore considered representative (or an overestimate) of the decommissioning phase. As such a separate assessment for noise from the decommissioning phase is not included.



Operational Assumptions and Limitations

- 11.4.9 A series of assumptions were made for the generation of the construction and operation noise models as follows:
 - Digital noise modelling of the operational Scheme has been based on the parameters set out in the drawings, plans, and construction and operation details as set out in Chapter 2: The Scheme;
 - Sound level data for operational noise-producing plant (i.e. inverters, transformers and BESS units) have been based on industry sound pressure level measurement data (see PEI Report Volume 3: Appendix 11-D);
 - Surrounding ground conditions have been modelled as soft (G=0.8).
 - Air temperature was assumed to be 10 degrees and humidity 70%, which are considered typical annual average weather conditions;
 - One order of reflection was modelled;
 - Land topography has been incorporated into the noise modelling; and
 - All receptor points have been set at a standard height of 1.5 m above local ground levels to calculate representative noise levels at sensitive receptors.
- 11.4.10 Operational noise has been predicted with all plant being in maximum operation at all times of day.
- 11.4.11 BESS cooling fans will also operate dependent on ambient temperatures and would not be in a full mode of operation during cooler temperatures.
- 11.4.12 Sound level data for transformers in reduced modes of operation is not available from manufacturers and therefore not available for the purposes of this assessment. Noise predictions are based on inverters and cooling fans operating at full load so are likely to be overestimated. Consequently, this is considered to represent a worst-case assessment scenario.

11.5 Study Area

11.5.1 The study area was defined to include Noise and Vibration features likely to be at risk from possible direct and indirect impacts that might arise from the Scheme, termed the Zone of Influence (ZoI). The potential ZoI is considered to be 500m from the Solar and Energy Storage Park Site and based on professional judgement. It is considered that receptors further than 500m will experience considerably lower levels of noise and vibration emissions as these will attenuate over distance, resulting in negligible noise and vibration effects from the Scheme; this is confirmed by the modelling output and conclusions in this chapter.

11.6 Assessment Methodology

Sensitive Receptors

11.6.1 Potential sensitive receptors (i.e. buildings whose occupants may be disturbed by adverse noise and vibration levels, and structures that are sensitive to vibration) have been taken into consideration when assessing the effects



- associated with noise and vibration levels from the construction and operational phases of the Scheme.
- 11.6.2 The type of receptors that may experience significant effects due to the construction and operation of the Scheme are identified in Table 11-1 as residential and non-residential.

Table 11-1 Receptor Types

Receptor Group	Receptors in Group
Residential	Individual dwellings and private open spaces (e.g. gardens)
Non-residential	Non-residential community facilities such as schools, hospitals, places of worship, and noise sensitive commercial properties

- 11.6.3 The effect of noise and vibration generated during the construction and operational phases of the Scheme are considered at nearby sensitive receptors. A number of receptors that may potentially be affected have been considered in this assessment. The sensitive receptors considered are the nearest receptors to the Site (i.e. the receptors that will experience the highest levels of noise and vibration). Although noise and vibration may be perceivable at other receptors in the area around the Scheme, effects will not be significant if they are suitably controlled at the identified receptors.
- 11.6.4 The identified noise-sensitive receptors are presented in **PEI Report Volume 2: Figure 11-1** and summarised in Table 11-2. The selection of receptors presented were agreed with LPAs through the scoping process.
- 11.6.5 Additionally, receptors along the proposed Grid Connection Route that may be impacted during construction activities have been considered in the assessment. As the Grid Connection Route is not finalised at this stage of the Scheme, receptors that may be affected by construction works cannot be identified. The assessment of construction noise effects will be finalised in the ES by identifying receptors located along the Grid Connection Route that are within the calculated distance that likely significant effects due to construction works may occur.

Table 11-2 Sensitive Receptors

Receptor Reference	Location	Description	Approximate Coordinates
R1	Knaith	Residential	53°21'13.04"N, 0°45'8.29"W
R2	Knaith Park	Residential	53°21'38.74"N, 0°44'11.30"W
R3	Kexby Lane Properties	Residential	53°21'38.69"N, 0°43'7.70"W
R4	Willingham by Stow	Residential	53°20'57.77"N, 0°41'26.87"W
R5	Stow Road Properties	Residential	53°20'37.99"N, 0°41'2.36"W



Receptor Reference	Location	Description	Approximate Coordinates
R6	Nursery House, Willingham Road	Residential	53°20'12.03"N, 0°42'31.56"W
R7	Sort Hills Farm, Willingham Road	Residential	53°19'57.09"N, 0°42'59.90"W
R8	Cedar Ridge, Willingham Road	Residential	53°19'54.95"N, 0°44'22.82"W
R9	Gate Burton	Residential	53°20'0.83"N, 0°44'33.77"W
R10	St Helen's Church, Gainsborough Road	Residential	53°20'10.93"N, 0°44'29.84"W
R11	Gate Burton Hall, Gainsborough Road	Residential	53°20'17.90"N, 0°44'37.35"W
R12	Rose Cottage, Gainsborough Road	Residential	53°20'25.59"N, 0°44'46.98"W
R13	Central Park Farm	Residential	53°21′5.22"N, 0°44′49.21"W
R14	White Hoses/ Dutch Cottage, Gainsborough Road	Residential	53°21′2.63"N, 0°45′14.21"W
R15	Sandy Barr Cottage, Marton Road	Residential	53°20'22.00"N, 0°42'13.82"W
R16	Sandybus Farm, Marton Road	Residential	53°20'13.53"N, 0°42'13.58"W
R17	Park Farm, Gainsborough Road	Residential	53°20′56.71″N, 0°42′26.26″W
R18	Clay Farm, Clay Lane	Residential	53°20'15.08"N, 0°43'26.70"W
R19	Park Farm South, Willingham Road	Residential	53°21'28.26"N, 0°43'46.35"W
R20	Marton	Residential	53°19'49.70"N, 0°44'29.37"W
R21	Keepers Cottage	Residential	53°21'3.74"N, 0°44'38.40"W
R22	Lea Fields Crematorium	Non-residential	53°21'36.29"N, 0°45'23.82"W

Baseline Noise Monitoring Methodology

11.6.6 Baseline noise monitoring has been carried out to establish the existing noise climate in the area. The monitoring procedures followed guidance from BS 7445-1:2003 'Description and environment of environmental noise – Part 1: Guide to quantities and procedures' (Ref 11-17) and BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' (Ref 11-18). All noise measurements included LAeq,T and LA90,T sound level indicators.



- 11.6.7 Letters were sent to residents of identified receptors to request access for noise monitoring. Where access was granted, noise monitoring was undertaken for one week from 20 to 26 April 2022. Where secure locations to safely leave noise monitoring equipment unattended could not be obtained noise measurements were undertaken for 24-hours from 13 to 14 April 2022.
- 11.6.8 Monitoring locations are shown in **PEI Report Volume 2: Figure 11-1** and summarised in Table 11-3. Based on their surroundings and relative distance to nearby sound sources (in particular road traffic), the monitoring locations have been allocated as representative of the local noise environment at each of the various noise-sensitive receptors (Table 11-3).

Table 11-3 Noise Monitoring Locations

Location Reference	Monitoring Period	Representative of Receptors
ML1	13/04/22 to 14/04/22	R8, R9, R10, R11, R12, R20
ML2	13/04/22 to 14/04/22	R1, R13, R14, R21, R22
ML3	20/04/22 to 26/04/22	R18
ML4	20/04/22 to 26/04/22	R6, R15, R16, R17
ML5	13/04/22 to 14/04/22	R4, R5
ML6	20/04/22 to 26/04/22	R2, R3, R19
ML7	13/04/22 to 14/04/22	R7

Sources of Information

- 11.6.9 The following sources of information were referenced for the noise and vibration assessment:
 - Aerial imagery of the site and surrounding area to define sensitive receptors and monitoring locations;
 - **PEI Report Volume 2: Figure 2-4**: Indicative Site Layout Plan for the noise model:
 - Plant noise source data were referenced from previous solar farm noise assessments;
 - Chapter 2: The Scheme for information on the operational Scheme and construction; and
 - Chapter 13: Transport and Access for information on construction traffic.

Impact Assessment Methodology

- 11.6.10 The NPSE sets definitions for 'significant adverse effects' and 'adverse effects' using the concepts:
 - Lowest Observed Adverse Effect Level (LOAEL) the level above which, as an average response, adverse effects on health and quality of life can be detected; and



 Significant Observed Adverse Effect Level (SOAEL) – the average response level above which, as an average response, significant adverse effects on health and quality of life occur.

11.6.11 The NPSE states that:

"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times".

11.6.12 Noise levels exceeding the SOAEL should be avoided as far as reasonably practicable. For noise levels exceeding the LOAEL, the NPSE states that:

"It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur".

- 11.6.13 All noise effects are local, only affecting nearby sensitive receptors, and are direct in nature; however, defining a likely effect and whether it is significant or not depends on the nature of a noise source. Likely effects have been defined based on guidance set out in national policy.
- 11.6.14 A new source of noise is assessed through the absolute noise level it generates at sensitive receptors. Where an exceedance of the defined SOAEL for each noise source occurs, it is an indication of a likely significant effect. However, where an existing noise source is changed (i.e. construction traffic changing road traffic noise levels), the assessment of the effect level due to the change in noise refers to guidance within DMRB and consideration of the absolute noise level based on national policy guidance.
- 11.6.15 Government policy for noise is based on community exposure response relationships and noise insulation of a typical dwelling. Consequently, an assessment based on LOAELs and SOAELs cannot be applied to non-residential sensitive receptors. As such, the approach to the assessment of non-residential receptors differs from that adopted for residential receptors. Non-residential receptors are considered on a case-by-case basis by considering the applicable design criteria for good internal noise levels.

Construction and Decommissioning Phase Overview of Works

- 11.6.16 For the purposes of assessing noise and vibration, the construction programme has been summarised into four scenarios that represent high noise generating activities. These activities are most likely to generate likely significant effects and are as follows:
 - Scenario 1 Construction of the BESS and main substation;
 - Scenario 2 Construction of inverters and transformers;
 - Scenario 3 Construction of PV modules: and
 - Scenario 4 Cable installation.



11.6.17 The earliest construction could start is Q1 2025 and construction will require an estimated 24 to 36 months. The majority of works activities would be completed under normal working hours/restrictions as shown in Table 11-4.

Table 11-4 Working Hours

Works	Working hours
Summer	07:00 – 19:00 Monday to Friday and Saturday 09:00-13:00 with no Sunday or Bank Holiday working.
Winter	08:00 – 18:00 Monday to Friday and Saturday 09:00-13:00 with no Sunday or Bank Holiday working.

- 11.6.18 Some works activities may need to occur out of these hours/times due to activities requiring to be undertaken continuously (such as HDD and cable jointing part of Scenario 4). Where work outside of times is necessary prior notification will be provided to the LPA.
- 11.6.19 Noise and vibration effects during the decommissioning phase of the Scheme will be similar to or less than noise effects during the construction phase; therefore, construction and decommissioning impacts are considered together. The noise assessment presented is considered representative (or an overestimate) of the decommissioning phase.

Construction of BESS

- 11.6.20 The following activities will be undertaken to construct the BESS:
 - Installation of electric cabling;
 - Construction of foundations;
 - Import of components to site;
 - Installation of transformers; and
 - Installation of battery, transformers, inverters and switchgear.

Installation of Inverters and Transformers

- 11.6.21 Solar farm infrastructure such as inverters and transformer stations will require the following steps prior to installation:
 - Excavation of the base;
 - Creation of concrete formwork for concrete foundation; and
 - · Concrete pour.

Construction of PV Modules

11.6.22 A supporting substructure of two 2.5 m piles will be required for every five PV modules installed. It is assumed that the piling method will be to install auger piles. Although the installation method of substructure for PV modules is yet to be confirmed, piling represents a reasonable worst case in terms of noise emissions.



Grid Connection Route

11.6.23 The proposed Grid Connection Route comprises an area within which the high voltage cables will be laid within the DCO Site, connecting the Solar and Energy Storage Park to Cottam Substation. It is proposed that the cables will be installed by a combination of open cut and trenchless methods. Open cut methods will be utilised more commonly across the underground cable route as it will be utilised when installing the cables within open agricultural land. It is assumed that trenchless methods are likely to be HDD and will be utilised under the River Trent.

Prediction Methodology

- 11.6.24 Noise levels experienced by sensitive receptors during such works depend upon several variables, the most significant of which are:
 - the noise generated by plant or equipment used on site, generally expressed as sound power levels (Lw) or the vibration generated by the plant;
 - the periods of use of the plant on site, known as its on-time;
 - the distance between the noise/vibration source and the receptor;
 - the noise attenuation due to ground absorption, air absorption and barrier effects:
 - in some instances, the reflection of noise due to the presence of hard surfaces such as the sides of buildings; and
 - the time of day or night the works are undertaken.

Construction and Decommissioning Noise Criteria

11.6.25 Annex E of BS 5228-1 provides example methods for the assessment of the significance of construction noise effects. With reference to the NPSE, the LOAEL and SOAEL thresholds have been set in Table 11-5below.

Table 11-5 Thresholds of Potential Effects of Construction Noise at Residential Buildings

Time Period	Threshold Value (L _{Aeq,T} dB)			
	LOAEL	SOAEL	UAEL	
Day (07:00 – 19:00) Saturday (07:00 – 13:00)	65	75	85	
Evening (19.00 – 23.00) Weekends (13.00–23.00 Saturdays and 07.00–23.00 Sundays)	55	65	75	
Night (23.00 – 07.00)	45	55	65	

a) These effects are expected to occur if the programme of works indicates that the relevant threshold values are likely to be exceeded over a period of at least one month. The values apply to a location one metre from a residential building façade containing a window, ignoring the effect of the acoustic reflection from that façade.



- 11.6.26 Although there is currently a lack of evidence relating to health effects to construction noise, the method for assessing construction noise effects is defined based on the current industry standard approach followed in DCOs¹.
- 11.6.27 In terms of sound insulation or temporary rehousing due to construction noise, BS 5228-1 states that a property would be eligible if exposed to significant levels of noise "for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months". Consequently, these durations will be considered where a significant effect is identified.

Construction and Decommissioning Vibration

11.6.28 BS 5228-2 provides further guidance on the perception of vibration within occupied buildings. This provides a simple method of determining annoyance alongside evaluation of cosmetic damage associated with construction and decommissioning induced vibration. Table 11-6 details Peak Particle Velocity (PPV) levels (a standard measure of vibration effects) and their potential effect on humans.

Table 11-6 Criteria for Construction and Decommissioning Vibration (Human Response)

Magnitude of Impact	PPV Vibration Level	BS 5228-2 Description of Impact
LOAEL	0.3 mm/s	Vibration might be just perceptible in residential environments.
SOAEL	1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but it can be tolerated if prior warning and explanation has been given to residents.

11.6.29 The recommended PPV vibration limits for transient vibration, above which cosmetic damage could occur for different types of buildings are provided in BS 5228-2 and presented in Table 11-7. For these limits, 'minor damage' is possible at vibration magnitudes that are greater than twice those given in Table 11-7, and 'major damage' can occur at values greater than four times the tabulated values. Consequently, the significance of effect has been provided based on the sensitivity of a building to vibration induced cosmetic damage. Cosmetic damage would precede the onset of any structural damage.

Table 11-7 Criteria for Construction and Decommissioning Vibration (Cosmetic Building Damage)

Type of building	Peak component particle velocity in frequency range of predominant pulse, at which cosmetic damage could occur		
	4 Hz to 15 Hz	4 Hz to 15 Hz	
Reinforced or framed structures, Industrial	50 mm/s at 4 Hz and above	50 mm/s at 4 Hz and above	

¹ For example High Speed 2, Longfield Solar Farm, A14 Cambridge to Huntingdon and Thames Tideway



Type of building	Peak component particle velocity in frequency range of predominant pulse, at which cosmetic damage could occur		
	4 Hz to 15 Hz	4 Hz to 15 Hz	
and heavy commercial buildings			
Industrial and heavy commercial buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above	

Note 1: A potential negligible effect (not significant) is indicated at vibration levels up to the threshold values.

Note 2: A potential minor adverse effect (not significant) is indicated at vibration levels up to a magnitude of twice the threshold values.

Note 3: A potential moderate adverse effect (significant) is indicated at vibration levels up to a magnitude of four times the threshold values.

Note 4: A potential major adverse effect (significant) is indicated at vibration levels equal to or greater than a magnitude of four times the threshold values.

Determining a Construction and Decommissioning Noise and Vibration Effect

- 11.6.30 Although a significant effect due to construction activities may be determined through an assessment based on exceedances of the defined SOAELs for construction noise and vibration, additional consideration of the overall significance of the effect for temporary construction activities will be provided through qualitative discussion of the following:
 - Duration of temporary likely effects:
 - Frequency of events; and
 - Sensitivity of receptor.

Construction and Decommissioning Traffic Noise

- 11.6.31 During the peak construction period, there will be up to 60 HGV deliveries and 30 light vehicles on the strategic road network. Traffic during decommissioning is expected to be similar (or lesser) to the construction phase. Construction and decommissioning traffic noise have been assessed for a representative worst-case day during the construction stage based on information in **Chapter 2: The Scheme**. Predicted construction traffic noise levels along the main access routes have been compared to measured ambient noise levels so a potential change in noise can be derived.
- 11.6.32 Road traffic noise levels have been calculated with reference to methodology within the Calculation of Road Traffic Noise (CRTN) (Ref 11-19), which contains an equation for the calculation of the Basic Noise Level (BNL) from a road in terms of the 18-hour Average Annual Weekday Traffic (AAWT) flow from 06:00 to 24:00. The temporary changes in road traffic noise levels along the local road network due to construction traffic have been assessed based on short-term changes in noise from Table 3.54a of the Design Manual for Roads and Bridges LA111 (Ref 11-20). Assessment criteria are presented in Table 11-8.



Table 11-8 Construction Traffic Noise Assessment Criteria

Effect Level	Magnitude criteria	
Negligible	≥ 0 dB and < 1 dB	
Minor	≥ 1 dB and < 3 dB	
Moderate	≥ 3 dB and < 5 dB	
Major	≥ 5 dB	

11.6.33 DMRB defines the LOAEL as 55 dB L_{A10,18h} and the SOAEL as 68 dB L_{A10,18h}. DRMB goes on to state that:

"Where any do-something absolute noise levels are above the SOAEL, a noise change in the short term of 1.0dB or over results in a likely significant effect".

11.6.34 This implies that receptors experiencing noise levels exceeding the SOAEL are more sensitive to smaller changes in noise than receptors experiencing absolute noise levels below the SOAEL. As the BNL is calculated at 10 m from the roadside, the absolute noise level is not considered to be representative of what nearby receptors may experience; however, it is appropriate for defining a change in noise level. Should an increase in noise of greater than 1 dB be identified from a road where the BNL exceeds the SOAEL, additional calculations are undertaken to identify the absolute noise levels at nearby receptors and the likelihood of significant effects.

Operational Noise

- 11.6.35 Noise predictions of the operational Scheme have been undertaken using CadnaA®, which implements the calculation procedures of ISO 9613 'Acoustics Attenuation of Sound During Propagation Outdoors' (Ref 11-21), to predict the propagation of noise away from the Scheme in all directions and to quantify resultant noise levels at the identified noise sensitive receptor locations.
- 11.6.36 Operational noise has been assessed following BS 4142 guidance, whereby the rating level of noise emissions from activities are compared against the background level of the pre-development noise climate. Source data for operational noise emissions is presented in **PEI Report Volume 3: Appendix 11-D**. The relevant parameters in this instance are as follows:
 - Background sound level LA90,T defined in the Standard as the 'A' weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels;
 - Specific sound level LAeq,Tr the equivalent continuous 'A' weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr; and
 - Rating level L_{Ar,Tr} the specific sound level plus any adjustment made for the characteristic features of the noise.



- 11.6.37 BS 4142 recognises that certain acoustic features of a sound source can increase the impact over that expected based purely on the sound level. The standard identifies the following features to be considered:
 - Tonality a penalty of 2 dB is applied for a tone which is just perceptible at the receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible;
 - Impulsivity a penalty of 3 dB is applied for impulsivity which is just perceptible at the receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible. An impulse is defined as the sudden onset of a sound;
 - Intermittency a penalty of 3 dB can be applied if the intermittency of the specific sound is readily identifiable against the residual acoustic environment at the receptor i.e. it has identifiable on/off conditions; and
 - Other sound characteristics a penalty of 3 dB can be applied where the specific sound features characteristics that are neither tonal nor impulsive but are readily distinctive against the residual acoustic environment.
- 11.6.38 BS 4142 states the following regarding the assessment of impacts, comparing the rating level of the new noise source with the existing background level:
 - "Typically, the greater this difference, the greater the magnitude of the impact.
 - A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
 - A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
 - The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."
- 11.6.39 BS 4142 advises that where rating levels and background levels are low, which is the case in rural areas surrounding the DCO Site Boundary, the assessment of operational noise should take into context the absolute noise level. BS 8233:2014 Guidance on sound insulation and noise reduction for buildings. (Ref 11-22) and the World Health Organization (WHO) 'Guidelines for Community Noise' (1999) (Ref 11-23) provide guidance levels for internal noise within dwellings and external noise levels in gardens. For gardens, a precautionary approach has been taken when defining the LOAEL by applying a minimum LOAEL of 35 dB LAeq,T, which is applicable for relaxation within a property. A similar approach has been taken for night-time noise when defining the minimum LOAEL of 30 dB LAeq,T. However, at night, residents are likely to be inside their properties. Assuming that a partially open window attenuates noise by 15 dB an external SOAEL 45 dB LAr,Tr during the night-time.
- 11.6.40 The assessment criteria for noise from fixed plant installations in low background noise environments are summarised in Table 11-9.



Table 11-9 Operational Noise Assessment Criteria

Effect Level	Rating Level (External) at Receptor, L _{Ar,Tr}		
	Daytime (07:00-19:00) and Evening (19:00-23:00)	Night-time (23:00-07:00)	
LOAEL	Less than or equal to the typical background level ($L_{\rm A90,T}$) – minimum of 35 dB $L_{\rm Ar,Tr}$	Less than or equal to the typical background level $(L_{A90,T})$ – minimum of 30 dB $L_{Ar,Tr}$	
SOAEL	Greater than 10 dB above the background noise level – minimum of 45 dB L _{Ar,Tr}	Greater than 10 dB above the background noise level – minimum of 45 dB L _{Ar,Tr}	

Non-Residential Receptors

11.6.41 Design guides for good internal conditions in non-residential receptor are usually set indoors. The only non-residential receptor in this assessment is a crematorium, which design criterion from BS 8233: 2014 for place of worship, counselling, meditation or relaxation is considered applicable. This design criterion is a range of 30-35 dB LAeq,T. Assuming that the crematorium may have doors or windows open at some points during the year, the maximum external noise level (assuming 15 dB attenuation for a partially open door or window) before the design criterion would be exceeded would be 50 dB LAeq,T. Should this level be exceeded, additional mitigation measures may be required for the crematorium to continue to operate.

11.7 Baseline Conditions

11.7.1 This section describes the baseline environmental characteristics for the Scheme and surrounding areas with specific reference to Noise and Vibration. Further details of the methodology and results of the baseline noise surveys are presented in **PEI Report Volume 3: Appendix 11-C**.

Existing Baseline

- 11.7.2 During the surveys the dominant noise source at the majority of the locations was observed to be road traffic from the surrounding road network. Additionally, at ML3 and ML7, train movements had a substantial contribution to the noise environment. Local noise sources that influence noise conditions are fauna, farming activities and local resident activities.
- 11.7.3 A summary of the noise monitoring results is presented in Table 11-10. Typical ambient (L_{Aeq,1h}) and background (L_{A90,1h}) sound levels are presented for the daytime, evening and night for weekdays at locations that 24-hour monitoring was undertaken and both weekdays and weekends for week-long monitoring locations.

Table 11-10 Summary of Baseline Noise Monitoring Results

Location Reference	Sound Level Indicator	Day (07:00 – 19:00)	Evening (19:00 – 23:00)	Night (23:00 – 07:00)
N 41 - 4	$L_{Aeq,1h}$	47	44	46
ML1 -	L _{A90,1h}	41	37	29



Location Reference	Sound Level Indicator	Day (07:00 – 19:00)	Evening (19:00 – 23:00)	Night (23:00 – 07:00)
MLO	L _{Aeq,1h}	51	52	52
ML2 -	L _{A90,1h}	39	35	31
ML3 -	L _{Aeq,1h}	57	55	56
IVIL3 -	L _{A90,1h}	32	26	26
ML4 -	L _{Aeq,1h}	48	40	40
IVIL4	L _{A90,1h}	37	32	32
ML5 -	L _{Aeq,1h}	54	48	44
IVILO	L _{A90,1h}	36	28	24
ML6 -	$L_{Aeq,1h}$	49	42	39
IVILO -	L _{A90,1h}	36	27	24
NAL 7	L _{Aeq,1h}	53	49	44
ML7 -	L _{A90,1h}	39	33	32

Future Baseline

- 11.7.4 The future baseline scenarios are set out in **Chapter 5: EIA Methodology**. In the absence of the Scheme it is considered that the future baseline noise environment will be higher than represented by the April 2021 measurement ambient sound levels. This is due to natural growth of road traffic flows resulting in increased noise in the local area.
- 11.7.5 The assessment of construction traffic noise effects accounts for the future peak construction year, which includes natural traffic growth. However, the operational noise assessment assumes that the measured baseline data is representative (i.e. no higher) than future baseline conditions.

11.8 Potential Effects

- 11.8.1 Potential noise and vibration effects during the construction and decommissioning phases are likely to include works activities associated with site preparation, plant installation, substation construction, cable laying, and construction-related vehicle movements within the DCO Site boundary and along access routes.
- 11.8.2 The potential noise effects during operation of the Scheme are likely to include noise from solar farm plant (e.g. inverters, transformers) and associated BESS plant (e.g. cooling units, transformers), the on-site substation (e.g. transformers), and any associated vehicle movements.
- 11.8.3 Plant items such as solar PV modules, PV module mounting structures, and cabling (both onsite and via the cable route) will not produce any operational noise emissions.
- 11.8.4 No major vibration sources are envisaged to be introduced as part of the Scheme and as such there will be no associated operational vibration effects.



11.8.5 It is proposed that operational vibration is scoped out of any further assessment (as agreed with the Planning Inspectorate in the Scoping Opinion **PEI Report Volume 3: Appendix 1-B**).

11.9 Mitigation Measures

11.9.1 The following embedded and additional measures have been incorporated into the Scheme design, with detailed proposals and locations to be submitted with the DCO application, shown in Table 11-11.

Table 11-11 Mitigation Categories

Category	Assessment	Description	Gate Burton Examples
Embedded	Factored into determining significant effects.	These form an integral, committed and deliverable part of the scheme design or standard construction practices and will be included within the DCO application.	Location of transformers to minimise noise effects at residential receptors Screening and planting design Selecting of quiet plant CEMP/ DEMP
Additional	Factored into determining residual significant effects.	Additional measures where standard (embedded) measures aren't not sufficient to avoid significant effects. Committed and deliverable as part of the Scheme and will be included within the DCO application.	None

Construction and Decommissioning

- 11.9.2 Measures to control noise as defined in Annex B of BS 5228-1 and measures to control vibration as defined in Section 8 of BS 5228-2 will be adopted where reasonably practicable. These measures represent BPM will be secured within a Framework Construction Environmental Management Plan (CEMP) for the construction phase and a Framework Decommissioning Environmental Management Plan (DEMP) for the decommissioning phase. BPM that will be implemented during construction works and secured through the Framework CEMP and Framework DEMP are presented below:
 - Ensuring that all appropriate processes, procedures and measures are in place to minimise noise before works begin and throughout the construction programme;
 - All contractors to be made familiar with current legislation and the guidance in BS 5228 (Parts 1 and 2) which should form a prerequisite of their appointment;
 - Where reasonably practicable, noise and vibration are controlled at source (e.g. the selection of inherently quiet plant and low vibration equipment), review of the construction programme and methodology to consider quieter methods, consideration of the location of equipment on-site and control of working hours;



- Use of modern plant, complying with applicable UK noise emission requirements;
- Hydraulic techniques for breaking to be used in preference to percussive techniques, where reasonably practicable;
- Drop heights of materials will be minimised;
- Plant and vehicles will be sequentially started up rather than all together.
- Off-site pre-fabrication where reasonably practicable;
- Use of screening locally around significant noise producing plant and activities:
- Regular and effective maintenance by trained personnel will be undertaken to keep plant and equipment working to manufacturer's specifications;
- All construction plant and equipment to be properly maintained, silenced where appropriate, operated to prevent excessive noise and switched off when not in use:
- Loading and unloading of vehicles, dismantling of site equipment or moving equipment or materials around the Order limits to be conducted in such a manner as to minimise noise generation, as far as reasonably practicable;
- All vehicles used on-site shall incorporate reversing warning devices as opposed to the typical tonal reversing alarms to minimise noise disturbance where reasonably practicable;
- Provision of information to the relevant local authority and local residents to advise of potential noisy works that are due to take place;
- Unnecessary revving of engines will be avoided, and equipment will be switched off when not in use; and
- Plant will always be used in accordance with manufacturers' instructions.
 Care will be taken to site equipment away from noise-sensitive areas.
 Where possible, loading and unloading will also be carried out away from such areas.
- 11.9.3 A construction noise monitoring scheme shall be developed as per requirements of the CEMP following appointment of a principal contractor and prior to commencement of construction works. Requirements for monitoring during the decommissioning stages will be outlined in the DEMP.
- 11.9.4 Noise complaints will be monitored and reported to the Applicant for immediate investigation and action. A display board will be installed on-site and a website will be set up. These will include contact details for the Site Manager or alternative public interface with whom nuisance or complaints can be lodged. A logbook of complaints will be prepared and managed by the Site Manager.
- 11.9.5 The effect of noise and vibration on nearby sensitive receptors can be minimised through a good communication strategy. Prior to construction works being undertaken, liaison will be undertaken with occupiers of sensitive receptors that may be adversely affected by construction noise and vibration. All communications will contain contact details to direct any questions or complaints to.
- 11.9.6 Consideration has been given to traffic routing, timing and access points to the Scheme to minimise noise impacts at existing receptors as detailed in **Chapter 13: Transport and Access**. Management of Heavy Goods Vehicles



(HGV) on the highway network will be managed through a Framework Construction Traffic Management Plan (CTMP) as outlined in **Chapter 2: The Scheme**. Appropriate routing of construction and decommissioning traffic on public roads and along access tracks will be pursuant to the CTMP.

Operation

- 11.9.7 The proposed Scheme minimises operational impacts by:
 - Locating the BESS compound in an area away from large concentrations of receptors such that noise emissions from the BESS are less impactful; and
 - Transformers will be housed in cabins, which will attenuate noise emissions.
- 11.9.8 Embedded mitigation measures that will be applied are summarised as follows:
 - Plant selection (quiet as possible);
 - Screening of noise sources; and
 - Design of layout including locating inverters and transformers.
- 11.9.9 Plant that will be used in the development has not yet been finalised. Consequently, a conservative approach has been taken when defining sound data for noise sources and it may be possible that quieter plant can be incorporated into the final design. Quieter plant would be the most effective way of controlling noise emissions.
- 11.9.10 Consideration of how the layout influences noise levels at receptors may allow a further reduction in noise to be achieved. However, the redistribution of noise may affect other receptors so testing will be undertaken when considering alternative layouts.
- 11.9.11 These embedded mitigation measures will be covered in more detail in the ES.
- 11.9.12 Low frequency noise can be very difficult to predict with a high level of certainty and similarly hard to identify and resolve if present. This is because it can be generated by the unexpected interactions between system components and can be amplified by the geometry of the site and receptor buildings. The issue of low frequency noise will be considered throughout the Front End Engineering Design for the substation and eliminated through design, or appropriately mitigated (isolation and attenuation measures) where appropriate.

Enhancement

11.9.13 No enhancement measures are proposed during construction, operation or decommissioning following the incorporation of the embedded measures described above.



11.10Assessment of Likely Impacts and Effects

11.10.1 Taking into account the committed avoidance and embedded mitigation measures as detailed in Section 11.9 above, the potential for the Scheme to generate effects was assessed using the methodology as detailed in Section 11.6 of this Chapter.

Construction (2025 to 2027) and Decommissioning (2088)

Construction Noise Effects

- 11.10.2 This section discusses the potential noise and vibration effects on sensitive receptors arising during the construction phase of the Scheme. The indicative programme and duration of likely installation methods are described in **Chapter 2: The Scheme**.
- 11.10.3 Noise predictions have been undertaken for Scenarios 1, 2 and 3. The results of construction noise predictions are summarised in Table 11-12. For Scenario 4, as the exact cable route has not been finalised, details of distances from cable laying activities at which likely significant effects may occur are provided. Scenario 4 will be assessed in more detail in the ES.

Indicative Free-Field Construction Noise Levels During Daytime Construction

Table 11-12 Construction Noise Prediction

Receptor Reference	Activity (dB L _{Aeq,12h})				
Reference	Scenario 1	Scenario 2	Scenario 3		
R1	43	25	56		
R2	42	32	64		
R3	41	32	65		
R4	37	29	60		
R5	36	26	55		
R6	42	36	68		
R7	42	32	66		
R8	44	26	59		
R9	45	26	59		
R10	47	29	65		
R11	49	30	66		
R12	48	29	64		
R13	46	28	59		
R14	42	23	56		
R15	41	34	69		
R16	40	33	67		
R17	42	32	68		



Receptor Reference

Indicative Free-Field Construction Noise Levels During Daytime Construction Activity (dB $L_{\text{Aeq},12h}$)

Reference	Scenario 1	Scenario 2	Scenario 3		
R18	48	37	71		
R19	44	31	63		
R20	40	22	54		
R21	49	31	65		
R22	49	38	27		

- 11.10.4 For Scenarios 1 and 2, noise predictions at sensitive receptors indicate that the LOAEL will not be exceeded.
- 11.10.5 For Scenario 3, construction activities will take place in close proximity to sensitive receptors, so the LOAEL is predicted to be exceeded at R6, R7, R11, R15, R16, R17 and R18. The SOAEL is not predicted to be exceeded at any receptor.
- 11.10.6 For Scenario 4, noise predictions indicate that receptors within approximately 45 m of the Grid Connection Route may experience noise levels exceeding the LOAEL and receptors within 15 m may experience noise levels exceeding the SOAEL. Receptors within these distances from the Grid Connection Route will be identified in the ES.
- 11.10.7 Predicted noise levels at R22 (crematorium) are below the threshold for 50 dB L_{Aeq,T}, which is considered to represent the level for potential disturbance. Consequently, no additional mitigation measures are required.
- 11.10.8 No significant construction or decommissioning noise effects are identified; however, this depends on the final cable route as receptors within 15m may experience significant noise effects. Any receptors experiencing significant noise effects due to Grid Connection Route works will be identified in the ES.
- 11.10.9 Occupants of nearby receptors are likely to be more tolerable of high noise events if they are regularly communicated to and kept informed of timings and duration of high noise generating events. Paragraph 6.3 of BS 5228-1 states that
 - "Local residents might be willing to accept higher levels of noise if they know that such levels will only last for a short time".
- 11.10.10 Consequently, the communication strategy secured through the CEMP and DEMP will ensure that occupants of affected properties will be notified of the timings and duration of works. As cable laying works are unlikely to occur for a period of 10 or more days in close proximity to sensitive receptors, noise effects due to construction and decommissioning activities are not considered to be significant.



Construction and Decommissioning Vibration Effects

- 11.10.11 It is generally accepted that, without a highly detailed understanding of the media, waveform, and frequency distribution, ground-borne vibration prediction methods are "beset with complexities and uncertainties" (Ref 11-24). However, it is unlikely that typical construction and decommissioning working routines would generate levels of vibration at local receptors at a level where cosmetic damage would be expected to be sustained or cause adverse effects for local residents. The level of impact at different receptors will be dependent upon a number of factors including distance between the works, ground conditions and the specific activities being undertaken. Consequently, vibration effects are defined with reference to information in guidance documents identified in the following paragraph.
- 11.10.12 Surface plant, such as cranes, compressors and generators, are not recognised as sources of high levels of ground-borne vibration. Reference to Figure C2 of 'Control of Vibration and Noise During Piling' (Ref 11-25) confirms that PPVs significantly less than 5 mm/s are generated by such machinery, even at distances of only 10 m. For example, the indication is that a bulldozer would generate a PPV of approximately 0.6 mm/s and a 'heavy lorry on [a] poor road surface' a PPV of less than 0.1 mm/s at 10 m. These values are well below levels at which cosmetic building damage are predicted to occur; the lower levels being 15 mm/s for predominantly transient vibrations and 7.5 mm/s for continuous vibrations at the base of residential or lighter framed commercial buildings. The aforementioned values are also below the 1.0 mm/s SOAEL (see Table 11-6) where it is likely that vibration in residential environments will result in complaints but can be tolerated if prior warning and explanation is given to residents.
- 11.10.13 Unless piling is undertaken at distances of approximately 25 m or less to a vibration sensitive building, it is considered that construction vibration would not result in a likely significant effect. Piling is proposed to be used for construction of PV Modules. The minimum distance between any piling works for the construction of the Converter Station and the nearest receptor Woodland Cottage is approximately 80 m and, therefore, ground borne vibration is unlikely to be an issue during piling works.
- 11.10.14 Accordingly, at this stage and without mitigation, it is anticipated that the vibration at nearby sensitive receptors would be below the SOAEL and **not significant** for all construction and decommissioning activities.

Construction and Decommissioning Traffic Noise Effects

11.10.15 The potential changes in road traffic noise from these roads as a result of the Scheme have been considered by calculating the CRTN BNL at 10 m from the road and comparing the change. Table 11-13 presents the results of the assessment.

Table 11-13 Construction Traffic Noise Assessment

Road Link

Baseline BNL Change in BNL Change



A156 Gainsborough Road (south of Kexby Lane)	72.0	72.1	+0.1	Negligible
A156 Gainsborough Road (south of Willingham Road)	70.7	70.9	+0.2	Negligible
Clay Lane (east of A156)	40.5	40.5	0.0	Negligible
Willingham Road (east of A156)	53.1	53.1	0.0	Negligible
A1500 Stow Park Road (east of A156)	68.7	68.7	0.0	Negligible
High Street (east of Marton Road)	62.1	62.1	0.0	Negligible
B1241 Gainsborough Road (south of Kexby Lane)	65.1	65.3	+0.2	Negligible
Marton Road (south of Gainsborough Road)	52.5	53.9	+1.4	Minor Adverse
B1241 Kexby Lane (east of Upton Road)	62.3	63.2	+0.9	Negligible
A156 Gainsborough Road (north of Kexby Lane)	70.1	70.3	+0.2	Negligible
Cottam Road (Outgang Lane)	61.5	61.5	0.0	Negligible
Headstead Bank (north of Cottam Road)	52.1	52.1	0.0	Negligible
B1241 High Street (north of A1500)	64.3	64.3	0.0	Negligible
A1500 Tillbridge Road (east of High Street)	67.1	67.1	0.0	Negligible
Saxilby Road (south of A1500)	65.0	65.0	0.0	Negligible

11.10.16 Noise calculations indicate that construction traffic will result in a Negligible noise effect on all road links with the exception of Marton Road, where construction traffic is calculated to result in a **minor adverse** noise effect. Changes in noise due to construction traffic are **not significant**.

Operation (2028 to 2087)

Operational Noise Effects

- 11.10.17 For the assessment of operational noise during the daytime (07:00 to 19:00 hours in the summer and 08:00 to 18:00 in the winter), the typical background level has been defined from a Sunday daytime period with lower noise levels compared to a weekday or Saturday, as to provide a worst-case assessment scenario. It has been assumed that all plant is in operation continuously during the daytime.
- 11.10.18 Plant will operate continuously so there will not be any noticeable impulsive or intermittent characteristics from plant noise emissions experienced at the



surrounding receptors. Transformers within the BESS compound can have tonal features, although noise emissions from the BESS will be dominated by the cooling fans such that any tonal features of the transformers will not be noticeable. However, overall plant noise emissions will likely be experienced at receptors as a distinctive continuous and steady hum; therefore a 3 dB correction to account for noise that is 'distinctive against the residual acoustic environment' has been applied in determining the rating level.

- 11.10.19 Details of the calculations are provided in **PEI Report Volume 3: Appendix 11-D.**
- 11.10.20 As the night-time period provides the most onerous assessment criteria and operational noise is assumed to be consistent, the assessment presented in Table 11-4 consider night-time noise only. The assessment presented in the ES will cover day, evening and night periods.

Table 11-14 Operational Noise Effects

Receptor Reference	Lowest Measured Background Level L _{A90,1h} dB	LOAEL/ SOAEL	Predicted Rating Level L _{Ar,Tr} dB	Effect Level	Significance
R1	31	31 / 45	37	Between LOAEL and SOAEL	Not significant
R2	24	30 / 45	44	Between LOAEL and SOAEL	Not significant
R3	24	30 / 45	44	Between LOAEL and SOAEL	Not significant
R4	24	30 / 45	41	Between LOAEL and SOAEL	Not significant
R5	24	30 / 45	36	Between LOAEL and SOAEL	Not significant
R6	32	32 / 45	44	Between LOAEL and SOAEL	Not significant
R7	32	32 / 45	45	Between LOAEL and SOAEL	Not significant
R8	29	30 / 45	39	Between LOAEL and SOAEL	Not significant
R9	29	30 / 45	39	Between LOAEL and SOAEL	Not significant
R10	29	30 / 45	42	Between LOAEL and SOAEL	Not significant
R11	29	30 / 45	44	Between LOAEL and SOAEL	Not significant
R12	29	30 / 45	43	Between LOAEL and SOAEL	Not significant
R13	31	31 / 45	41	Between LOAEL and SOAEL	Not significant



Receptor Reference	Lowest Measured Background Level L _{A90,1h} dB	LOAEL/ SOAEL	Predicted Rating Level L _{Ar,Tr} dB	Effect Level	Significance
R14	31	31 / 45	36	Between LOAEL and SOAEL	Not significant
R15	32	32 / 45	43	Between LOAEL and SOAEL	Not significant
R16	32	32 / 45	45	Between LOAEL and SOAEL	Not significant
R17	32	32 / 45	45	Between LOAEL and SOAEL	Not significant
R18	26	30 / 45	44	Between LOAEL and SOAEL	Not significant
R19	24	30 / 45	44	Between LOAEL and SOAEL	Not significant
R20	29	30 / 45	36	Between LOAEL and SOAEL	Not significant
R21	31	31 / 45	43	Between LOAEL and SOAEL	Not significant
R22	31	-	37	-	-

- 11.10.21 At all receptors, the LOAEL is exceeded but the SOAEL is not. The NPSE states...
 - "...all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur".
- 11.10.22 Reasonable steps to reduce noise are covered in the embedded mitigation section and have been applied in noise predictions. Consequently, NPSE requirements are complied with through provision of embedded mitigation.
- 11.10.23 At R22 (crematorium) the predicted rating level of 37 dB L_{Ar,Tr} does not exceed the threshold that may cause disturbance.

11.11 Residual Effects and Conclusions

11.11.1 This section summarises the residual significant noise effects of the Scheme following the implementation of additional mitigation during the operational phase. Significant residual effects are defined in accordance with national noise policy as an exceedance of the SOAEL. The SOAELs for each assessment topic are defined in Table 11-5 (Scheme construction and decommissioning noise), Table 11-6 (Scheme construction and decommissioning vibration) and Table 11-9 (Scheme operation). The exception to this is the assessment of construction traffic noise, is assessed as the magnitude of change of road traffic noise (see Table 11-8).



11.11.2 No significant noise or vibration effects are predicted during the construction phase or the operational phase. Please see **PEI Report Volume 3: Appendix 11-F** for a summary of non-significant residual effects.



11.12 Cumulative Assessment

- 11.12.1 The cumulative schemes are currently being agreed in consultation with Lincolnshire and Nottinghamshire County Council, and as such the cumulative effects will be reviewed following statutory consultation and fully addressed in the ES.
- 11.12.2 Cumulative noise effects during construction and operation phases may occur when developments are within 500m of a common receptor. At greater distances, any noise emissions would be attenuated such that there would normally be no combined effect.
- 11.12.3 At this stage of the PEI Report, developments that may give rise to cumulative noise effects with the Scheme have not yet been fully assessed. A list of relevant developments is presented in **Chapter 16: Cumulative Effects and Interactions**. The cumulative assessment methodology is presented within **Chapter 5: EIA Methodology**. Cumulative noise effects will be assessed in the ES.
- 11.12.4 It is therefore not possible to definitely state the significance of cumulative impacts, however based on an initial review of the list and their nature and distance from the DCO Site, it is not expected that cumulative schemes would elevate any of the residual effects identified in this assessment. However, the cumulative effect of any cumulative schemes within 500m of the DCO Site will be reviewed as part of the ES.



11.13 References

- Ref 11-1 Her Majesty's Stationery Office (1974); Control of Pollution Act.
- Ref 11-2 Her Majesty's Stationery Office (1995); Environmental Protection Act.
- Ref 11-3 Ministry of Housing, Communities & Local Government (2021) National Planning Policy Framework.
- Ref 11-4 Department of Energy and Climate Change. (2011) Overarching National Policy Statement for Energy (EN-1).
- Ref 11-5 Department of Energy and Climate Change (2011) National Policy Statement for Renewable Energy Infrastructure (EN-3).
- Ref 11-6 Department for Business, Energy & Industrial Strategy (2021) Draft overarching National Policy Statement for energy (EN-1).
- Ref 11-7 Department for Business, Energy & Industrial Strategy (2021) Draft National Policy Statement for renewable energy infrastructure (EN-3).
- Ref 11-8 Department for Environment Food and Rural Affairs (2010); Noise Policy Statement for England.
- Ref 11-9 Ministry of Housing, Communities & Local Government (2019); Planning Practice Guidance Noise.
- Ref 11-10 Lincolnshire County Council, "Central Lincolnshire Local Plan 2012-2036," Lincolnshire County Council, Lincoln, 2017.
- Ref 11-11 Lincolnshire Minerals and Waste Local Plan including the Core Strategy & Development Management Policies Plan adopted in June 2006 and the Site Locations Plan adopted in December 2017.
- Ref 11-12 Bassetlaw District Council Core Strategy and Development Management Policies DPD, adopted 22 December 2011.
- Ref 11-13 Nottinghamshire Minerals Local Plan, adopted March 2021.
- Ref 11-14 Nottinghamshire Waste Local Plan, adopted 2002.
- Ref 11-15 CadnaA®, registered trademark of Datakustik GmbH (Munich, Germany). (www.datakustik.com).
- Ref 11-16 British Standards Institute (2009 with 2014 amendments) BS 5228:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Noise, BSi, London.
- Ref 11-17 British Standards Institute (2003); BS 7445 Description and environment of environmental noise Part 1: Guide to quantities and procedures, BSi, London.
- Ref 11-18 British Standards Institute (2014 with 2019 amendments); BS 4142 Methods for rating and assessing industrial and commercial sound, BSi, London.
- Ref 11-19 Department of Transport/Welsh Office (1988), Calculation of Road Traffic Noise. Her Majesty's Stationery Office, London.
- Ref 11-20 Highways England (2020); Design Manual for Road and Bridges LA111: Noise and Vibration, Revision 2.
- Ref 11-21 International Standards Organization (Part 1: 1993, Part 2: 1996) ISO 9613 Acoustics Attenuation of sound during propagation outdoors, ISO.
- Ref 11-22 British Standards Institute (2014); BS 8233 Guidance on sound insulation and noise reduction for buildings, BSi, London.
- Ref 11-23 World Health Organization (1999); Guidelines for Community Noise.
- Ref 11-24 Hiller, D. M., and G. I. Crabb, (2000); Groundborne Vibration Caused by Mechanised Construction Works. TRL Report 429.
- Ref 11-25 Selby, A.R. (1997). "Control of vibration and noise during piling." Brochure publication, British Steel, UK



12. Socio-Economics and Land Use

12.1 Introduction

- 12.1.1 This chapter of the Preliminary Environmental Information (PEI) Report presents the findings of an assessment of the likely socio-economic and land use effects as a result of the Scheme. For more details about the Scheme, refer to **Chapter 2: The Scheme** of this PEI Report.
- 12.1.2 This chapter identifies the potential impacts and proposes measures to address the likely effects of the Scheme on Socio-economics and Land Use, during the construction, operation, and decommissioning phases. This includes consideration of the potential for impacts arising with regard to:
 - Employment generation;
 - Gross Value Added (GVA);
 - Public Rights of Way (PRoW);
 - · Agricultural land; and
 - Local amenities and land use (residential properties, business premises, community facilities and development land).
- 12.1.3 This chapter is supported by the following appendices in **PEI Report Volume** 3:
 - Appendix 12-A Legislation and Planning Policy; and
 - Appendix 12-B Summary of Non-Significant Effects on Socio-Economic and Land Use Receptors.
- 12.1.4 This chapter is supported by the following figures in **PEI Report Volume 2**:
 - Figure 12-1 Drive Time Analysis

12.2 Consultation

- 12.2.1 A request for an EIA Scoping Opinion was sought from the Secretary of State through the Planning Inspectorate in 2021 as part of the EIA Scoping Process and a Scoping Opinion was issued on 20 December 2021. Consultation responses in relation to Socio-economics and Land Use, to date, are presented in **PEI Report Volume 3: Appendix 1-C**.
- 12.2.2 Consultation has been undertaken with key stakeholders including the Planning Inspectorate, Lincolnshire County Council, Nottinghamshire County Council, West Lindsey District Council, Bassetlaw District Council

12.3 Legislation and Planning Policy

12.3.1 Relevant policy documents are listed below. More detailed information regarding these policies can be found in **PEI Report Volume 3: Appendix 12-A**.



- 12.3.2 National planning policy and guidance to be considered includes:
 - National Policy Statement EN-1 (2011) (Ref 12-9);
 - Industrial Strategy: Building a Britain Fit for the Future (2017) (Ref 12-11);
 - Planning Practice Guidance (Ref 12-13);
 - National Planning Policy Framework (NPPF) (2021) (Ref 12-14); and
 - National Policy Statement for Renewable Energy Infrastructure (2011) (Ref 12-18).
- 12.3.3 Local planning policy and guidance to be considered includes:
 - Draft Bassetlaw Local Plan (2021) (Ref 12-10);
 - Central Lincolnshire Local Plan (2017) (Ref 12-12); and
 - West Lindsey Sustainability, Climate Change and Environmental Strategy (2021) (Ref 12-15).

12.4 Assessment Assumptions and Limitations

- 12.4.1 This assessment is based on baseline and design information available at the time of writing this PEI Report. Following consultation, a further assessment will be undertaken as part of the EIA and will be reported in the Environmental Statement (ES) that will be submitted with the DCO application.
- 12.4.2 The assessment of the significance of effects has been carried out against a benchmark of current socio-economic baseline conditions prevailing around the Scheme, as far as is possible within the limitations of such a dataset. Baseline data is also subject to a time lag between collection and publication. As with any dataset, these conditions may be subject to change over time which may influence the findings of the assessment.
- 12.4.3 Baseline Conditions reported in Section 12.8 regarding population and labour force and the local economy are based on latest data available at the time of writing. It is likely that current conditions are greatly changed owing to the ongoing effect of the Covid-19 pandemic on the labour market, businesses, and the economy. The assessment of effects reported in Section 12.10 is based on the conditions as reported wherever relevant and it is not expected that the assessment of significance would change if they were based on current conditions.
- 12.4.4 Effects on PRoW during the construction, operation and decommissioning phases are assessed in this PEI Report. Potential closures and diversions are examined for both the Solar and Energy Storage Park and the Grid Connection Route.
- 12.4.5 Effects on local amenities and land use during the construction, operation and decommissioning phases are based on preliminary assessments taking into consideration the results from the relevant environmental studies that can act in-combination to cause effects to occur. These studies comprise the transport and access, noise and vibration, landscape and visual amenity, and air quality assessments. These will be further investigated in the ES. Where any two of these topics or more each record a significant effect on a receptor



- or group of receptors, it will be assumed as a worst-case that the effect could occur at the same time. These will be further investigated in the ES.
- As noted in **Chapter 2: The Scheme**, the construction period is expected to be a minimum of 24 months. This is expected to be a realistic worst-case assumption for this assessment, as it represents the expected minimum build time and therefore the most intense activity onsite (and therefore greatest impacts associated with traffic, noise, dust, visual, etc). Should the build period be a longer duration, the intensity would be less and the impact on the community therefore the same or lower. This approach may mean the maximum number of jobs during peak construction has been overestimated, it should not affect the average number presented in this chapter or the associated spending benefits attributed to this phase of the Scheme.

12.5 Study Area

- 12.5.1 The impacts of the Scheme are considered at varying spatial levels according to the nature of the effects considered. This approach is consistent with the Homes and Communities Agency (HCA), now known as Homes England, guidance entitled 'Additionality Guide, A Standard Approach to Assessing the Additional Impact of Projects, 4th Edition' (Ref. 12-8).
- The DCO Site is located within the District Council administrative areas of West Lindsey in Lincolnshire and Bassetlaw in Nottinghamshire. **Chapter 2: The Scheme** provides a description of the DCO Site and its surroundings, which mainly consists of agricultural fields under arable production, interspersed with individual trees, hedgerows, tree belts (linear), small woodland blocks and farm access tracks.
- 12.5.3 The landscape features immediately surrounding the Solar and Energy Storage Park comprise a number of villages and settlements, including Gate Burton, Knaith to the west, and Knaith Park to the north of the site. Marton (to the south west) and Willingham by Stow and Kexby (east of the site) are other villages in the near proximity but not immediately surrounding the site.
- 12.5.4 The potential impacts arising from the Scheme are considered relative to a 60-minute drive time as this represents the principal labour market catchment area for the Scheme (Travel to Work Area), particularly given the absence of a functional economic market area presented within local policy of both local authorities.
- 12.5.5 The boundary of the Solar and Energy Storage Park and effects on land that borders this has been used for consideration of effects on agricultural land and soils. The Grid Connection Route is also considered as part of this assessment.
- 12.5.6 Effects on users of PRoW considers resources likely to be affected by closures and diversions of routes. The study area therefore comprises all PRoW located within the DCO Site (including along the Grid Connection Route) or likely to be impacted by the work within the DCO Site (within 500m).



- 12.5.7 The principal impacts on local amenities will be considered on a geographical scale based on the finding of other assessments presented in Chapter 10:

 Landscape and Visual Amenity, Chapter 11: Noise and Vibration,
 Chapter 13: Transport and Access and Chapter 15: Other Environmental
 Topics (Air Quality) of this PEI Report.
- 12.5.8 Table 12-1 presents the different components of the Socio-economics and Land Use effects assessment and the geographical scale at which each component is assessed.

Table 12-1 Socio-Economics and Land Use Impacts by Geographical Scale

Impact	Geographical area of Impact	Rationale for impact area
Employment generation during construction phase, operational phase and decommissioning phase (direct, indirect and induced impacts)	60-minute travel area	Research by Chartered Institute of Personnel and Development (CIPD) found that 90% of national employees commuted for 60
Gross Value Added (GVA) during construction phase		minutes or less each way. This was reported by CIPD in the 2017 Employee outlook 'Employee views on working life' (Ref 12-19).
Public Rights of Way	500m radius from the DCO Site and beyond this where routes extend outside this radius.	Professional judgement and experience from other schemes in England.
Agriculture and soils	The DCO Site.	Professional judgement and experience from other schemes in England.
Local amenities- Residential Properties	500m radius from the DCO Site.	Professional judgement and location of sensitive receptors for impacts arising from the Scheme as informed by other assessments.
Local amenities- Business Premises	500m radius from the DCO Site.	Professional judgement and location of sensitive receptors for impacts arising from the Scheme as informed by other assessments.
Local amenities- Community Facilities	2km radius from the DCO Site	Professional judgement and location of sensitive receptors for impacts arising from the Scheme as informed by other assessments. Community facilities are likely to be accessed by residents from a wider catchment, especially in rural areas, owing to a tendency for provision to be sparse. A wider radius has been considered for this receptor in order to fully appreciate the



Impact	Geographical area of Impact	Rationale for impact area
		effect of severance on access to these facilities.
Development land	500m radius from the DCO Site.	Professional judgement and experience from other schemes in England.

12.6 Assessment Methodology

- 12.6.1 There is currently no statutory guidance on the methodology for undertaking assessments of socio-economic and land use effects. The assessment follows best practice methodology from other assessments undertaken on comparable energy infrastructure schemes.
- 12.6.2 This section sets out the scope and methodology for the Socio-economics and Land Use assessment of the Scheme.
- 12.6.3 The Scheme has the potential to have a range of effects, some of which would be temporary whilst others would be permanent. For the purposes of this PEI Report chapter, due consideration is given to the Scheme in terms of effects on the following:
 - Employment generation;
 - Gross Value Added (GVA);
 - Public Rights of Way (PRoW);
 - Agricultural land; and
 - Local amenities and land use (residential properties, business premises, community facilities and development land).

Sources of Information

12.6.4 The following assessment seeks to establish the potential social, economic, and land use effects of the Scheme and assesses these against the current baseline conditions within the DCO Site and in the surrounding area.

Socio-economic Conditions

- 12.6.5 Baseline data illustrating the existing conditions surrounding the DCO Site has been collected through a desk-based research exercise using publicly available sources, documents, and web-based applications. These sources are listed below. It is important to note that Census data has only been used in the absence of more recent statistics at the relevant geography.
 - English Indices of Deprivation (2019) (Ref 12-1);
 - 2011 Census Data (Ref 12-2);
 - ONS (2017) Gross Value Added (Income Approach) (Ref 12-3);
 - ONS (2019) UK Business Register and Employment Survey (Ref 12-4);
 - Annual Population Survey (2020) (Ref 12-5); and
 - ONS Mid-year Population Estimates (Ref 12-6).



Desktop Research for Agricultural Land

12.6.6 Natural England 'Technical Information Note 049 – Agricultural Land: protecting the best and most versatile agricultural land (TIN049)' provides guidance on agricultural land quality assessment for development planning (Ref 12-17). A provisional Agricultural Land Classification ('ALC') is available from the Defra mapping service found at: magic.defra.gov.uk. This plan shows land grades across the whole of England. However, the mapping uses a now superseded methodology and is based predominantly on small scale (extensive) assessment from published sources such as geology maps. As this map uses a superseded methodology and is based primarily upon small scale published sources, TIN049 advises that it is of limited value for assessing land quality of large sites. Detailed ALC site sampling has been undertaken rather than relying on the provisional ALC secondary data.

Impact Assessment Methodology

Methodology for Determining Effects

- 12.6.7 As mentioned previously, the economic impact of the Scheme is considered relative to a 60-minute travel time (car or public sector) to the Scheme. In accordance with research this is considered a reasonable timeframe to use as a baseline within which workers would commute to the Scheme.
- 12.6.8 Additionality has been calculated by considering the overall impact of job gains to the area, the level of leakage, number of displaced jobs and multiplier effects, such as supply chains and worker spending related jobs. These assumptions have been informed by the HCA Additionality Guide (Ref 12-8).
- 12.6.9 Table 12-2 Construction, Operational and Decommissioning Phases Economic Additionality assumptions outlines the values that have been allocated to the construction, operational and decommissioning phases' additionality formula, enabling the tailored calculation of the net additional employment and economic impacts. Justifications for the values have been considered and are summarised in the right-hand column of the table.

Table 12-2 Construction, Operational and Decommissioning Phases Economic Additionality assumptions

Additionality Factor	Value	Justification
Leakage (% of jobs that benefit those residents outside the Scheme's identified target area)	43%	The analysis of Census 2011 ¹ data indicates that approximately 43% of workers in the Study Area live outside the Study Area. This corresponds to approximately a medium to high leakage rate as set out by HCA Additionality Guide (Ref. 12-8) and implies that a reasonably high proportion of benefits will be retained within the Study Area but many will also go to people living outside the area.
Displacement (% of jobs that account for a reduction in	25%	For the purpose of this assessment, a low level of displacement (25%) has been assumed, in

¹ Census 2011 remains the latest available dataset. Census 2021 data is due to be released in Summer 2022.



Additionality Factor	Value	Justification
related jobs in the Scheme's identified target areas)		line with the HCA Additionality Guide (Ref 12-8).
Multiplier (further economic activity associated with the additional local income, supplier purchase and longerterm development effects)	1.5	The multiplier is a composite figure which takes into account both the indirect jobs created across the study area based on supply chain activity but also the induced employment created through increased spending across the study area. The HCA Additionality Guide provides a 'ready reckoner' of composite multipliers. The study area is likely to have 'average' supply linkages and induced effects based on the scale of its economy. Therefore, a 'medium' multiplier of 1.5 is determined from the HCA guidance to be the most appropriate measure.

- 12.6.10 The land use and PRoW impacts have been assessed against the significance criteria below using professional judgement.
- 12.6.11 The principal amenity impacts on residential properties, business premises and community facilities will be informed by other assessments and assessed against the significance criteria using these assessments and professional judgement.

Significance Criteria

- 12.6.12 The assessment of potential socio-economic effects uses the effect significance terms and definitions described within **Chapter 5: EIA**Methodology of this PEI Report. Where possible, socio-economic impacts have been appraised against relevant national standards, such as those provided by Department for Business, Energy & Industrial Strategy (DBEIS) and HCA. Where relevant standards do not exist, professional experience and expert judgement have been used to assess the scale and nature of the effects of the Scheme against baseline conditions.
- 12.6.13 The assessment aims to be objective and quantifies effects as far as possible. However, some effects can only be evaluated on a qualitative basis. Effects are defined as follows:
 - Beneficial classifications of significance indicate an advantageous or beneficial effect on an area, which may be minor, moderate or major in effect:
 - Negligible classifications of significance indicate imperceptible effects on an area:
 - Adverse classifications of significance indicate a disadvantageous or adverse effect on an area, which may be minor, moderate or major in effect; and
 - No effect classifications of significance indicate that there are no effects on an area.
- 12.6.14 The geographical scales considered to assess significance are described in Table 12-1, and are organised around the following:



- National levels are associated with effects that impact on England;
- Regional levels are associated with effects that impact on the East Midlands;
- District levels are associated with effects that impact on West Lindsey and Bassetlaw; and
- **Local** levels are associated with effects that impact on the DCO Site and neighbouring area.
- 12.6.15 Duration of effect is also considered, with more weight given to permanent changes than to temporary ones. Permanent effects are generally those associated with the completed scheme. Temporary effects are those associated with the construction works. For the purposes of this assessment, short-term effects are of one year or less, medium-term effects of one to five years and long-term effects for over five years.
- 12.6.16 For socio-economics, there is no accepted definition of what constitutes a significant (or not significant) socio-economic effect. It is however recognised that 'significance' reflects the relationship between the scale of effect (magnitude) and the sensitivity (or value) of the affected resource or receptor. As such the significance criteria of socio-economic effects has been assessed based on expert judgment and professional experience of the author, and relies on the following considerations:
 - Sensitivity of resources/receptors: specific values in terms of sensitivity
 are not attributed to socio-economic resources / receptors due to their
 diverse nature and scale; however, the assessment takes account of the
 qualitative (rather than quantitative) 'sensitivity' of each receptor and, in
 particular, their ability to respond to change based on recent rates of
 change and turnover (if appropriate);
 - Magnitude of impact: this entails consideration of the size of the effect on people or business in the context of the area in which effects will be experienced; and
 - Scope for adjustment: the socio-economic assessment is concerned in part with economies. These adjust themselves continually to changes in supply and demand, and the scope for the changes brought about by the Scheme to be accommodated by market adjustment will therefore be a criterion in assessing significance.
- 12.6.17 Criteria for receptor sensitivity and impact magnitude have been set out below (although specific sensitivity values are not attributed to socioeconomics receptors as explained above), which have been grouped as follows: economic impacts, local amenities and land use impacts, and tourism impacts. The significance of effect matrix has been provided following the receptor sensitivity and impact magnitude criteria.

Economic Impacts

- 12.6.18 The following criteria have been set to assess the effects on socio-economics receptors in relation to employment and GVA which have been grouped together as economic impacts.
- 12.6.19 Table 12-3 identifies the sensitivity criteria that have been used to inform the assessment on socio-economic receptors relating to employment and GVA,



in conjunction with the magnitude criteria set out above to establish the significance of the identified effects.

Table 12-3 Economic Impact Sensitivity Criteria

Magnitude	Description
High	Businesses, workers or residents who have little or no capacity to experience the impact without incurring an economic loss or have capacity to experience an economic gain.
Medium	Businesses, workers or residents that have a moderate or average capacity to experience the impact without incurring a change on their economic well-being.
Low	Businesses, workers or residents that generally have adequate capacity to experience impacts without incurring a change on their economic well-being.
Very Low	Businesses, workers or residents that are unlikely to experience impacts on their economic well-being.

12.6.20 Table 12-4 identifies the magnitude of impact criteria which have been used to assess the socio-economic receptors relating to employment and GVA.

Table 12-4 Economic Impact Magnitude Criteria

Magnitude	Description
High	An impact that is expected to have considerable adverse or beneficial socio-economics effects. Such impacts will typically affect large numbers of businesses, workers or residents.
Medium	An impact that will typically have a noticeable effect of a moderate number of businesses, workers or residents, and will lead to a small change to the study area's baseline socio-economic conditions
Low	An impact that is expected to affect a small number of businesses, workers or residents or an impact that may affect a larger number of receptors but does not materially alter the study area's baseline socioeconomic conditions.
Very Low	An impact which has very little change from baseline conditions where the change is barely distinguishable, approximating to a "no change" situation.

Public Rights of Way (PRoW)

12.6.21 The following criteria have been set to assess the effects of users on PRoW focusing on the impact of severance of existing routes and the resulting changes in journey lengths and times and local travel patterns.



12.6.22 Table 12-5 identifies the sensitivity criteria that have been used to inform the assessment on PRoW, in conjunction with the magnitude criteria set out above to establish the significance of the identified effects.

Table 12-5 Public Rights of Way Impact Sensitivity Criteria

Magnitude	Description			
High	PRoW is of high importance with limited potential to substitute with other route options to access with the wider network or community infrastructure.			
Medium	PRoW is of medium importance with moderate potential to substitute with other route options to access with the wider network or community infrastructure.			
	Or PRoW is of high importance with alternative routes available.			
	Or PRoW is of low importance with limited potential to substitute with other route options to access with the wider network or community infrastructure.			
Low	PRoW is of low importance with alternative routes available.			
	Or PRoW is of very low importance with moderate potential to substitute with other route options to access with the wider network or community infrastructure.			
Very Low	PRoW is of very low importance with alternative routes available.			

12.6.23 Table 12-6 identifies the magnitude of impact criteria which have been used to assess the impacts on PRoW.

Table 12-6 Public Rights of Way Impact Magnitude Criteria

Magnitude	Description
High	Substantial increase/decrease in journey length and/or travel patterns and increased/decreased opportunities for users to access the wider network and/or community infrastructure.
Medium	Noticeable increase/decrease in journey length and/or travel patterns and increased/decreased opportunities for users to access the wider network and/or community infrastructure.
Low	Slight increase/decrease in journey length and/or travel patterns and increased/decreased opportunities for users to access the wider network and/or community infrastructure.
Very Low	No increase or decrease in journey length and/or travel patterns and no increase or decrease in opportunities for users to access the wider network and/or community infrastructure

Agricultural Land

12.6.24 This section outlines the criteria that have been set to assess the effects on agricultural land and soils receptors. Best and Most Versatile ('BMV')



agricultural land is a strategic, finite, and irreplaceable national resource with longstanding policy to prevent the unnecessary loss of such land to non-agricultural development. As set out in TIN049 (Ref 12-17), land in ALC Grades 1, 2 and 3a are considered to be the nation's best and most versatile land. Paragraph 174 of the NPPF (Ref 12-14) directs that planning should consider the economic and other benefits of the BMV agricultural land. TIN049 and national planning policy do not seek to enforce continuity of agricultural production or any specific agricultural management.

- 12.6.25 For all practical intents and purposes, agricultural land cannot be created or translocated, nor can a compensatory area of land have its ALC grade enhanced. There is therefore no viable potential for beneficial effect or mitigation with regard to agricultural land quality.
- 12.6.26 For the agricultural land resource, the presence of BMV land and the grade of that land determine sensitivity, with Grades 1 and 2 land being of higher sensitivity than land in Grade 3a. The magnitude of change criteria is based on the extent of BMV land lost, with the area of 20 hectares (ha) referred to below being derived from the threshold contained within the former MAFF guidance (Ref 12-16) and maintained by Natural England when informing their consultation on projects.
- 12.6.27 The sensitivity of agricultural land is assessed according to its grade within the ALC, as set out in Table 12-7. This criteria takes into account the above guidance in respect of the economic and other benefits of the BMV and gives little weight to the loss of land in Grades 3b, 4 and 5.

Table 12-7 Receptor Sensitivity Criteria – Agricultural Land

Agricultural Land

High	Agricultural land predominantly in Grades 1 and 2
Medium	Agricultural land predominantly in Grade 3a or containing some Grade 1 and 2
Low	Agricultural land containing some Grade 3a
Very low	Agricultural land all Grade 3b or lower

- 12.6.28 The thresholds for the magnitude of impact adopted in this assessment are based on a threshold of the permanent change of 20 ha of BMV agricultural land, taken from Article 18(1), paragraph (y) of the Table in Schedule 4 to the Town and Country Planning (Development Management Procedure) Order 2015 (S.I. No 2015/595) (Ref 12-20). These documents do not state that this threshold should be used to determine change significance for the purpose of impact assessment; however, as this is the area of BMV change that triggers a requirement to consult with Natural England, it implies that this is also the point at which the change is no longer considered to be 'not significant'. Therefore, for the purposes of this assessment:
 - a total permanent loss/gain of BMV land which exceeds 20 ha is considered significant;

Sensitivity



- a loss of BMV which is either temporary and reversible after construction, or which falls below the 20 ha threshold, is considered as being not significant; and
- a loss of non-BMV land is considered as being not significant.

Local Amenities and Land Use

- 12.6.29 The following criteria has been set to assess the effects on local amenities which in this Scheme comprises residential properties, business premises and community facilities and development land.
- 12.6.30 Table 12-8 identifies the sensitivity criteria that have been used to inform the assessment of effects relating to local amenities, which in conjunction with the magnitude criteria set out above to establish the significance of the identified effects.

Table 12-8 Local Amenities Impact Sensitivity Criteria

Magnitude	Description
High	Amenity or land use is of high importance and rarity with limited potential for substitution or access to alternatives.
Medium	Amenity or land use is of medium importance and rarity with moderate potential for substitution or access to alternatives.
Low	Amenity or land use is of low importance and rarity with alternatives available.
Very Low	Amenity or land use is of very low importance and rarity with alternatives available.

12.6.31 The magnitude of change on local amenities (residential properties, business premises, community facilities and development land) is assessed by appraising the level of impact on the receptor and the permanency of change arising from the Scheme. Table 12-9 identifies the magnitude of impact criteria which have been used to assess the impacts on local amenities and land use.

Table 12-9 Local Amenities Impact (Residential properties, business premises, and community facilities) Magnitude Criteria

Magnitude	Description
High	An impact that permanently affects the integrity and value of an amenity; or an impact that considerably enhances the value and quality of an amenity or land use.
Medium	An impact that negatively affects the value of an amenity, but a recovery is possible with no permanent impacts; or an impact that improves key characteristics and features of the amenity or land use.
Low	An impact that negatively affects the value of an amenity, but a recovery is expected in the short-term with no change to its integrity; or an impact



Magnitude	Description
	that has some beneficial impact on the attributes of the amenity or land use.
Very Low	An impact which is a very minor loss or benefit from baseline conditions where the change is barely distinguishable, approximating to a "no change" situation.

12.6.32 For development land, an assessment has been undertaken of the effects on development land within the study area as identified from a review of planning applications which have received planning permission, or which are under consideration and allocated sites including Mineral Safeguarding Areas, Mineral Consultation Areas, Waste Consultation Areas and Transport Safeguarded Areas. This is considering temporary and permanent land take of development land which affects its viability. Table 12-10 identifies the magnitude of impact criteria which have been used to assess the impacts on development land.

Table 12-10 Local Amenities Impact (Development Land) Magnitude Criteria

Magnitude	Description
High	An impact that permanently affects the integrity and value of a development land resource; or an impact that considerably enhances the value and quality of such a resource.
Medium	An impact that negatively affects the value of a development land resource, but a recovery is possible with no permanent impacts; or an impact that improves key characteristics and features of such a resource
Low	An impact that negatively affects the value of a development land resource, but a recovery is expected in the short-term with no change to its integrity; or an impact that has some beneficial impact on the attributes of such a resource
Very low	An impact which is a very minor loss or benefit from baseline conditions where the change is barely distinguishable, approximating to a "no change" situation.

Significance of Effects

12.6.33 Socio-economic effects reflect the relationship between the sensitivity of the affected receptor (Table 12-3, Table 12-5, Table 12-7 and Table 12-8) and the magnitude of the impact. Table 12-11 below shows how the assessment of the significance of effects is arrived upon.

Table 12-11 Impact Assessment and Significance

Magnitude of Impact	Sensitivity of Receptor				
	High	Medium	Low	Very Low	
High	Major	Major	Moderate	Minor	
Medium	Major	Moderate	Minor	Negligible	



Low	Moderate	Minor	Negligible	Negligible	
Very Low	Minor	Negligible	Negligible	Negligible	

- 12.6.34 In accordance with the methodology set out within **Chapter 5: EIA Methodology** of this PEI Report, the following criteria is applied:
 - 'Moderate' or 'major' are classed 'significant';
 - 'Minor' are classed as 'not significant', although they may be a matter of local concern; as
 - 'Negligible' effects are classed as 'not significant'.

12.7 Baseline Conditions

- 12.7.1 This section describes the baseline environmental characteristics with specific reference to Socio-economics and Land Use. The study area for the baseline conditions comprises of West Lindsey and Bassetlaw local authority areas.
- 12.7.2 The potential impacts arising from the Scheme are assessed relative to the baseline conditions and benchmarked against regional and national standards where appropriate. These include:
 - Existing site and land use;
 - Population and deprivation;
 - Employment:
 - · Local economy and labour market; and
 - Local receptors.

Existing Baseline

Existing site and land use

- 12.7.3 **Chapter 2: The Scheme** of this PEI Report contains a detailed description of existing conditions within and surrounding the DCO Site.
- 12.7.4 The landscape of the site mainly consists of agricultural fields interspersed with trees, woodlands, hedgerows, linear tree belts, farm access tracks, and local transport roads.
- 12.7.5 Immediately surrounding the Solar and Energy Storage Park are several small rural villages, including Knaith approximately 200m to the west and Gate Burton approximately 50m to the west, Marton approximately 500m to the south west, and Willingham by Stow 700m to the east and Kexby 1.8km to the east. There are limited industrial or commercial land uses within the immediate vicinity.
- 12.7.6 Other infrastructure within the surrounding area includes 400kV overhead powerlines carried by pylons. These extend from Cottam Substation within the Grid Connection Route.



Agricultural land

12.7.7 In terms of ALC (Agricultural Land Classification), only the Solar and Energy Storage Park has been surveyed and assessed at this point and not the Grid Connection Route (the Grid Connection Route will be assessed as the Environmental Statement progresses). The land within the Solar and Energy Storage Park is predominantly ALC Grade 3b (moderate quality agricultural land) with some Grade 3a (good quality agricultural land). Table 12-12 displays the land grades and area occupied by each.

Table 12-12 Agricultural Land Classification

Agricultural Land Class	Total Area (Ha)	Proportion of the Site (%)
Subgrade 3a	73.6	11
Subgrade 3b	493.9	74
Estimated subgrade 3b	67.3	10
Non agricultural	32.5	5
Total	667.3	100

Population and deprivation

- 12.7.8 According to the ONS Mid-Year Population Estimates (Ref 12-6), the residential population of the Study Area (the 60-minute drive radius) has increased from 4,628,317 in 2011 to 4,888,882 in 2020, representing a 5.6% increase over 9 years. This population growth rate is slightly lower than the overall rates recorded for the East Midlands and England during the same time period (7.2% and 6.5% respectively).
- 12.7.9 In 2020, 3,035,596 (62.1%) of residents in the Study Area were of working age (defined by ONS as men and women aged 16 to 64). This is a similar rate to the rates recorded for the East Midlands (61.8%) and England as a whole (62.3%).

Plate 12-1 Age Breakdown





Source: ONS (2020)

- 12.7.10 In 2020 the Annual Population Survey (Ref 12-5) showed that 35.6% of working age residents in the Study Area have a degree level qualification or higher (National Vocational Qualification [NVQ] Level 4+), similar to the rate in similar to the average for the East Midlands (37.2%) but slightly lower than for England (42.6%). The proportion of residents in the Study Area with no qualifications is 7%, similar to the rates recorded for the East Midlands (6.2%) and England (6.3%).
- 12.7.11 Based on the 2019 Indices of Multiple Deprivation (IMD), which is measured at local authority level, (Ref 12-1), West Lindsey is the 146th most deprived local authority of 317 districts in England (where 1 is most deprived). Within West Lindsey, four of the Lower Layer Super Output Areas (LSOAs) are within the top 10% most deprived LSOAs in England. Of each domain, West Lindsey performs worst for employment deprivation for which it is the 96th most deprived local authority and best for crime deprivation in which it is the 274th most deprived.
- 12.7.12 Also regarding IMD, Bassetlaw is the 108th most deprived local authority in England. Within the local authority, 5 LSOAs are within the top 10% most deprived in England. The worst performing domain in Bassetlaw is employment deprivation for which the local authority is the 72nd most deprived in England and performs best in terms of living environment deprivation for which it is the 224th most deprived.

Employment

- 12.7.13 According to Business Register and Employment Survey (BRES) data, employment (amongst 16- to 64-year-olds) reached 2,041,545 in 2020 in the Study Area.
- 12.7.14 According to the Annual Population Survey, in 2020 the economic activity rate (amongst 16- to 64-year-olds) in the Study Area was 77.7%, generally in line with the averages of 79.5% in the East Midlands and 79.4% in England as a whole.
- 12.7.15 The unemployment rate for working age residents in the Study Area was 5.2%. This is similar to the rate for the East Midlands (5%) and England (4.9%).

Table 12-13 Economic Indicators

Economic Indicator	Study Area	East Midlands	England
Economic activity rate - aged 16-64 (%)	77.	7 79.5	79.4
Unemployment rate - aged 16-64 (%)	5.	2 5.0	4.9

Source: ONS (2020)



Local Economy and Labour Market

- 12.7.16 GVA per head (Ref 12-3) is slightly lower in West Lindsey (£15,558) compared to the average for the East Midlands (£21,845) and for England (£28,096). The sectors which contribute the most towards GVA in West Lindsay are the Public Services, Distribution and Real Estate sectors.
- 12.7.17 The Bassetlaw economy performs worse than the regional economy in a number of measures. In Bassetlaw, GVA per head is £18,703, lower than the East Midlands average and the England average. The Distribution, Manufacturing and Public Services sectors make up the greatest percentages of GVA to the Bassetlaw economy. This means that the average GVA per head for the study area is £17,130.
- 12.7.18 Table 12-14 presents a detailed breakdown of employment by broad industrial group across the study areas and their comparators. Based on the most recently available data (2020) (Ref 12-5), the highest levels of employment in West Lindsey are recorded in the Manufacturing, Health and Retail sectors (each representing 11.7% of employment). These three sectors are also the most common in Bassetlaw where Manufacturing makes up 18% of employment, followed by Health (14%) and Retail (12%). This is also echoed in the East Midlands as a whole.
- 12.7.19 The mining, quarrying and utilities broad industrial group (which includes employment from the generation of energy) is one of the least prominent sectors across the Study Area (1.4%) and also in the East Midlands (1.4%) and England (1.1%) as a whole.
- 12.7.20 The construction industry is more common in the Study Area (5.5%) as well as regionally (4.7%) and nationally (4.9%).

Table 12-14 Employment by Broad Industrial Group

Industry	Study Area (%)	East Midlands (%)	England (%)
Agriculture, forestry & fishing	0.3	2.1	1.4
Mining, quarrying & utilities	1.4	1.4	1.1
Manufacturing	12.6	11.9	7.6
Construction	5.5	4.7	4.9
Motor trades	2.2	2.2	1.8
Wholesale	4.3	5.0	3.9
Retail	9.4	9.2	9.3
Transport & storage (inc postal)	6.1	7.0	5.2
Accommodation & food services	6.3	6.3	7.1



Industry	Study Area (%)	East Midlands (%)	England (%)
Information & communication	2.8	3.0	4.5
Financial & insurance	1.5	1.6	3.5
Property	1.7	1.9	2.0
Professional, scientific & technical	5.9	7.1	9.1
Business administration & support services	7.7	6.8	8.8
Public administration & defence	4.6	3.7	4.1
Education	9.2	8.8	8.7
Health	14.2	13.0	12.9
Arts, entertainment, recreation & other services	4.2	4.3	4.3

Source: ONS (2020)

Public Rights of Way ("PRoW")

- 12.7.21 PRoW are primarily located west of the River Trent, outside the Solar and Energy Storage Park.
- 12.7.22 There is one PRoW located within the Solar and Energy Storage Park boundary: LL|Knai|44/2 (footpath), which is the prolongation of LL|Knai|44/1 (footpath). These two PRoW connect Kexby Lane (east) to Station Road / Knaith Hill (west). The two PRoW cover a combined distance of circa 1.2km (about 600m each).
- 12.7.23 In addition to LL|Knai|44/1 (footpath) a few PRoW are also located within proximity to the site, such as:
 - LL|Lea|513/1 (footpath c.100m), north of the Site, connecting Station Road to Willingham Road;
 - LL|Mton|69/1 (footpath c.500m), on the south-east border of the Site, connecting Willingham Road to Stow Park Road; and
 - LL|Mton|68/1 (footpath c.700m), south of the Site, on the north border of the Grid Connection Route, connecting the High Street to Stow Park Road.
- 12.7.24 The Grid Connection Route will pass through:
 - LL|Mton|66/4 (footpath c.600m) going from Trent Port Road to LL|Bram|66/1 (footpath c.500m) connecting to Gainsborough Road;
 - NT|Cottam|FP1 (footpath c.150m) which runs along the River Trent and forms part of a wider footpath route;
 - NT|Cottam|FP3 (footpath c.1km) connecting Headstead Bank (west) to NT|Cottam|FP1 (east);
 - NT|Cottam|RB4 (restricted byway c.1km) connecting Broad Land (north) to Overcoat Lane (south);



- NT|South Leverton|BOAT16 (byway open to all public c.1km) connecting Broad Land (north) to Overcoat Lane (south); and
- NT|Rampton|FP5 (footpath c.1.1km) connecting Torksey Ferry Road (south) to NT|Treswell|FP5 (footpath) which boarders Cottam Power Station.

Local Receptors

Residential Properties

12.7.25 The area around the DCO Site is mostly rural and relatively sparsely populated. There are two residential properties within the DCO Site on Clay Lane to the south of the Solar and Energy Storage Park. Larger groups of residential properties are located to the west of the Site in Knaith, to the south west of the Site in Gate Burton and to the north of the Site in Knaith Park.

Business Premises

12.7.26 There are some agricultural business premises lying directly within the DCO Site such as N K Taylor Farm. There is a business management consultancy approximately 500m west of the DCO Site. A furniture shop also lies 500m north of the Site.

Education

- 12.7.27 There are two schools located in proximity to the DCO Site. These are Frances Olive Anderson C of E Primary School approximately 1km to the north and The Marton Academy Primary School approximately 1km to the south.
- 12.7.28 Table 12-15 provides a list of educational facilities within 2km of the DCO Site and their approximate distance from the Site.

Table 12-15 Educational facilities in the study area

Educational facility	Approximate distance from Site
Frances Olive Anderson CofE Primary School	1km
The Marton Academy	1km
Sturton by Stow Primary School	2km
Sturton Cygnets Pre School	2km

Source: AECOM desk-based analysis

Community Facilities

12.7.29 There is a range of community and recreational facilities within proximity of the Scheme. Table 12-16 illustrates the facilities within 2km of the Site and their distances from the DCO Site. There are no police or fire stations within 2km of the DCO Site. The nearest are Gainsborough Police Station and Gainsborough Fire Station both located approximately 5km north of the site.



Table 12-16 Community and recreational facilities nearby the Site

Receptor	Description	Approximate distance from Site
St Mary Church	Church in the village of Knaith	0.5km
Church of St Helen	Church in the village of Gate Burton	0.5km
St Helen's Church	Church in the village of Willingham	0.5km
Marton and Gate Burton Village Hall	Village Hall in the village of Marton	0.5km
Fox and Hounds Pub	Public house in the village of Willingham	0.5km
Black Swan Guest House	Accommodation in the village of Marton	0.5km
Rose and Crown Pub	Public house in the village of Upton	1km
Park Springs Community Centre	Community centre in the town of Gainsborough	2km
Lincoln Golf Club	Golf Club in the village of Torksey	2km

Development land

- 12.7.30 There are no planning applications or permissions within the DCO Site. The Cottam Power Station site is identified as being a Priority Regeneration Area within the emerging Local Plan, however, the site is not currently allocated for any alternative uses.
- 12.7.31 Regarding planning allocations, as noted in **PEI Report Volume 3: Appendix 1-C**, discussion on the need for a Mineral Safeguarding Assessment (MSA) was held between the Applicant and Lincolnshire County Council and Nottinghamshire County Council in May 2022. It was agreed that an MSA was not necessary as a standalone DCO Application document due to information provided on the reduced and narrowed routing of the Grid Connection Route which passes through an MSA for sand and gravel. Further consideration of mineral safeguarding will be provided in the DCO Application.
- 12.7.32 In addition to this, there are no development allocations relating to waste or transport safeguarding and consultation areas in the Local Plan and therefore these do not need to be considered.

Sensitivity of receptors

12.7.33 Table 12-17 identifies the sensitivity of socio-economics receptors identified within the baseline and sets a value based on the criteria highlighted in Table 12-3, Table 12-5, Table 12-7 and Table 12-8.

Table 12-17 Sensitivity of Socio-Economic and Land Use Receptors

Impact	Sensitivity of receptor	Justification
Local Economy (employment creation during construction, operation and decommissioning)	Varies due to type of employment activity – Low to Medium	Relative to size and type of employment sectors



Impact	Sensitivity of receptor	Justification
Gross Value Added (GVA) during construction phase	Medium	Relative to scale of existing GVA for local authority areas and nationally
Impact on Public Rights of Way	Very Low or Low	No impact on PRoW expected
Agricultural land	Low	Agricultural land contains some Grade 3a but mostly 3b
Local amenities and land use – residential properties	Varies due to type of amenity – Medium to High	Residential properties have high sensitivity to disruption during night time and medium sensitivity during day time
Local amenities and land use – business premises	Varies due to type of amenity – Low to Medium	Relative to scale of employment
Local amenities and land use – community facilities	Varies due to type of amenity – Low to Medium	Relative to nature of use
Local amenities and land use – development land	Variable by use – Low to Medium	Based on availability of alternative development opportunities.

Future Baseline

- 12.7.34 The future baseline scenarios are set out in **Chapter 5: EIA Methodology**.
- 12.7.35 In the absence of the Scheme, the future baseline is anticipated to be largely the same as the existing baseline for Socio-economics and Land Use. However, it would be reasonable to expect that the population would increase. The population of West Lindsey is expected to increase from 95,898 in 2020 to 102,249 in 2040 which represents an increase of 6.6%. In addition, the population of Bassetlaw is projected to increase from 118,633 to 131,199 which represents a larger increase of 10.6%. In the East Midlands and England as a whole, there is expected to be increases of 11.1% and 7.9% respectively.
- 12.7.36 Table 12-18 illustrates the population projections broken down by age group. It shows that by 2040, both the 0–15-year-old and the 16-64-year-old population will make up a lower proportion of the total population across all of the geographies. Instead, there will be a larger share of 65 and over residents.

Table 12-18 Population Projections by age breakdown

		2020	2025	2030	2035	2040	
West Lindsey	Aged 0 to 15 (%)	17.2	16.7	15.7	15.2	15.1	
	Aged 16 to 64 (%)	57.7	56.5	54.9	53.5	52.9	



		2020	2025	2030	2035	2040
	Aged 65+ (%)	25.1	26.9	29.4	31.4	32.0
Bassetlaw	Aged 0 to 15 (%)	18.0	17.8	17.1	16.7	16.8
	Aged 16 to 64 (%)	59.6	58.3	56.9	55.7	55.1
	Aged 65+ (%)	22.4	23.8	25.9	27.6	28.2
East Midlands	Aged 0 to 15 (%)	19.2	18.6	17.6	17.1	17.1
	Aged 16 to 64 (%)	62.3	61.7	60.9	59.9	59.1
	Aged 65+ (%)	18.5	19.7	21.5	23.0	23.8
England	Aged 0 to 15 (%)	18.6	18.2	17.3	16.8	16.9
	Aged 16 to 64 (%)	61.7	61.0	60.2	59.1	58.4
	Aged 65+ (%)	19.7	20.8	22.5	24.0	24.8

- 12.7.37 In terms of the local economy, it would be reasonable to expect that employment and GVA would increase, associated with the expected increase in population. It is expected that PRoW will continue to be used. Businesses and community facilities may open and close however it is not expected that there will be any perceptible changes to the local economic baseline assessment and the Scheme should be assessed against current baseline conditions and policies. These changes are not considered to constitute significant changes to baseline.
- 12.7.38 The future baseline for the study area is anticipated to be similar for agricultural land use to that found at present. ALC grading is deliberately designed to be insensitive to good or bad land management. Occupancy of farm land can change, but a change in tenure between farm businesses is unlikely to significantly change land use. Any change to external factors such as the successor to the Common Agricultural Policy support will not be confined to farmland within the study area.

12.8 Potential Impacts

- 12.8.1 The Scheme has the potential to have a range of effects, some of which would be temporary, whilst others would be permanent. For the purpose of this PEI Report chapter, due consideration is given to the Scheme in terms of effects on the following:
 - Employment;
 - GVA;
 - Public Rights of Way (PRoW);



- Agricultural Land; and
- · Local Amenities and Land Use.
- 12.8.2 Potential impacts (positive and negative) on Socio-economics and Land-Use receptors during construction, operation and during decommissioning considered in this chapter are assessed prior to the implementation of the mitigation.
- 12.8.3 Mitigation measures being incorporated in the design and construction of the proposed Scheme are set out below. Residual impacts following the implementation of mitigation are identified and presented.

12.9 Mitigation Measures

- 12.9.1 Embedded and additional mitigation measures are incorporated and secured into the Scheme, as set out in the respective chapters, to reduce other construction and operational effects (such as noise, air quality, transport and landscape) which in turn will mitigate the effects on the local community and existing facilities from a socio-economic and land use perspective.
- 12.9.2 The Scheme has been designed to take into account the quality of agricultural land such as positioning the permanent infrastructure (the substation and the BESS) to avoid BMV land as far as possible, and also minimising impacts on PRoW.

12.10 Assessment of Likely Impacts and Effects

12.10.1 The impacts and effects (both beneficial and adverse) associated with the construction, operation and decommissioning of the Scheme are outlined in the sections below.

Construction (2025 to 2027-28)

Employment

- 12.10.2 The estimated construction period is expected to last 24 to 36 months. Therefore, likely effects will be of a medium-term temporary nature. Although these jobs are temporary, they represent a positive economic effect for a substantial period that can be estimated as the function of the scale and type of activities required to construct the DCO site.
- 12.10.3 The Applicant estimates that the Scheme will require an average of 400 gross direct full-time employment (FTE) jobs on-site per day during the construction period, equivalent to 400 FTE jobs per annum. This is based on activities required and will fluctuate during the period therefore being both higher and lower than average at times.

Leakage

12.10.4 Leakage effects are the benefits to those outside the study area, defined as a 60-minute travel area as shown in Table 12-1. It is estimated that 57% of construction staff could be sourced from the Study Area based on Travel to Work Data (Ref 12-2). This will be subject to labour availability and take-up



at the time of construction however it is considered to be a reasonable assumption on which to base this assessment. As such, 43% of staff would be likely to reside outside of this Study Area. This indicates that although a reasonably high proportion of employment opportunities will be retained in the Study Area, a noticeable number of jobs will be taken up by people living outside of the Study Area. Whilst it is not a specific consideration of the assessment, it is noted that a larger proportion of the jobs taken up by people living outside the area will likely be in more specialised solar PV professions owing to the scarcity of such resources within localised areas compared with less skilled professions.

12.10.5 An adjustment of 43% has therefore been applied to the estimated 400 gross direct construction jobs on-site on average during the construction period to estimate the jobs created within the target area. On this basis it is estimated that the Scheme will create 228 FTE jobs per annum for residents within the study area during the construction period. This is considered a reasonable assumption based on the Applicant's experience constructing other solar PV developments in the UK.

Displacement

- 12.10.6 Displacement measures the extent to which the benefits of a development are offset by reductions in output or employment elsewhere. Any additional demand for labour cannot simply be treated as a net benefit since it has the potential to displace workers from other positions and the net benefit is reduced to the extent that this occurs.
- 12.10.7 Construction workers typically move between construction projects when delays occur or to help the workforce meet construction deadlines. Due to the flexibility of the labour market, construction labour force displacement has been assumed to be low.
- 12.10.8 The HCA Additionality Guide (Ref 12-8) provides standards (or 'ready reckoners') for displacement. Within the context of a construction project in the study area, a low displacement factor for 25% is considered appropriate according to the HCA Additionality Guide. This factor is a best practice approach in the absence of specific local information that might provide a defensible justification for a different level of displacement being used. Applying this level of displacement to the total gross direct employment figure results in a total net direct employment figure of 300 FTE jobs per annum during the construction period.

Multiplier Effect

12.10.9 In addition to the direct employment generated by the construction of the Scheme, there will be an increase in local employment arising from indirect and induced effects of the construction activity. Employment growth will arise locally through manufacturing services and suppliers to the construction process (indirect or supply linkage multipliers). Additionally, it is assumed that part of the income of the construction workers and suppliers will be spent in the Study Area, generating further employment (in terms of induced or income multipliers).



12.10.10 The effect of the multiplier depends on the size of the geographical area that is being considered, the local supply linkages and income leakage from the area. The HCA Additionality Guide provides 'ready reckoner' composite multipliers (the combined effect of indirect and induced multipliers) to account for this. This is a best practice approach in the absence of specific information that might provide a defensible justification for another multiplier effect level being used, appropriate to the sectors concerned. For the study area, a medium multiplier effect of 1.5 has been considered appropriate. Applying the 1.5 multiplier to the total net direct employment figure of 300 workers results in net indirect and induced employment of 150 jobs per annum during the construction period.

Net Construction Employment

12.10.11 Table 12-19 presents the temporary annual employment generated by the Scheme accounting for leakage, displacement, and multiplier effects. The Scheme will support, on average, 450 total net jobs per annum during the construction period. Of these, 257 jobs per annum will be expected to be taken-up by residents within the study area.

Table 12-19 Net Additional Construction Employment per annum from the Scheme

	Study Area (60- minute travel area)	Outside Study Area	Total
Gross Direct Employment	228	172	400
Displacement	-57	-43	-100
Net Direct Employment	171	129	300
Indirect & Induced Employment	86	64	150
Total Net Employment ²	257	193	450

Source: AECOM Calculations 2022. Please note that figures have been rounded to the nearest whole number.

- 12.10.12 The direct, indirect and induced employment, expenditure and upskilling created from the construction of the Scheme must be judged in the context of the labour pool of construction workers in the Study Area (60-minute travel area) (106,000). Taking this into account, the impact of construction employment generation in the Study Area has been assessed as temporary low beneficial, which results in a medium-term temporary minor beneficial effect. This is not considered significant.
- 12.10.13 Analysis of the hotel, bed and breakfast and inns accommodation sector has been undertaken to assess the likely capacity against the demand from the potential peak construction workforce, and indicates, considering existing seasonal demand and typical occupancy, that capacity is sufficient, and that the workforce can be accommodated within existing provision within a 30-minute drive time radius of the Site. This is shown in Table 12-20. Further analysis to identify accommodation within a 60-minute drive time radius

² Sum of Net Direct Employment and Indirect & Induced Employment



indicates that there would typically be 1,934 remaining rooms at a minimum available after taking into account the peak construction workforce and typical seasonal occupancy levels. This is shown in Table 20-21. This analysis demonstrates that at peak workforce employment and peak occupancy levels, 100% of the Scheme's construction workers could be accommodated within both a 30-minute and 60-minute drive time of the Site. Given this, there would be **no effect** on the hotel, bed and breakfast, and inns accommodation sector arising from the Scheme.

Table 12-20 Accommodation Capacity within 30-minute drive time radius of the Site

Month	Room Occupancy[1]	Rooms Typically Available after Existing Demand	Construction Workers (Peak)	Remaining Rooms Available	Remaining Rooms Available (%)
January	29%	3,251	400	2,851	62%
February	34%	3,022	400	2,622	57%
March	37%	2,885	400	2,485	54%
April	38%	2,839	400	2,439	53%
May	46%	2,473	400	2,073	45%
June	61%	1,786	400	1,386	30%
July	70%	1,374	400	974	21%
August	77%	1,053	400	653	14%
September	77%	1,053	400	653	14%
October	77%	1,053	400	653	14%
November	72%	1,282	400	882	19%
December	58%	1,923	400	1,523	33%

Source: CoStar (2022) and VisitBritain (2021)

Table 20-21 Accommodation Capacity within 60-minute drive time of the Site

Month	Room Occupancy [1]	Rooms Typically Available after Existing Demand	Construction Workers (Peak)	Remaining Rooms Available	Remaining Rooms Available (%)
January	29%	7,204	400	6,804	67%
February	34%	6,696	400	6,296	62%
March	37%	6,392	400	5,992	59%
April	38%	6,291	400	5,891	58%
May	46%	5,479	400	5,079	50%



Month	Room Occupancy [1]	Rooms Typically Available after Existing Demand	Construction Workers (Peak)	Remaining Rooms Available	Remaining Rooms Available (%)
June	61%	3,957	400	3,557	35%
July	70%	3,044	400	2,644	26%
August	77%	2,334	400	1,934	19%
September	77%	2,334	400	1,934	19%
October	77%	2,334	400	1,934	19%
November	72%	2,841	400	2,441	24%
December	58%	4,261	400	3,861	38%

Source: CoStar (2022) and VisitBritain (2021)

Gross Value Added (GVA)

12.10.14 Applying the average gross direct value added per construction worker in the area to the total number of construction workers generated from the Scheme gives the total GVA arising from the construction period. This is shown in Table 12-22. Note that this has been calculated based on the compound average GVA per worker in the construction sector in West Lindsey and Bassetlaw as the appropriate benchmark as data is published at this level rather than the more granular, LSOA-derived, study area. By taking an average of the two local authorities' GVA per worker rates, output generated by activity in the construction sector is estimated to be £17,103 per worker. By applying this figure to the total direct construction workers generated by the Scheme, it is estimated that construction will contribute approximately £7.7 (£m) to the national economy, of which £4.4m would likely be within the study area.

Table 12-22 Gross Direct Value Added per annum from the Scheme during the Construction Phase

	Study Area (60- minute travel area)	Outside Study Area	Total
GVA (£)	4,386,920	3,309,430	7,696,350

- 12.10.15The impact of direct GVA generation from the construction phase on the economy within the Study Area has been assessed as medium-term temporary medium beneficial, which results in a temporary **moderate beneficial** effect. This is considered significant.
- 12.10.16 The impact on the national economy as represented by the total GVA generated has been assessed as medium-term temporary low beneficial, which results in a temporary **minor beneficial** effect. This is not considered significant.



Public Rights of Way

- 12.10.17 Changes to journey times, local travel patterns, and certainty of routes for users would arise from the temporary diversions of PRoW. Effects during construction on relevant routes are set out in the following paragraph.
- 12.10.18 The DCO Site intersects a small section of a PRoW at Knaith Park. Although the intersection is slight, it is assumed that construction vehicles will cross the PRoW to access a field to the north west of the Site via a manned crossing.
- 12.10.19In a small number of cases, where PRoW cross the grid connection construction spread, diversions will be required to be put in place. Diversions would all be temporary and would be in place from several weeks up to a maximum of three months depending on the construction activities taking place.
- 12.10.20 Due to the limited scale of impacts upon PRoW, these effects are assessed to be very low adverse, which results in a **minor adverse** effect. This is not considered significant.

Agricultural Land

12.10.21 From the construction phase, temporary use of agricultural land will occur. The total area of agricultural land temporarily required from construction and throughout operation of the Scheme would be approximately 667ha as shown in Table 12-23 agriculture.

Table 12-23 Agricultural Land required for the Construction of the Scheme

Grade/subgrade	Area (ha)	% of the land	
Subgrade 3a	73.6	11	
Subgrade 3b	493.9	74	
Estimated subgrade 3b	67.3	10	
Non agricultural	32.5	5	
Total	667.3	100	

Source: AECOM calculations 2022. Note figures may not always sum due to rounding.

- 12.10.22 The Scheme has been designed to take into account the quality of agricultural land such as positioning the permanent infrastructure (the substation and the BESS) to avoid BMV land as far as possible. The substation is estimated to take a maximum of 2ha of grade 3a BMV land (less than 1% of total land and grade 3a land).
- 12.10.23 The area of land which would be required during construction only and can be returned to farming use (e.g., sheep farming, but not arable farming) after construction comprises approximately 73.6ha of grade 3a BMV land, and as there is no land in Grade 1 or 2, the sensitivity is assessed to be low. As the loss of the entire area of BMV agricultural land is reversible (after operation), the temporary effect of the Scheme on the use of BMV agricultural land is



assessed to be low adverse which results in a **negligible** effect. This is not considered significant.

12.10.24 Construction work will involve relatively little displacement of the soil material, with the dominant impact being the trafficking over land with delivery and construction vehicles and the soil compaction this might cause, although measures can be adopted to minimise impacts. Although only the Solar and Energy Storage Park has been assessed at this point, the nature of the works for the Grid Connection Route (cable burial and restatement) indicate that temporary impacts only would occur.

Local Amenities and Land Use

Residential Properties, Business Premises, and Community Facilities

- 12.10.25 There is potential for noise, air quality, visual and traffic effects arising from construction of the Scheme to impact on the amenity of residents, businesses and users of community facilities.
- 12.10.26 Taking into account the results of the air quality, noise, traffic and visual assessments, there are no residents, businesses or community facilities that would likely experience a significant effect on their amenity during construction from effects acting in combination. Therefore, there are no impacts arising from the Scheme on these local amenities during construction which results in **no effect**, and which is not considered significant.

Development Land

12.10.27 There are no planning applications, permissions or allocations affected by land required for the construction of the Scheme and thus no effects have been assessed. The Cottam Power Station site is identified as being a Priority Regeneration Area within the emerging Local Plan, however, the site isn't currently allocated for any alternative uses.

Summary of Effects

12.10.28 A summary of significant effects is provided in Table 12-24. Please see **PEI Report Volume 3: Appendix 12-B** for a summary of non-significant effects.

Table 12-24 Summary of Significant Effects during construction

Receptor	Sensitivity (Value)	Description of Impact	Magnitude of Impact	Effect Category
Gross Value Added (GVA) – Local Economy	Medium	GVA generation	Medium beneficial	Moderate beneficial

Operation (2028 to 2088)

Employment

12.10.29 The Scheme will generate long-term jobs once it is complete and operational. In estimating operational employment generation, it is important to consider



not just the gross effects of the Scheme, but also net effects considering leakage, displacement, and multiplier effects.

Existing Employment

- 12.10.30The DCO Site consists of agricultural land, and the Applicant has estimated that there are 1.5 existing jobs in the DCO Site related to agricultural activities. Therefore, there is expected to be some employment loss as a result of the Scheme.
- 12.10.31 'Existing employment' refers to the employment outcomes which would have occurred without intervention. For example, if the Scheme were to result in a disruption to any existing economic activity currently occurring in relation to the DCO Site.
- 12.10.32The existing DCO Site is agricultural land, and there is expected to be an employment loss of 1.5 permanent jobs as a result of the Scheme.

Total Net Operational Employment

- 12.10.33The Applicant has estimated there will be a gross number of 14 jobs generated by the Scheme once operational.
- 12.10.34 Assuming a leakage of 43% outside the study area, displacement of 25% and a 1.5 multiplier, it is estimated that the Scheme will result in a net creation of an estimated 14 jobs, of which at least 7 are within the study area. Accounting for the existing employment effects outlined above, the total net employment of the Scheme is 13 jobs. This is presented in Table 12-25.

Table 12-25 Total net employment during operation of the Scheme

	Study Area	Outside Study Area	Total
Gross Direct Employment	7	7	14
Displacement	-2	-2	-4
Net Direct Employment	5	5	10
Indirect and Induced Employment	2.5	2.5	5
Existing Employment	-1	-1	-2
Total Net Employment	6.5	6.5	13

Source: AECOM calculations. Note that figures have been rounded to nearest whole number.

12.10.35 The impact of operational employment generation in the local economy would be slightly increased by the Scheme. However, the increase would be marginal and therefore the impact has been assessed as permanent, very low beneficial which results in a permanent **negligible** effect, which is not considered significant.



Public Rights of Way

12.10.36 There is one PRoW located within the Solar and Energy Storage Park, and the Grid Connection Route will pass through 6 PRoW. PRoW are not expected to be affected during operation, however in the event that PRoW closures are required for maintenance activities temporary diversions will be put in place. Due to no closures expected, the impact on users of PRoW has been assessed as very low which results in **no effect**. This is not considered significant. In a worst case scenario, if temporary diversions are needed this will result in a temporary **negligible** effect which is not considered significant.

Agricultural Land

12.10.37 Effects on agricultural land use would occur as long-term effects arising from the construction of the Scheme and hence have been assessed in the construction phase. There are no new potential or additional impacts on agricultural land during the operation of the scheme.

Local Amenities and Land Use

Residential Properties, Business Properties and Community Facilities

- 12.10.38 There is potential for noise, air quality, and visual effects arising from the operation of the Scheme which would impact on the amenity of residents, businesses and users of community facilities. There are around 200 properties located within 500m of the Site. In addition, there are two businesses within 500m of the Site and nine community facilities within 2km of the Site.
- 12.10.39 Taking into account the results of the noise, traffic, air quality and visual assessments, there are no residents, community facilities or businesses that would likely experience a significant effect on their amenity during operation. Therefore, there are no impacts arising from the Scheme on local amenities which results in **no effect**, and which is not considered significant.

Development Land

12.10.40 There are no planning applications, permissions or allocations affected by land required for the operation of the Scheme and thus no effects have been assessed. The Cottam Power Station site is identified as being a Priority Regeneration Area within the emerging Local Plan, however the site isn't currently allocated for any alternative uses.

Summary of Effects

12.10.41 There are no significant effects expected during the operational phase of the Scheme. Please see **PEI Report Volume 3: Appendix 12-B** for a summary of non-significant effects.

Decommissioning (2088 to 2089-2090)

Employment

12.10.42 The year for the decommissioning the Scheme is assumed to be 2088, reflecting a 60-year operation period, however it is possible that the Scheme will be operational for a longer period of time. At the end of its operating life.



the most likely scenario is that the Scheme would be shut down and all infrastructure removed. It can be expected that employment will be generated to carry out the removal of the infrastructure from the DCO Site.

- 12.10.43 The estimated duration of the decommissioning period is expected to be similar to that of the construction period of 24 to 48 months. Therefore, the likely effects will be of a medium-term temporary nature. Although these jobs are temporary, they represent a positive economic effect for a substantial period that can be estimated as the function of the scale and type of activities required to decommission the DCO Site.
- 12.10.44 It is assumed based on the activities taking place that the same number of jobs required for constructing the Scheme will be needed to carry out the activities required to remove the infrastructure from the DCO Site. Therefore, an average of 400 gross Full-time employment (FTE) jobs will be on-site per day during this decommissioning period.

Net Decommissioning Employment

12.10.45 Table 12-26 presents the temporary decommissioning employment generated by the Scheme, accounting for leakage, displacement and multiplier effects as identified in the above section of the construction period. The Scheme will support, on average, 450 total net jobs per annum during the decommissioning period. Of these, 257 jobs per annum will be expected to be taken-up by residents within the Study Area, whilst 193 jobs will likely be taken-up by workers living outside the area.

Table 12-26 Net Additional Decommissioning Employment per annum from the Scheme

	Study Area (60- minute travel area)	Outside Study Area	Total
Gross Direct Employment	228	172	400
Displacement	-57	-43	-100
Net Direct Employment	171	129	300
Indirect & Induced Employment	86	64	150
Total Net Employment ³	257	193	450

Source: AECOM Calculations 2022. Note that figures have been rounded to nearest whole number.

12.10.46The direct, indirect and induced employment, expenditure and upskilling created from the decommissioning of the Scheme must be judged in the context of the labour pool of construction workers in the study area. The study area currently has around 106,000 workers in its construction sector. The impact of decommissioning employment generation in the local economy has been assessed as temporary medium beneficial, which results in a medium-term temporary minor beneficial effect. This is not considered significant.

³ Sum of Net Direct Employment and Indirect & Induced Employment



Employment loss following Decommissioning (permanent long-term)

- 12.10.47 It can be expected that if the Scheme is shut down and all infrastructure is removed, the employment required to carry out maintenance activities (14 jobs) will no longer be generated at this point. These workers can be expected to be integrated into the economy and find new employment after the loss of their job at the Scheme. As the Scheme is assumed to revert back to agriculture land after decommissioning, it is likely that the existing 2 jobs related to agriculture activities would be generated again.
- 12.10.48 The impact of employment loss in the local economy during the decommissioning phase during the long-term has been assessed as permanent very low adverse. This results in a permanent **negligible** effect, which is not considered significant.

Public Rights of Way

- 12.10.49 Changes to journey times, local travel patterns, and certainty of routes for users would arise from the temporary diversions of PRoW. Effects during decommissioning on relevant routes are set out in the following paragraph. There is one PRoW within the Solar and Energy Storage Park, and six PRoW within the Grid Connection Route. Closure of PRoW will be avoided wherever possible within the Solar and Energy Storage Park. As stated in **Chapter 2:**The Scheme, in a worst case scenario, the Grid Connection Infrastructure will require removal of cables from manholes and vehicles accessing the Site to retrieve them. No open excavation or ground disturbance is likely.
- 12.10.50 Due to the limited scale of impacts upon PRoW, these effects are assessed to be very low adverse, which results in a **minor adverse** effect. This is not considered significant.

Agricultural Land

- 12.10.51 An increase in soil organic matter content may occur during the lifetime of the Solar and Energy Storage Park. The land will therefore be in the same or better condition than it is currently as a result of the expected natural enhancement through approximately 60 years of being set-aside, however this is likely to be temporary and subject to good agricultural land management practices being adopted after decommissioning. As noted in Chapter 8: Ecology and Biodiversity, land used for the Scheme will be returned to arable agricultural use. Ground physical infrastructure will be removed and the DCO Site returned to landowners in the condition as at the end of operation.
- 12.10.52The Solar and Energy Storage Park will not be available for farming during decommissioning activities, while works are taking place on site, leading to a temporary sterilisation of the land. However, as long as it is safe to do so, farming will be allowed in fields cleared of Solar PV and associated infrastructure while decommissioning activities occur in other fields. This sterilisation may therefore only be a few weeks or months duration in each field.
- 12.10.53 Overall, given the short time frame of any disruption to farming activities during decommissioning and the return of the DCO Site to solely farming



practices following completion of decommissioning, the magnitude of change during the decommissioning phase is considered to be low and the significance of effect therefore **not significant**. This impact ends following completion of the decommissioning activities when the land is returned to farming use.

Local Amenities and Land Use

- 12.10.54 There is potential for noise, traffic, air quality, and visual effects arising from operation of the Scheme to impact on the amenity of residents, businesses and users of community facilities.
- 12.10.55 Taking into account the results of the noise, air quality visual and transport assessments, there are no residents, community facilities or businesses that would likely experience a significant effect on their amenity during operation. Therefore, there are no effects arising from the Scheme on local amenities which results in **no effect**, and which is not considered significant.

Summary of Effects

12.10.56There are no significant effects expected during the decommissioning phase of the Scheme. Please see **PEI Report Volume 3: Appendix 12-B** for a summary of non-significant effects.

12.11 Residual Effects and Conclusions

- 12.11.1 This section summarises the residual significant effects of the Scheme on socio-economic and land use receptors following implementation of mitigation.
- 12.11.2 Significant residual effects are defined as moderate or major adverse or beneficial and are listed in Table 12-27.
- 12.11.3 The construction phase significant residual effects are due to the GVA generated during construction of the Scheme resulting in beneficial effects within the study area.
- 12.11.4 There are no significant residual effects in the operational or decommissioning phases.
- 12.11.5 Non-significant effects are listed in **PEI Report Volume 3: Appendix 12-B**.

Table 12-27 Summary of significant residual effects (construction)

Receptor	Description of impact	Significance of effect without mitigation	Mitigation measures	Residual effect after mitigation
Local economy	GVA generation	Moderate beneficial (significant)	N/A	Moderate beneficial (significant)



12.12 Cumulative Assessment

- 12.12.1 This section presents an assessment of cumulative effects between the Scheme and other proposed and committed plans and projects including other developments.
- 12.12.2 This assessment has been made with reference to the methodology and guidance set out in **Chapter 5: EIA Methodology** of this PEI Report.

Construction and Decommissioning

- 12.12.3 All cumulative schemes and submitted applications listed in **Chapter 16**: **Cumulative Effects and Interactions** will generate additional construction related employment either in the Study Area or in the surrounding areas to the Study Area if they were to go ahead. The scale of the construction and decommissioning employment generated cannot be readily quantified based on the information available for each scheme as this information is commercially sensitive and not available.
- 12.12.4 The combined effect of the construction of the cumulative developments is likely to bring considerable additional employment to the Study Area. Although this is expected to result in an increase in construction and decommissioning employment, the overall cumulative effect from the generation of workers is likely to remain as temporary medium beneficial effect on the Study Area economy, resulting in a temporary minor beneficial effect which is not considered significant.
- 12.12.5 Given the scale of the employment associated with the construction of the cumulative developments, an assessment has been undertaken to confirm whether there is likely to still be surplus capacity within the hotel, bed and breakfast, and inns accommodation sector within a 60-minute drive time. It is estimated that there will be approximately 1,934 spare bedspaces from an available supply in the peak occupancy month (August) of 10,146 bedspaces. This indicates that there would still be sufficient rooms available within the hotel, bed and breakfast, and inns accommodation sector to accommodate demand arising from all consented schemes and there would still be **no effect** on the integrity of the hotel, bed and breakfast, and inns accommodation sector arising from the Scheme.
- 12.12.6 The overall cumulative effect from the generation of GVA from construction is likely to remain temporary medium beneficial on the economy of the Study Area, resulting in a temporary **moderate beneficial** effect, which is significant.
- 12.12.7 The overall cumulative effect on PRoW has the potential to have a greater effect due to the cumulative schemes of West Burton and Cottam Power Stations adjacent to the Scheme. These will be reviewed and further assessed in the ES. At present it is expected that these will not be affected, resulting in a permanent **negligible** effect, which is not considered significant.



- 12.12.8 The overall cumulative effect on agricultural land is likely to remain temporary low adverse, resulting in a **minor adverse** effect, which is not considered significant.
- 12.12.9 The overall cumulative effect on residential properties, business premises and community facilities is likely to remain as **no effect**, but the cumulative schemes mentioned in Section 12.13.6 and their effects will be further assessed in the ES.

Operation

- 12.12.10 If all the schemes are to be realised there will be considerable additional employment from some of the cumulative schemes. Most cumulative schemes, however, will not generate considerable operational employment due to their nature as infrastructure or as purely residentially-led development projects. Therefore, the overall combined cumulative effect from the generation of workers during operation is likely to remain permanent very low beneficial, resulting in a permanent negligible effect which is not considered significant.
- 12.12.11 The overall cumulative effect on PRoW has the potential to have a greater effect due to the cumulative schemes of West Burton and Cottam Power Stations adjacent to the Scheme. These will be reviewed and further assessed in the ES. At present it is expected that these will not be affected, resulting in a permanent **negligible** effect, which is not considered significant.
- 12.12.12 The overall cumulative effect on residential properties, business premises and community facilities is likely to remain as **no effect**, but the cumulative schemes mentioned in Section 12.12.11 will be further assessed in the ES.



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13. Transport and Access

13.1 Introduction

- 13.1.1 This chapter of the Preliminary Environmental Information (PEI) Report presents the preliminary findings of an assessment of the likely significant effects from Transport and Access as a result of the Scheme. For more details about the Scheme, refer to **Chapter 2: The Scheme** of this PEI Report.
- 13.1.2 This chapter identifies and proposes measures to address the potential impacts and likely significant effects of the Scheme on Transport and Access, during the construction, operation, and decommissioning phases of the Scheme.
- 13.1.3 This chapter is supported by the following appendices:
 - Appendix 13-A Transport Assessment Scoping Note;
 - Appendix 13-B Key Policies and Guidance; and
 - Appendix 13-C Summary of Non-Significant Effects.
- 13.1.4 This chapter is supported by the following figures:
 - Figure 13-1 Study Area;
 - Figure 13-2 Traffic Survey Locations;
 - Figure 13-3 Heavy Goods Vehicle (HGV) Routing;
 - Figure 13-4 Surrounding Highway Network;
 - Figure 13-5 Walking and Cycling Network; and
 - Figure 13-6 Cumulative Solar Farm Schemes.

13.2 Consultation

- 13.2.1 A request for an Environmental Impact Assessment (EIA) Scoping Opinion (Ref. 13-1) was sought from the Secretary of State through the Planning Inspectorate in 2021 as part of the EIA Scoping Process. Consultation responses in relation to Transport and Access, to date, are presented in **PEI Report Volume 3: Appendix 1-C**.
- 13.2.2 A transport scoping meeting was subsequently held with Lincolnshire County Council (LCC), Nottinghamshire County Council (NCC), West Lindsey District Council (WLDC) and Bassetlaw District Council (BDC) to review the proposed access and routing strategy for the Scheme and to set out the proposed scope and methodology for the transport deliverables.
- 13.2.3 Following the meeting, a Transport Scoping Note (**PEI Report Volume 3: Appendix 13-A**) has been prepared to facilitate agreement of the scope and methodology for the Transport and Access Chapter of this PEI Report and Environmental Statement (ES), and the Transport Assessment (TA) that will support the Development Consent Order (DCO) application, in order to address comments raised during scoping. The following comments were received from NCC and LCC:



- NCC Comments (5th April 2022):
 - Within the confines of the Nottinghamshire road network collision data can be obtained from roadinjuryaccidentdata@viaem.co.uk. As this is only likely to be relevant to the grid connection corridor, it is difficult to agree the extent of a study area without details of the potential road crossings and what would be involved. However, it is envisaged that this could be addressed by appropriate traffic management. In this regard we would wish to see provision for; parking of site operatives and visitors; the loading and unloading of plant and materials; and the storage of plant, materials, and waste associated with the construction of the grid connection corridor to be addressed within the Construction Traffic Management Plan or other relevant section of the submission.
 - The construction of the grid connection corridor within Nottinghamshire is not in an area that would be likely to be materially affected by the traffic impact of committed development. However, this Authority would welcome the inclusion of the traffic associated with the construction of the proposed West Burton and Cottam Solar Farms within the Transport Assessment including the opportunity to construct a shared grid connection to Cottam Power Station thereby reducing the potential cumulative disruption during construction.
- LCC confirmed that the study area for the collision data review was acceptable on 19th April 2022
- LCC Comments (26th April 2022): This scoping note and Figure 2 is acceptable to LCC. As mentioned at the meeting, we would like the TA to ensure that a cumulative assessment is undertaken which also includes the other solar farms in this area which are currently being developed by others (West Burton and Cottam solar farms).
- 13.2.4 In view of the above, a TA and Framework Construction Traffic Management Plan (CTMP) are being prepared as part of the DCO submission and will form part of the ES. These will include details of traffic management, the Grid Connection Corridor and committed developments. Further details relating to committed developments are also presented in Section 13.12 of this PEI Report.
- 13.2.5 Further consultation will be held with the local highway and planning authorities, as well as other stakeholders as required, to inform the development of the ES.

13.3 Legislation and Planning Policy

- 13.3.1 There are a number of policies that relate to how traffic and transport-related impacts should be assessed, in terms of identifying both the level of impact of the Scheme and any necessary mitigation.
- 13.3.2 Planning policy and guidance relating to transport and relevant to the Scheme comprise the following, of which a review is provided within **PEI Report Volume 3: Appendix 13-B**:
 - National Planning Policy



- Overarching National Policy Statement for Energy (NPS EN-1) (2011) (Ref. 13-2);
- Draft Overarching National Policy Statement for Energy (2021) (NPS EN-1) (Ref. 13-3);
- National Policy Statement for Renewable Energy Infrastructure (NPS EN-3) (2011) (Ref. 13-4);
- Draft National Policy Statement for Renewable Energy Infrastructure (NPS EN-3) (2021) (Ref. 13-5)
- National Policy Statement for Electricity Networks Infrastructure (EN-5) (2011) (Ref. 13-6);
- Draft National Policy Statement for Electricity Networks Infrastructure (EN-5) (2021) (Ref. 13-7)
- o National Planning Policy Framework (2021) (Ref. 13-8); and
- o National Planning Practice Guidance (2019) (Ref. 13-9).

Local Planning Policy

- o Lincoln Transport Strategy 2020 to 2036 (Ref. 13-10);
- Adopted Central Lincolnshire Local Plan (Ref. 13-11);
- Fourth Lincolnshire Local Transport Plan 2013/14 to 2022/23 (Ref. 13-12);
- Gainsborough Transport Strategy (October 2010) (Ref. 13-13);
- Draft Bassetlaw District Local Plan 2020-2037 (August 2021) (Ref. 13-14);
- o Nottinghamshire Local Transport Plan 2011-2026 (Ref. 13-15); and
- Nottinghamshire Local Transport Plan Implementation Plan 2018/19-2020/21 (Ref. 13-16).

Industry Guidance

 Institute of Environmental Management and Assessment (IEMA) Guidelines for the Environmental Assessment of Road Traffic (1993) (Ref. 13-17).

13.4 Assessment Assumptions and Limitations

13.4.1 This preliminary assessment is based on baseline data and Scheme design information (see **Chapter 2: The Scheme**) available at the time of writing this PEI Report. An initial assessment of the Solar and Energy Storage Park has been undertaken as part of this PEI Report based on a daily peak of 400 construction workers. At this stage, there is only expected to be a daily peak of 25 construction workers for the Grid Connection Route and so this element has been examined qualitatively at this stage. The exact location of the Grid Connection Route (within the DCO Site boundary) has also yet to be defined as this will be guided/ informed by the comments received during Statutory Consultation. Therefore, a full assessment which includes both the Solar and Energy Storage Park and the Grid Connection Route (which will connect the Solar and Energy Storage Park to the Cottam Substation) known collectively as the Scheme, is being undertaken as part of the EIA and will be reported in the ES that will be part of the DCO submission.



- 13.4.2 A TA and Framework Construction Traffic Management Plan (CTMP) are also being prepared as part of the DCO submission and will form part of the ES. This chapter has been informed by the consultation responses to the EIA Scoping Opinion (see **PEI Report Volume 3: Appendix 1-C**), as well as a Transport Scoping Meeting which was held with the local authorities and a subsequent Transport Scoping Note (see **PEI Report Volume 3: Appendix 13-A**).
- 13.4.3 The main construction phase for the Scheme is currently predicted to be 24 months between 2025 and 2027, with the construction peak in terms of activity and vehicle movements expected to take place in 2026. Whilst the construction programme may extend slightly beyond 24 months, the approach taken in this chapter offers a reasonable worst-case assessment, as this is based on a rapid construction period that would generate the highest number of peak hour and daily road trips on the local network.
- 13.4.4 There is expected to be a daily peak of 400 construction workers, 30 LGVs and 60 HGVs associated with the Solar and Energy Storage Park. The associated vehicle trips will be split across four access points including the A156 Gainsborough Road primary site access, and secondary access points on Kexby Lane (North and South) and Marton Road. In the absence of a more recent suitable alternative, the forecast trip distribution of construction staff vehicles has been derived using 2011 Census data. This PEI Report includes an assessment of the Solar and Energy Storage Park within Section 13.10.
- 13.4.5 There is expected to be a daily peak of 25 construction workers, 16 LGVs and 12 HGVs associated with the Grid Connection Route. The associated vehicle trips are expected to be split across several access points including the A156 to the east of the River Trent (in Lincolnshire) and Cottam Road to the west of the River Trent (in Nottinghamshire). In view of the minimal levels of vehicle trips to be generated, the Grid Connection Route is not expected to have a material impact on the surrounding highway network. The exact location of the Grid Connection Route (within the redline boundary) has yet to be defined. An assessment of the Grid Connection Route will be included as part of the ES once further Scheme design information is available.
- 13.4.6 It is not considered that the conclusions of this PEI Report would change in the instance that the start of construction is delayed. For example, other cumulative schemes may have been completed by the time the Scheme construction begins, which would elevate the trips on the local road network in the future baseline. As the assessment criteria is based on a percentage change of vehicle numbers, a higher baseline flow would reduce the proportional impact that the Scheme has on the road network. This would reduce or maintain the levels of effect presented in this chapter. It is therefore considered that assessment of 2026 reflects a worst case approach and the conclusions would remain valid should the peak be later than this.
- 13.4.7 Although the Scheme is located close to a number of small villages/ settlements including Willingham by Stow, Lea and Marton, only a small proportion of trips are expected to either originate from or pass through these villages during the construction, operation, or the decommissioning phases. For example, the Framework CTMP will restrict HGVs to routes which avoid



these villages when travelling to/ from the main site access on the A156 Gainsborough Road as illustrated by HGV routing plan is shown in **PEI Report Volume 2: Figure 13-3**. In addition, the majority of construction vehicle trips will travel to/ from the main site access on the A156 Gainsborough Road as identified in Table 13-1. Whilst some staff may originate from larger settlements nearby (e.g. Gainsborough and Lincoln) and may travel by public transport or bicycle (the distance is too far to walk) these modes are not expected to constitute a significant proportion of trips to the Solar and Energy Storage Park.

- 13.4.8 In terms of potentially utilising the railway for deliveries during the construction phase, whilst the existing Cottam Power Station is served by a rail station, it is understood that this section of track is no longer in use. This may therefore facilitate over-track crossings for the Grid Connection Route works if required. Furthermore, the railway running through the Solar and Energy Storage Park is frequently used by mainline passenger services and is therefore not considered to be viable for serving the Scheme in terms of delivering equipment, materials etc.
- 13.4.9 Further details relating to the assumptions that have been adopted in support of the assessment work (e.g. relating to access points, working hours, trip generation) are set out within Section 13.6.

13.5 Study Area

- 13.5.1 The study area includes areas of the highway and Public Rights of Way (PRoW) networks which, based on professional judgement and experience of other Solar Farm DCO submissions, are considered to be potentially at risk from possible direct and indirect impacts arising from the Scheme. The study area is shown in **PEI Report Volume 2: Figure 13-1**.
- 13.5.2 Consideration has been given to a number of locations within the surrounding highway network which could potentially be impacted. The following junctions have been considered based on traffic surveys which were carried out in the vicinity of the Solar and Energy Storage Park in March and April 2022 (see PEI Report Volume 2: Figure 13-2):
 - A156/A1500/Littleborough Lane staggered junction;
 - A1500/B1241 T-Junction;
 - Marton Road/High Street/Gainsborough Road T-Junction; and
 - A156/Gainsborough Road/Willingham Road Junction;
- 13.5.3 The following road links have also been considered based on the traffic surveys (see **PEI Report Volume 2: Figure 13-2**):
 - A156 Gainsborough Road (north of Kexby Lane);
 - A156 (south of Clay Lane);
 - Clay Lane;
 - Willingham Road;



- A1500 Stow Park Road;
- A156 (south of Marton);
- High Street (Willingham by Stow);
- Gainsborough Road (Willingham by Stow);
- Marton Road (Willingham by Stow);
- Kexby Lane;
- Town Street/ Headstead Bank;
- B1241;
- A1500 (East of Saxilby Road); and
- Saxilby Road.
- 13.5.4 The study area (as it relates to the Solar and Energy Storage Park) has been submitted for agreement with LCC and NCC, as the local highway authorities.
- 13.5.5 The study area proposed as part of this PEI Report has been determined by our understanding of the road network and where the likely impacts will be. Any additional junctions or parts of the network requested for inclusion by the highway authorities, including in relation to the Grid Connection Route, will be assessed as part of both the TA and the ES.

13.6 Assessment Methodology

Sources of Baseline Information

- 13.6.1 To inform the assessment of the Scheme, information has been collected from a number of sources including:
 - Traffic counts carried out for the surrounding highway network in March and April 2022 (see the Transport Scoping Note within PEI Report Volume 3: Appendix 13-A as well as the locations shown on PEI Report Volume 2: Figure 13-2 for further details);
 - Traffic growth has been calculated using National Road Traffic Forecast (NRTF) growth factors, with National Transport Model (NTM) adjustments applied within the Trip Ends Model Program (TEMPRO) utilising National Trip Ends Model (NTEM) dataset v7.2;
 - Local travel and network information gathered from various sources including local rail and bus operators;
 - Personal Injury Collision (PIC) data from CrashMap (Ref. 13-18) for the highway network in the vicinity of the Solar and Energy Storage Park and the north-eastern part of the Grid Connection Route (within Lincolnshire) as identified within PEI Report Volume 2: Figure 13-1. This study area has been agreed with LCC. PIC data covering the likely impacted section of highway network in the vicinity of the south-western part of Grid Connection Route (within Nottinghamshire) will be included as part of the ES and TA;



- Ordnance Survey (OS) Base Mapping to ascertain an accurate geographical representation of the areas in the vicinity of the Scheme;
- Location of usual residence and place of work by method of travel to work data from the 2011 Census (please note that more recent Census data is not currently available); and
- Route planning software such as, Google Maps, was used to assess the most direct and functional route to the Solar and Energy Storage Park.

Proposed Access Arrangements

Solar and Energy Storage Park

- 13.6.2 The proposed construction accesses for the Solar and Energy Storage Park are as follows:
 - A156 Gainsborough Road North (primary access located to the north of Gate Burton);
 - Kexby Lane North (secondary access located between Knaith Park and Kexby);
 - Kexby Lane South (secondary access located between Knaith Park and Kexby); and
 - Marton Road (secondary access located by Willingham by Stow, utilising an existing farm access and track).
- 13.6.3 It should be noted that whilst an additional construction access is being considered in the form of a one-way 'loop' via Clay Lane and Willingham Road and their junctions with the A156, this has not been confirmed and the assessment within this PEI Report has therefore been based on the four access/ egress points identified above. In addition, the exact locations of the A156 access and the Kexby Lane (north and south) site accesses are currently being determined. During the transport scoping meeting with the LHAs, both options for the A156 were considered to be acceptable from a highway's perspective. In terms of Kexby Lane, two potential options were discussed including a crossroads option with the northern and southern accesses opposite each other, as well as a staggered option with two separate T-junctions. Further details of the proposed access points will be provided within the TA and ES.
- 13.6.4 Operational access will primarily be taken from the A156 Gainsborough Road via Clay Lane. The majority of routine visits by vans and four-wheel drive vehicles would utilise the Clay Lane rail underpass for access to the eastern part of the Solar and Energy Storage Park. If larger vehicles are required to access the eastern part of the Solar and Energy Storage Park, then these would utilise the Kexby Lane South and/ or the Marton Road access points which will also be retained during the operational phase.

Grid Connection Route

13.6.5 A new access will be provided on the northern side of Cottam Road (in the vicinity of the existing power station access) and an access will also be provided on the western side of the A156 to the south of Marton to provide



construction vehicle access to the Grid Connection Route works. Additional access points may also be required and further details of the proposed access arrangements for the Grid Connection Route will be provided within the ES.

Programme and Working Hours

- 13.6.6 The following assumptions have been adopted to provide a robust assessment of the Solar and Energy Storage Park:
 - The shortest expected construction programme will be 24 months, which provides a worst-case in terms of monthly (and therefore daily) construction vehicle trips;
 - The summer construction working hours will be Monday to Friday (07:00-19:00) and Saturday (09:00-13:00) with no Sunday or Bank Holiday working;
 - The winter construction hours will be Monday to Friday (08:00-18:00) and Saturday (09:00-13:00) with no Sunday or Bank Holiday working;
 - To provide a robust assessment, the winter weekday working hours will be adopted so that staff travel patterns are more closely aligned with the traditional network hours of 08:00-09:00 and 17:00-18:00;
 - As such, staff arrivals are expected between 07:00-08:00 and staff departures are expected between 18:00-19:00 (Monday to Friday);
 - HGV and Light Goods Vehicle (LGV) movements will be distributed across an 8-hour window, avoiding the weekday peak hours, arriving and departing between 09:00-17:00; and
 - A weekday assessment (Monday to Friday) will be carried out to provide a worst-case assessment of the peak construction phase based on the above (and it is not proposed to carry out a Saturday assessment given that both baseline traffic flows and construction traffic flows would be lower than weekday traffic flows i.e. the network will have more capacity to accommodate construction traffic at this time).

Construction Traffic Flows

- 13.6.7 Details of the forecast trip attraction of the Scheme during the construction phase are set out within the Transport Scoping Note included within **PEI Report Volume 3: Appendix 13-C**. Further details are also provided below.
- 13.6.8 For the purposes of this assessment, and based on the information provided by the application, the peak daily number of HGVs, LGVs and construction staff required for the Solar and Energy Storage Park (excluding the Grid Connection Route see Section 13.4) are identified below. It should be noted that the forecast numbers below include consideration of daily variation and peak daily movements to provide a robust assessment:
 - 60 HGV deliveries (120 movements per day);
 - 30 LGV deliveries (60 movements per day); and



- 400 construction staff (persons) with the forecast number of staff vehicles identified below.
- 13.6.9 In terms of construction staff vehicles, the following has been included as part of this assessment:
 - 55% of construction staff (220 persons) to be transferred to/ from the Scheme by shuttle service (each with capacity for 50 staff) to/ from four centres in the vicinity considered to be Gainsborough (north), Lincoln (south), Retford (west) and Newark on Trent (also south). It is assumed that an average of 55 staff would reside within each of the four areas (as indicated) and two shuttle services would be required to/ from each area equating to a total of eight shuttle services in the morning (16 movements) and eight shuttle services in the evening (16 movements). All shuttle services will be required to travel via the main site access on the A156 Gainsborough Road and it has been assumed that 50% shuttle services would travel via the A156 to the north (for Gainsborough and Retford) and 50% would travel via the A156 to the south (for Lincoln and Newark on Trent).
 - 45% of construction staff (180 persons) to travel by private vehicle with an average occupancy of 1.3 staff per vehicle, resulting in 138 staff vehicles (276 daily movements).
- 13.6.10 In relation to the shuttle service provision, if additional demand is identified as part of the Framework CTMP then additional shuttle services will be provided to further reduce the number of construction staff vehicles on the network.
- 13.6.11 Given the locations of the nearest rail and bus services/ stops to the Scheme and considering the public transport timetables in relation to the construction staff working hours, there will be limited opportunities for construction staff to travel to the Solar and Energy Storage Park by rail or bus. Nevertheless, sustainable travel will be promoted for usage by construction staff travelling to/ from the Solar and Energy Storage Park with further details set out within the TA and Framework CTMP. The above mode share is considered to provide a worst-case assessment in terms of the number of construction staff vehicles forecast.
- 13.6.12 The forecast distribution of HGVs, LGVs and construction staff vehicles across the site accesses is presented below in Table 13-1. A slightly different distribution has been adopted for construction workers based on the proposed levels of parking at each of the compounds, with the majority of parking to be provided at the main compound accessed via the A156 Gainsborough Road.



Table 13-1. Forecast Trip Distribution (Construction Accesses)

Access	Description	Description Construction Staff (%)	
A156 Gainsborough Road	Primary access serving the majority of the main site	70%	62%
Kexby Lane North	Secondary access serving a few parcels to the north of Kexby Lane	9%	9%
Kexby Lane South	Secondary access serving the main site (east of the railway line)	12%	20%
Marton Road	Secondary access serving a few parcels to the southeast	9%	9%
Total	-	100%	100%

13.6.13 Based on the trip generation and distribution outlined above, the forecast peak daily trip generation for each of the Solar and Energy Storage Park accesses during the construction period (in terms of vehicles) is set out in Table 13-2 below.

Table 13-2. Forecast Peak Daily Construction Vehicles for Solar and Energy Storage Park

Site Access	HGVs	LGVs	Staff Vehicles	Shuttle Services	Total Vehicles
A156	38	18	97	16*	169
Kexby Lane North	5	3	12	0	20
Kexby Lane South	12	6	17	0	35
Marton Road	5	3	12	0	20
Total	60	30	138	16*	244

*each shuttle service to depart from and arrive back to the site twice per day i.e. eight shuttle services picking-up and dropping-off staff in the morning, and eight shuttle services in the evening

13.6.14 A daily profile of overall construction movements (arrivals and departures) is presented in Table 13-3 below based on the anticipated travel patterns of staff, LGVs and HGVs across the day and the winter profile in terms of staff working hours (to provide a robust assessment due to compressed working hours close to the traditional network peak hours).



Table 13-3. Forecast Peak Daily and Hourly Construction Movements for Solar and Energy Storage Park

Hour	HGVs and LGVs		Staff Vehicles (inc. Shuttle Services)		Total Vehicles		
	Arr	Dep	Arr	Dep	Arr	Dep	Total
06:00-07:00	0	0	0	0	0	0	0
07:00-08:00	0	0	146	8	146	8	154
08:00-09:00	0	0	0	0	0	0	0
09:00-10:00	11	11	0	0	11	11	22
10:00-11:00	12	12	0	0	12	12	24
11:00-12:00	11	11	0	0	11	11	22
12:00-13:00	11	11	0	0	11	11	22
13:00-14:00	11	11	0	0	11	11	22
14:00-15:00	12	12	0	0	12	12	24
15:00-16:00	11	11	0	0	11	11	22
16:00-17:00	11	11	0	0	11	11	22
17:00-18:00	0	0	0	0	0	0	0
18:00-19:00	0	0	8	146	8	146	154
19:00-20:00	0	0	0	0	0	0	0
Total	90	90	154	154	244	244	488

- 13.6.15 For the purposes of the assessment the following assignment of HGV and LGV trips have been made onto the local highway network (as proposed and agreed during scoping discussions with the LHAs):
 - 50% of HGVs and LGVs to travel to/ from the A156 to the north; and
 - 50% of HGVs and LGVs to travel to/ from the A156 to the south.
- 13.6.16 An HGV routing plan is shown in **PEI Report Volume 2: Figure 13-3**, identifying the key routes which will be used by HGVs and LGVs (including shuttle services) to travel to/ from each site access. It should be noted that all HGVs will be expected to travel via the A156 and the majority of these vehicles would avoid the local towns/ villages such as Sturton by Stow and Willingham by Stow.
- 13.6.17 In the absence of a more recent suitable alternative, the forecast trip distribution of construction staff vehicles has been derived using the 2011 Census 'WU03EW Location of usual residence and place of work by method of travel to work' dataset for the West Lindsey Middle Super Output Area (MSOA) 007 i.e. to identify incoming vehicle trips to the area where the Solar and Energy Storage Park is located. Route planning software has been used to determine the likely routes that will be used by construction staff to/ from each of the Solar and Energy Storage Park site accesses.
- 13.6.18 To provide an example, the distribution of construction staff vehicle trips (excluding shuttle services) to/ from the main site access on the A156 is



identified in Plate 13-1 below. It should be noted that a separate distribution has been derived for each site access point and further information relating to the distribution and assignment of construction staff vehicles to all of the site accesses of the Solar and Energy Storage Park will be provided in the TA.

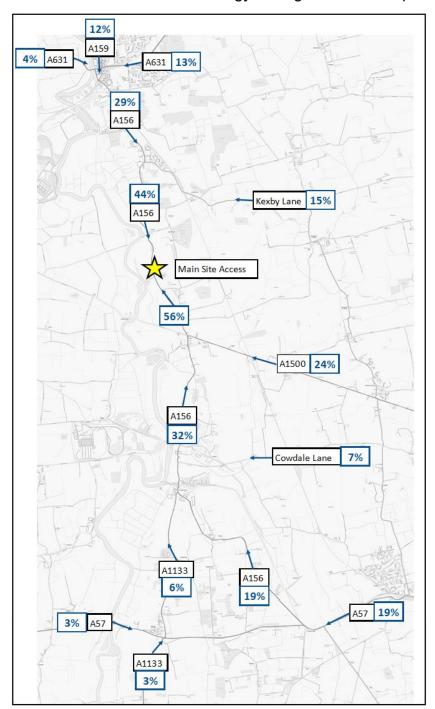


Plate 13-1. Staff Trip Distribution Example (Main Site Access on the A156)

Operational Traffic Flows

13.6.19 During the operational phase, the Scheme will be manned by a nominal amount of people across the Site (up to 14 permanent staff per day), predominantly undertaking maintenance tasks. In addition, there is expected to be approximately 3-4 visitors per week (equating to one visitor per day) for



- deliveries, and periodic replacement of any components. Staff vehicles and those used for maintenance will primarily be four wheeled drive vehicles and vans, with HGVs rarely accessing the site once operational.
- 13.6.20 Therefore, due to the low level of trips likely to be generated within the network peak hours (with up to 15 arrivals and 15 departures expected daily), an assessment of the operational phase has been excluded from this PEI Report. Operational phase effects will also be excluded from the EIA and this has been agreed in the Scoping Opinion ref ID 3.8.1 (see PEI Report Volume 3: Appendix 1-C). Further details of the operational stage transport arrangements will be set out in the ES and TA to support this approach.
- 13.6.21 Notwithstanding the above, solar panels typically have a lifespan of 30-40 years and may therefore need to be replaced at least once during the operational life of the Scheme. At this stage, the level of vehicle trips associated with component replacement (e.g. batteries and panels) is expected to be considerably lower than the level of vehicle trips generated during the peak construction phase. For example, even in the instance that full panel replacement is required, this would be programmed in stages over a much longer period than the construction phase (when the panels will be rapidly installed). This would be done in order to maximise the number of panels which are kept 'live' at any given time and avoid compromising the electricity generating capacity of the site. Otherwise, components would be replaced as and when required throughout the operational lifetime of the scheme (circa. 60-year period). As such, the above approach is considered to be appropriate for assessing the operational effects of the Scheme, including in the instance that any components need to be replaced. Further details are provided within Chapter 15: Other Environmental Topics of this PEI Report (which includes waste) and will also be set out within the Framework DEMP.
- 13.6.22 It should be noted that the TA and ES will consider the operational scenario on the same basis as the above, in line with the scoping discussions held with the local authorities and the Transport Scoping Note (**PEI Report Volume 3: Appendix 13-A**).
- 13.6.23 The above meets the requirements of ID 3.8.3 of the EIA Scoping Opinion (Ref. 13-1) which states the following "The Inspectorate accepts that a full assessment of traffic impacts may not be possible at the current time, however, the ES should provide commentary on the likely transport impacts of the decommissioning process in light of comments in section 3.10 of this Opinion regarding component refurbishment, where possible", as well as ID 3.8.10 which states "there is a potential need for substantial removal of panel waste prior to the end of the stated operational period that should be addressed within the ES and/ or ODEMP."
- 13.6.24 In terms of operational access, this is expected to be mainly taken from the proposed main access via A156 and/ or via Clay Lane. Routine visits by vans and four-wheel drive vehicles would utilise the Clay Lane rail underpass to access the eastern part of the Solar and Energy Storage Park. Larger vehicles could utilise the proposed access points along Kexby Lane (north and south) and/ or Marton Road to access the eastern part of the Solar and Energy



Storage Park, on the assumption that these are retained during the operational phase.

Decommissioning Traffic Flows

13.6.25 For the purposes of the EIA, the decommissioning assessment year is assumed to be 2088 (60 years from opening) which will be addressed through a Framework Decommissioning Environmental Management Plan (DEMP). The decommissioning period is expected to be similar in duration and nature to the construction phase, albeit with fewer vehicle trips over a slightly shorter duration. In addition, this scenario is considered to be too far into the future to be able to accurately predict traffic flows or road/ junction layouts at that time. It is therefore considered reasonable to assume that the impacts will be the same as, or not greater than, the construction phase. This may overestimate the actual impacts slightly, but it is considered broadly accurate.

Assessment Scenarios

- 13.6.26 The nature of the proposals is such that the greatest impact is likely to occur during the construction and decommissioning phases. At this stage, the construction of the Solar and Energy Storage Park is anticipated to take place over a 24-month period between 2025 and 2027, with the peak construction expected to occur in 2026. Therefore, to determine the likely effects of the Scheme, and in view of the above, the following scenarios have been considered as part of this PEI Report:
 - Baseline (2022) AM, PM and daily; and
 - Peak Construction Year (2026) With and Without Development AM, PM and Daily.
- 13.6.27 The baseline reporting sets out the existing conditions within the study area against which the construction impacts have then been assessed.
- 13.6.28 As set out in Section 13.4, it is not considered that the conclusions of this PEI Report would change in the instance that the start of construction is delayed. For example, other cumulative schemes may have been completed by the time the Scheme construction begins, which would elevate the trips on the local road network in the future baseline. As the assessment criteria is based on a percentage change of vehicle numbers, a higher baseline flow would reduce the proportional impact that the Scheme has on the road network. This would reduce or maintain the levels of effect presented in this chapter.
- 13.6.29 As above, the decommissioning assessment year is assumed to be 2088 (60 years from opening) which is considered to be too far into the future to accurately predict traffic flows or junction forms. Therefore, the assessment of the construction phase has been used to determine the anticipated impact of the Scheme during its decommissioning phase.

Consultation

13.6.30 Details of the consultation held in support of this PEI Report are provided within Section 13-2 of this PEI Report, as well as within **PEI Report Volume 3: Appendix 13-A**.



Impact Assessment Methodology

- 13.6.31 The assessment methodology adopted in this PEI Report, as contained in the Guidelines for the Environmental Assessment of Road Traffic (Ref. 13-17). The guidelines outline the issues and the respective changes in volume and composition of traffic regarded as necessary before each issue results in traffic and transport impacts.
- 13.6.32 In accordance with the above, the following criteria has been considered in this assessment:
 - Severance;
 - Driver delay;
 - Pedestrian delay;
 - Pedestrian and cyclist amenity;
 - Fear and Intimidation;
 - Accidents and safety; and
 - Hazardous loads.
- 13.6.33 The significance of effect has been determined through consideration of two elements; the magnitude of impact and the sensitivity of the receptor.
- 13.6.34 The overall effect has been determined by measuring the magnitude of the impact following mitigation measures (where applicable) against criteria including; the number of activities of the population affected; the type and sensitivity of the receptor; and the type of impact. Effects are defined as beneficial or adverse, with effects further defined using the following classifications:
 - Minor slight, very short, or highly localised impact of no significant consequence;
 - Moderate limited impact (by extent, duration or magnitude) which may be considered significant; and
 - Major considerable impact (by extent, duration or magnitude) of more than local significance, or in breach of recognised acceptability, legislation, policy or standards.
- 13.6.35 The IEMA guidelines (Ref. 13-17) state that the magnitude of each impact should be determined as the predicted deviation from the baseline conditions. This has been completed for the construction and decommissioning phases.
- 13.6.36 IEMA (Ref. 13-17) sets out a number of criteria by which the magnitude of impact can be measured. These are outlined below based on the EIA Scoping Report (see **PEI Report Volume 3: Appendix 1-A**). Many of the criteria do not provide specific thresholds by which such impacts can be measured, and as a result will be measured qualitatively where necessary.
- 13.6.37 It should be noted that irrespective of the proportional increase in traffic flows, an increase of fewer than 30 additional vehicle trips per hour during each of the development peak hours has been categorised as a very low magnitude



- of change. This threshold has been determined based on professional judgement, as it is considered that an increase of less than one vehicle every two minutes would be immaterial and would not result in any significant effects.
- 13.6.38 **Severance** is defined in the IEMA guidelines (Ref. 13-17) as the "perceived division that can occur with a community when it becomes separated by a major traffic artery". The term is used to describe a complex series of factors that separate people from places and other people. Severance may result from the difficulty of crossing a heavily trafficked road or a physical barrier created by the road itself. It can also relate to quite minor traffic flows if they impede pedestrian access to essential facilities. IEMA guidelines suggest that 30%, 60% and 90% increases in traffic flows will result in slight, moderate and substantial changes in severance, respectively.
- 13.6.39 **Driver Delay** has been determined through the analysis of junction capacity assessments carried out as part of the TA, where required (as requested by LCC for the Solar and Energy Storage Park). Further details including in relation to the Grid Connection Route will be provided as part of the ES. Delay is measured in terms of change in delay per vehicle (in seconds) from the baseline situation. This criterion is considered to be applicable to all modes of transport using the public highway, namely cars, motorcycles, pedal cycles and buses. This impact has been considered to be negligible (and therefore has not been considered further) for any parts of the network where junction capacity assessments were not required as part of the TA, given that no adverse impacts are envisaged for these parts of the network in terms of additional delay to road users.
- 13.6.40 **Pedestrian Delay** is considered to be affected by the changes in volume, composition or speed of traffic, in terms of their respective impacts on the ability of pedestrians to cross roads. In general, increases in traffic levels and/ or traffic speeds are likely to lead to greater increases in pedestrian delay.
- 13.6.41 **Pedestrian and Cycle Amenity** is broadly defined as "the relative pleasantness of a journey and is considered to be affected by traffic flow, traffic composition and pavement width / separation from traffic". The guidance suggests that a tentative threshold for judging the significance of changes in pedestrian and cycle amenity would be where the traffic flow is halved or doubled.
- 13.6.42 **Fear and Intimidation** is "dependent on the volume of traffic, its HGV composition, and its proximity to people or the lack of protection caused by such factors as narrow pavement widths".
- 13.6.43 At this stage an assessment of **Accidents and Safety** has been carried out by examination of PIC data for the most recent five-year period available. The PEI Report includes a review of the PIC data for the highway network in the vicinity of the Solar and Energy Storage Park and the north-eastern part of the Grid Connection Route (within Lincolnshire). The ES will include a full review of PIC data including the likely impacted section of highway network in the vicinity of the south-western part of Grid Connection Route (within Nottinghamshire). This analysis will be included in the TA and undertaken to highlight if there are any existing safety issues on the local road network which



- may be exacerbated by the Scheme. The outcome of the assessment will be presented in the ES.
- 13.6.44 With regard to Hazardous and Dangerous Loads, the guidance indicates that "the Statement should include a risk or catastrophe analysis to illustrate the potential for an accident to happen and the likely effect of such an event." Analysis of the road network within the study area indicates that there are no particular features, such as a significant vertical drop immediately beyond the carriageway, which would suggest that the transfer of materials poses a particular risk beyond that which would be expected on the general highway network. In addition, there are not expected to be any Hazardous and Dangerous Loads associated with the Scheme. Nonetheless, the Framework CTMP and the ES will include details of measures that will be employed to ensure the safe vehicular transport of components to and from the Solar and Energy Storage Park.
- 13.6.45 In view of the above, it is concluded that the impacts of Hazardous and Dangerous Loads do not warrant further consideration in the preparation of the ES, and with reference to ID 3.8.2 of the Scoping Opinion (see **PEI Report Volume 3: Appendix 1-C**), this will not then be assessed further beyond an estimation of the likely number and composition of loads required and the measures which will be implemented to safely transport components to and from the Solar and Energy Storage Park.
- 13.6.46 The IEMA guidelines set out two rules in identifying potential links for analysis:
 - **Rule 1**: include highway links where traffic flows will increase by more than 30% (or the number of HGVs will increase by more than 30%); and
 - Rule 2: include any other specifically sensitive areas (e.g. accident black spots, conservation areas, hospitals, links with high pedestrian flows etc) where traffic flows have increased by 10% or more.
- 13.6.47 Based on this, links have been assessed where traffic flows are expected to increase by 30% or more during the peak hours of the peak construction phase (2026). However, links have not been assessed where there is expected to be a less than 30% increase in traffic flows as a result of the Scheme, unless any specifically sensitive areas are identified. In addition, a very low magnitude of change has been assigned where there is expected to be fewer than 30 additional vehicle trips per hour during each of the development peak hours as a result of the Scheme, irrespective of the proportional increase in traffic flows.
- 13.6.48 In terms of Severance, Pedestrian Delay, Pedestrian / Cycle Amenity and Fear and Intimidation, the road links within an easy walking/ cycling distance of the Solar and Energy Storage Park have been used as receptors, as well as any road links which are expected to provide a main vehicular route to/ from the Solar and Energy Storage Park and contain pedestrian/ cycle facilities. A review of any internal routes and road links within an easy walking/ cycling distance of the Grid Connection Route will be carried as part of the ES Chapter once these have been confirmed i.e. given that the exact location of the Grid Connection Route (within the redline boundary) has yet to be defined.



- 13.6.49 For the construction impacts, the sensitivity of pedestrian routes and cycle routes are based on a qualitative assessment of the 2022 baseline scenario, taking into consideration the importance and attractiveness of the routes and the destinations served. The thresholds have been defined based on professional judgement and experience of other Solar Farm DCO submissions and are as follows:
 - Very Low Sensitivity: Rural road with no pedestrian/cycle facilities provided;
 - **Low Sensitivity**: Strategic vehicular route in a rural setting with pedestrian/cycle facilities;
 - Medium Sensitivity: Main vehicular route with pedestrian/ cycle facilities provided in built up area; and
 - High Sensitivity: Lightly trafficked route provided in town centre setting.
- 13.6.50 The impacts of **Driver Delay** have been assessed at junction level. The sensitivity of these receptors is expressed in terms of Ratio of Flow to Capacity (RFC) or Degree of Saturation (DoS). The worst-case development peak hours of 07:00-08:00 and 18:00-19:00 have been assessed with reference to the baseline traffic flows on the surrounding highway network at these times.
- 13.6.51 As set out within the EIA Scoping Report (see **PEI Report Volume 3: Appendix 1-A**), the thresholds for sensitivity of junctions have been defined as:
 - Low Sensitivity: RFC / DoS below 90%;
 - Medium Sensitivity: RFC / DoS between 90% and 95%; and
 - **High Sensitivity**: RFC / DoS above 95%.
- 13.6.52 As mentioned above, an assessment of Driver Delay has not been carried out for any parts of the network where detailed junction capacity analysis will not be required as part of the TA.
- 13.6.53 In terms of **Accidents and Safety** the impacts of the Scheme will be assessed based on the findings of the TA, in terms of whether any accident clusters or patterns have been identified across the study area.
- 13.6.54 The significance of effect is determined through the consideration of two elements; the sensitivity of receptors and the magnitude of impact, as outlined above. The matrix that has been used to determine the effect category is identified within Table 5-1 of **Chapter 5: EIA Methodology** of this PEI Report. Effects which are classified as major or moderate are considered to be significant.

Deliverables

- 13.6.55 The following deliverables are anticipated to be required to accompany the submission:
 - Transport Scoping Note;
 - Transport Assessment (TA);



- ES Transport and Access Chapter; and
- Framework CTMP.
- 13.6.56 It should be noted that the Framework CTMP will include a chapter on construction worker travel patterns and measures to encourage travel by alternative modes to the single occupancy vehicle. A standalone Travel Plan is not expected to be required, as this document typically applies to the operational phase of a development (however a chapter will be included as part of the Framework CTMP). As set out above, due to the low level of trips likely to be generated within the network peak hours, it is proposed to exclude operational phase transport effects and therefore a Travel Plan from the EIA.

13.7 Baseline Conditions

Existing Baseline

13.7.1 This section describes the baseline environmental characteristics for the Scheme and surrounding areas with specific reference to Transport and Access.

Strategic Highway Network

- 13.7.2 The A1(M) is a dual carriageway road which forms part of the trunk road network and is managed by National Highways. The A1(M) can be accessed via A614 Blyth Interchange, A638, A631 and A156 Gainsborough Road to the north or via A57, Markham Moor Interchange and A156 Gainsborough Road to the south.
- 13.7.3 The A614 is a single carriageway road which links the A1(M) to the A638 which runs north to Doncaster. The A614 is classified by the Department of Transport (DfT) as part of the Major Road Network (MRN) and provides access to the A631, which joins with A631 to the northwest and provides access to A156 from the north.
- 13.7.4 The A57 is a single carriageway road which links the A1(M) to the A46 to the west of Lincoln. The A57 is classified by the DfT as part of the MRN and provides access to the A156 from the south. The A57 also provides access to Laneham Road, which joins with Rampton Road and provides access to Cottam Road from the west.
- 13.7.5 A plan showing the surrounding highway network as this relates to the study area for the Solar and Energy Storage Park is shown in **PEI Report Volume** 2: Figure 13-4.

Local Highway Network

Solar and Energy Storage Park

13.7.6 The A156 High Street/ Gainsborough Road runs north-south, bordering the Solar and Energy Storage Park to the west between and including its junctions with the A631/ A159 within Gainsborough to the north and the A57 to the southwest of Saxilby to the south.



- 13.7.7 The A156 High Street/ Gainsborough Road is a single carriageway road connecting with A57 to the west of Saxilby in the south and with A631/ A159 in Gainsborough to the north. The road runs in a north-south direction, bordering the Solar and Energy Storage Park to the north and west. The road is subject to the National Speed Limit (60mph) and does not contain pedestrian footways or street lighting provision within its vicinity, which is in keeping with their rural character. In the vicinity of Marton, to the south of the Solar and Energy Storage Park, the A156 High Street is restricted to 30mph and some pedestrian footways and street lighting provision are provided.
- 13.7.8 The B1241 runs both north-south and east-west, to the north and east of the Solar and Energy Storage Park between and including its junctions with the B1241 Kexby Lane/ Upton Road/ Willingham Road to the north and A1500 Till Bridge Lane to the southeast. The B1241 is a rural single carriageway; the road is subject to a 60mph speed limit and does not contain pedestrian footways or street lighting. There are a number of villages along B1241 to the east of the Solar and Energy Storage Park including Kexby, Willingham by Stow, Normanby by Stow and Sturton by Stow and as a result the speed limit in the vicinity of, and through these villages is 30mph. In the more rural sections it is subject to a derestricted speed limit and in keeping with their rural character.
- 13.7.9 Willingham Road, which becomes Marton Road are both narrow rural roads with passing places along its route; the roads connects to the A156 to the west and B1241 to the east. The two roads provide a physical border to the south and east of the Solar and Energy Storage Park and are subject to a derestricted speed limit. The route has signing stating it is unsuitable for HGV use.
- 13.7.10 Clay Lane is a no-through road single lane track (with passing places) accessed via the A156 to the southwest of the Solar and Energy Storage Park and passing underneath the railway via a relatively narrow and low underpass.
- 13.7.11 The A1500 Stow Park Road/ Marton Road/ Till Bridge Lane runs east-west, to the south of the Solar and Energy Storage Park between and including its junctions with the A156 to the west and the B1241 to the east. In the vicinity of Marton to the west and Sturton by Stow to the east, the road is subject to a 30mph speed limit, in the more rural sections it is subject to a derestricted speed limit in keeping with their rural character.

Grid Connection Route

13.7.12 The Grid Connection Route is planned to run in a southwest direction from the Solar and Energy Storage Park, crossing the A156 (to the south of Marton), the A1500 (to the east of Marton) and the River Trent within the county of Lincolnshire. Then it is anticipated that the route will head west into the county of Nottinghamshire connecting to Cottam Power Station, crossing agricultural land as well as Headstead Bank, Cow Pasture Lane and the disused railway track to the northwest of Cottam. Both Headstead Bank, Cow Pasture Lane are narrow, minor, very low trafficked single-track roads with no pedestrian facilities/ street lighting etc.



- 13.7.13 Cottam Road is located circa. 6km to the southwest of the Solar and Energy Storage Park between its junction with Rampton Road/ Green Lane to the west and the village of Cottam to the east. Cottam Road is a single carriageway road, with a single lane in each direction and subject to a derestricted speed limit. Sections of footway exist on Cottam Road around the existing power station access and to the east of the power station towards Cottam village.
- 13.7.14 Rampton Road is a single carriageway road which connects to Cottam Road and Green Lane at a junction in the north and Laneham Road to the south. Laneham Road connects to Rampton Road in the north and A57 in the south. Both of the roads are subject to the National Speed Limit (60mph) and do not feature pedestrian footways or street lighting, which is in keeping with their rural character.
- 13.7.15 As set out previously, the exact location of the Grid Connection Route (within the redline boundary) has yet to be defined. Therefore, further details relating to the Grid Connection Route including the specific locations where this will potentially impact the baseline conditions, will be discussed in the TA and ES once these details are known.

Baseline Traffic Flows

- 13.7.16 The following time periods have been reviewed to inform the assessment, based on the winter working hours of 08:00-18:00 (as opposed to the summer working hours of 07:00-19:00):
 - 07:00 to 08:00 construction staff AM peak hour (winter profile);
 - 18:00 to 19:00 construction staff PM peak hour (winter profile); and
 - Daily (24 hours).
- 13.7.17 A summary of the baseline traffic data within the study area is set out in Table 13-4 and Table 13-5 below, based on the traffic surveys carried out in March and April 2022 (these were carried out between 22nd to 28th March as shown by **PEI Report Volume 2: Figure 13-2**, with the exception of traffic count ATC 6 which was resurveyed between 30th March to 10th April).



Table 13-4. Baseline Traffic Survey Data (2022) – Total Vehicles – Links

Location	on		ev Pea 0-08:00			ev Pea 0-19:00		Daily (24 Ho	urs)	
Ref	Link	Total	HGVs	% HGVs	Total	HGVs	% HGVs	Total	HGVs	% HGVs
ATC1	A156 Gainsborough Road (south of Kexby Lane)	831	47	5.6%	503	12	2.4%	9,663	540	5.6%
ATC2	A156 Gainsborough Road (south of Willingham Road)	835	42	5.1%	500	13	2.5%	9,686	533	5.5%
ATC3	Clay Lane (east of A156)	1	0	0.0%	1	0	0.0%	22	1	2.7%
ATC4	Willingham Road (east of A156)	14	0	1.4%	10	0	2.0%	228	13	5.8%
ATC5	A1500 Stow Park Road (east of A156)	418	17	4.0%	272	10	3.7%	4,539	228	5.0%
ATC6	A156 Gainsborough Road (south of A1500)	425	34	8.0%	297	10	3.5%	5,897	397	6.7%
ATC7	High Street (east of Marton Road)	163	8	4.7%	133	4	2.7%	2,512	112	4.5%
ATC8	B1241 Gainsborough Road (south of Kexby Lane)	173	10	6.0%	138	3	2.5%	2,574	140	5.4%
ATC9	Marton Road (south of Gainsborough Road)	15	1	3.9%	13	0	1.6%	251	12	4.8%
ATC10	B1241 Kexby Lane (east of Upton Road)	54	3	5.5%	56	2	3.6%	1,083	69	6.4%
ATC11	A156 Gainsborough Road (north of Kexby Lane)	942	52	5.5%	655	17	2.6%	12,249	617	5.0%
ATC14	B1241 High Street (north of A1500)	212	14	6.4%	154	4	2.6%	2,741	138	5.0%
ATC15	A1500 Tillbridge Road (east of High Street)	561	23	4.1%	325	13	3.9%	5,718	263	4.6%
ATC16	Saxilby Road (south of A1500)	299	16	5.4%	299	16	5.4%	3,612	186	5.2%



Table 13-5. Baseline Traffic Survey Data (2022) - Total Vehicles - Junctions

		AM Dev Peak (07:00- 08:00)			PM Dev Peak (18:00- 19:00)		
Ref	Junction	Total	HGVs	% HGVs	Total	HGVs	% HGVs
MCC1	A156 High Street/ A1500 Stow Park Road	930	40	4.3%	546	11	2.0%
MCC2	A1500 Tillbridge Road/ Saxilby Road	840	34	4.0%	505	5	1.0%
мсс3	B1241 High Street/ Marton Road	200	13	6.5%	121	3	2.5%
MCC4	A156 Gainsborough Road/ Willingham Road	977	33	3.4%	632	11	1.7%

Collision Data Review

- 13.7.18 This section provides a high-level review of Personal Injury Collision (PIC) data obtained from CrashMap (Ref. 13-18) for the highway network in the vicinity of the Solar and Energy Storage Park and the north-eastern part of the Grid Connection Route (within Lincolnshire) as identified within **PEI Report Volume 2: Figure 13-1**. The PIC data covers the most recent five-year period available (start of 2017 to end of 2021). A further review of the PIC data including the remainder of the highway network within the vicinity of the Grid Connection Route (within Nottinghamshire) will be included within the TA and ES assessment.
- 13.7.19 A total of 32 collisions have occurred within the study area, for the most recent five-year period. A summary of these collisions by location and severity is set out in Table 13-6 below (for those locations where collisions were recorded).

Table 13-6. Collision Data Summary

Location	Number of Collisions				
	Slight	Serious	Fatal	Total	
A156 Gainsborough Road/ Willingham Road junction	2	0	0	2	
A156 Gainsborough Road/ A1500 Stow Park Road junction	2	1	0	3	
Willingham Road/ The Grove junction	2	0	0	2	
Upton Road/ Willingham Road/ Kexby Lane junction	1	0	0	1	
A1500 Till Bridge Lane/ Stow Park Road	1	0	0	1	
A1500 Tillbridge Rd/ B1241 High Street/ Saxilby Road junction	4	1	0	5	
A156 Gainsborough Road (north of Willingham Road)	1	0	0	1	
A156 Gainsborough Rd (circa. 2km between Willingham Rd and	3	1	0	4	
A156 Gainsborough Rd (circa. 3km between Knaith Hill and	2	0	1	3	
A156 High Street (south of A1500 Stow Park Road)	0	2	0	2	
Willingham Road (east of A156 Gainsborough Road)	1	0	0	1	
Kexby Lane	0	1	0	1	
A1500 Marton Road	1	0	0	1	



Location	Number of Collisions				
	Slight	Serious	Fatal	Total	
B1241 Stow Road and B1241 Sturton Road	2	0	0	2	
Ingham Road (east of Sturton Road)	0	2	0	2	
Private road (west of 156 Gainsborough Road)	1	0	0	1	

- 13.7.20 The above indicates that a total of five collisions (one serious and four slight) occurred at the A1500 Tillbridge Road/ B1241 High Street/ Saxilby Road junction during the five year period, equivalent to one collision per year. This is therefore considered to represent a cluster site which is reflected within the assessment of accidents and safety within Section 13.10.
- 13.7.21 A total of four collisions (one serious and three slight) occurred along a circa. 2km stretch of the A156 Gainsborough Road between the junctions with Willingham Road to the north and Knaith Hill to the south. This is equivalent to less than one collision per year along this section which is not considered to represent a cluster site.
- 13.7.22 In terms of the remaining collisions, one fatal collision occurred on the A156 Gainsborough Road approximately 300m north of the junction with Clay Lane. The circumstances of this collision are not detailed in the PIC report for this collision.
- 13.7.23 For the remainder of the network within the study area, fewer than five collisions occurred at any junction or link between junctions within the five-year period, equivalent to less than one collision per year. As such, no additional cluster sites have been identified.
- 13.7.24 It should be noted that none of the 32 collisions appeared to involve vulnerable road users based on the PIC data obtained.

Walking Facilities

Solar and Energy Storage Park

- 13.7.25 Due to the rural location of the Solar and Energy Storage Park, there is limited footway provision in the surrounding area. Footways are limited to the settlements that surround the Solar and Energy Storage Park, as follows:
 - A156 footways on both sides of A156 within Marton village; footways on western side of A156 north of Marton to Gate Burton and further north between Knaith and Lea:
 - B1241 (North) footway provision, varying from both sides to one side between Lea and Knaith Park and then on the northern side of B1241 between Upton Rd/ Willingham Road junction and western extent of residential dwellings on eastern part of Kexby Lane;
 - B1242 (East) footway provision, on at least one side of the carriageway exists along the full extent of the route from the Kexby lane junction in the north to the A1500 junction in the south; and



- A1500 Other than in the settlements of Marton and Sturton by Stow (at either extent of the A1500 within the study area) there is no footway provision along this route.
- 13.7.26 There is one PRoW crossing the Solar and Energy Storage Park, and in addition, there are three further PRoW which run in close proximity the proposed boundary of the Solar and Energy Storage Park. These PRoW are:
 - PRoW Knai 44/2 a footway which runs for 452m along the northern extents of the Solar and Energy Storage Park (in its northwest corner) from Knaith Hill/ Station Road to the railway line to the east;
 - PRoW Knai 44/1 a footway which runs for 330m within the vicinity of the northern extent of the Solar and Energy Storage Park, running in an eastwest direction between the railway line in the west and B1241 to the east;
 - PRoW Mton 69/1 a footway which runs for 339m and runs within the vicinity of the Solar and Energy Storage Park boundary to the southwest, running in a north-south direction between the Solar and Energy Storage Park in the north and A1500 Stow Park Road in the south; and
 - PRoW Upton 53/1 a footway which runs for 1250m within the vicinity of the northern extent of the Solar and Energy Storage Park, running in an east to west direction between PRoW Kexb/53/1 and Upton Road.

Grid Connection Route

- 13.7.27 At this stage, the exact alignment of the Grid Connection Route has not been yet defined, however based on the proposed corridor for the Grid Connection Route, below is a list of all PRoW which could be potentially impacted (the list below includes both the PRoW located in Lincolnshire and Nottinghamshire county, listed in east-west direction along the Grid Connection Route), these include:
 - PRoW Mton 68/1 footway which runs for 453m, through the field to the west of A1500 Stow Park Road to A156 High Road (PRoW Mton/68/1);
 - PRoW Mton 66/4 footway which runs for 351m, to the fields to the east of the River Trent, west of A156 Gainsborough Road (PRoW_Mton/66/4);
 - **PRoW Cottam FP1** footway which runs for 567m (PRoW FP1);
 - PRoW Cottam FP3 footway which runs for 661m, to the fields to the west of the River Trent, north of Cottam (PRoW_FP3);
 - PRoW Cottam RB4 restricted byway which runs for 356m, along Okercoal Lane, west of Wells Lane, north of Cottam (PRoW RB4);
 - PRoW Cottam RB6 restricted byway which runs for 110m, along Wells Lane to the west of Town Street, north of Cottam (PRoW_RB6) (along the Grid Connection Route boundary line);
 - PRoW Treswell FP4 footway which runs for 151m, to the west of Cottam Power Station (PRoW FP4);
 - PRoW Treswell FP5 footway which runs for 255m, to the west of Cottam Power Station (PRoW FP5);



- **PRoW Rampton FP6** footway which runs for 310m, to the west of the Cottam Power Station (PRoW FP6); and
- **PRoW South Leverton BOAT16** byway which runs for 658m, along Cow Pasture Lane, to the north of Outgang Lane (PRoW_BOAT16).

Cycling Facilities

Solar and Energy Storage Park

- 13.7.28 There are no on or off carriageway dedicated/ marked cycling facilities within the immediate vicinity of the Solar and Energy Storage Park and whilst relatively fast vehicle speeds and high traffic flows on the two A-roads (A156 and A1500) may deter cyclists, the B1421 to the north and east of the site, as well as the smaller roads closer and within the Solar and Energy Storage Park itself are likely to be attractive to leisure cycling. The Solar and Energy Storage Park could be potentially accessed by cyclists from Lea, Willingham, Stow, Upton and Brampton located within an approximate 2.5km cycle radius.
- 13.7.29 There are no formal cycle facilities in the vicinity of the Solar and Energy Storage Park. The nearest National Cycle Network route (between Harby and Lincoln) is located approximately 12km to the south.

Grid Connection Route

13.7.30 There are no on or off carriageway dedicated/ marked cycling facilities within the immediate vicinity of the Grid Connection Route. The eastern extent of the Grid Connection Route connects to the Solar and Energy Storage Park and therefore as previously mentioned above, the relatively fast vehicle speeds and high traffic flows on the two A-roads (A156 and A1500) may deter cyclists within the vicinity of the Grid Connection Route within Lincolnshire. However, there is a number of minor roads within the western extents of the Grid Connection Route within Nottinghamshire, including Cottam Road which is relatively lowly trafficked and would appear to be attractive to leisure cyclists. Additionally, this area could be potentially accessed by cyclists from Coates, South Leverton, Rampton and Treswell, all within a 2.5km cycle distance.

Equestrian Facilities

Solar and Energy Storage Park

13.7.31 There are no formal equestrian facilities (i.e. Bridleways) in the vicinity of the Solar and Energy Storage Park, however, some of the surrounding roads are generally lightly trafficked and could be used by equestrians on this basis.

Grid Connection Route

13.7.32 There are formal equestrian facilities in the vicinity of the Grid Connection Route along its western part within Nottinghamshire County. These include Bridleways, Restricted Byways and Byways Open to All Traffic (BOAT). These are listed in Section 13.7.18 above. Also, there are a number of narrow single-track roads to the north of Cottam near to Headstead Bank which appear to be very low trafficked and therefore may be appealing to equestrians.



Public Transport Facilities

Solar and Energy Storage Park

Bus

13.7.33 Bus stops are located on the A156 and B1421 (north and east) which broadly surround the Solar and Energy Storage Park. The bus routes which serve these bus stops are identified in Table 13-7 below:

Table 13-7. Bus Stops/ Services near the Solar and Energy Storage Park

Bus Stop	Service	Route	Typical Frequency				
Bus Stop	Service	Route	Weekday	Weekend			
A156 Gainsborough Road	107	Gainsborough to Lincoln	One service per hour (first service at the nearest stop to the Solar Energy Storage park at 06:50)	One service per hour on Saturday No service on Sunday			
B1241 Willingham Road	100	Scunthorpe to Lincoln	One service per hour (first service at the nearest stop to the Solar and Energy Storage Park at 08:00)	One service per hour on Saturday No service on Sunday			
B1241 Willingham Road	105	Gainsborough to Lincoln	One service a day (Service at the nearest stop to the Solar and Energy Storage Park at 07:36)	Bus service 106 replaces 105 on school holidays and Saturdays No service on Sunday			

Rail

- 13.7.34 Gainsborough is located to the north of the Solar and Energy Storage Park and has two railway stations, Gainsborough Central and Gainsborough Lea Road.
- 13.7.35 Gainsborough Central Station is located approximately 6km to the north of the Solar and Energy Storage Park and is managed by Northern Rail, running services between Sheffield and Cleethorpes. The only passenger services calling at the station during a weekday are two services in the AM peak and two services in the PM peak.
- 13.7.36 Gainsborough Lea Road Station is located approximately 4.5km to the north of the Solar and Energy Storage Park and is served by rail services operated by both Northern Rail and East Midlands Railway, running services from Sheffield to Lincoln/ Cleethorpes and Peterborough to Doncaster. The two operators which serve the station run services at the following combined frequency:
 - Sheffield to Lincoln/ Cleethorpes (Northern Rail) Three services during the morning (07:00-10:00) and afternoon (16:00-19:00) in each direction, with a total of circa. 20 services a day in each direction (Monday to Friday); and
 - Peterborough to Doncaster (East Midlands Railway) Five services a day in each direction (Monday to Friday).



13.7.37 Saxilby Station is located approximately 10.5km to the south of the Solar and Energy Storage Park and is served by the same rail services as Gainsborough Lea Road.

Grid Connection Route

Bus

13.7.38 The eastern extent of the Grid Connection Route could be served by the same bus services as for the Solar and Energy Storage Park mentioned above. However, as the Grid Connection Route is severed by River Trent, the nearest bus stops and bus service to the western extent of the Grid Connection Route, as well as the Grid Connection Point are located on Cottam Road. The bus stops are situated approximately 1.3km to the west of Cottam Substation on Cottam Lane/ Green Lane on the eastern side of Treswell. Bus Route 190 serves these stops, with the service running between Retford to Tuxford (via Rampton). There are only two daily services which run from Tuxford to Retford (during the AM peak) and only three daily services which run from Retford to Tuxford (during the PM peak).

Rail

13.7.39 Retford Station is located approximately 10.5km to the west of Cottam Substation and is managed by East Coast Mainline, running services between York, Hull and Newcastle in the north and London King's Cross in the south. The station runs the same services as Gainsborough Central and Gainsborough Lea Road to Lincoln/ Cleethorpes and Sheffield/ Lincoln. The service between London King's Cross and Hull or Edinburgh run two services in each of the AM and PM peaks, a total of 30 services in both direction (Monday to Friday) run through Retford.

Future Baseline

- 13.7.40 The future baseline scenarios are set out in **Chapter 5: EIA Methodology**.
- 13.7.41 In the absence of the Scheme, traffic flows on the surrounding highway network would be expected to increase as a result of housing and employment growth. Therefore, projected background traffic growth has been applied to the traffic flows derived from the traffic surveys (March/ April 2022) to represent conditions during the future baseline (and construction peak assessment year) of 2026. As previously mentioned, the decommissioning assessment year is assumed to be 2088 which is considered to be too far into the future to be able to accurately predict traffic flows at that time.
- 13.7.42 Projected background traffic growth has been applied to the surveyed traffic flows to represent conditions during the future construction peak assessment year of 2026.
- 13.7.43 Traffic growth has been calculated using National Road Traffic Forecast (NRTF) growth factors, reflecting projected increases in annual vehicle mileage on roads within the England and Wales. National Transport Model (NTM) adjustments have then been applied within the Trip Ends Model Program (TEMPRO) utilising National Trip Ends Model (NTEM) dataset v7.2



and 2018 RTF – Scenario 1 (Reference Case) to reflect local factors (i.e. West Lindsey) for the appropriate road types, to determine the forecast increases in future baseline car driver trips during each weekday peak period. These represent the latest datasets available, covering the period up to 2050.

13.7.44 A summary of the growth factors is set out in Table 13-8 below.

Table 13-8. Traffic Growth Factors

Growth Period Road Type Traffic Growth Factor (West Lindsey)

		AM Peak	PM Peak	Average Weekday
2022 to 2026 (Construction)	Principal	1.030	1.031	1.033
	Minor	1.029	1.030	1.032
	All	1.034	1.035	1.037

- 13.7.45 To provide a robust approach, the highest growth factors (all roads) as presented above in **bold** have been applied to the 2022 baseline traffic flows.
- 13.7.46 The anticipated future baseline flows on the surrounding highway network are set out in Table 13-9 and Table 13-10 below. It should be noted whilst additional traffic surveys have also been undertaken in Nottinghamshire, these relate to the Grid Connection Route element of the scheme which is located outside of the study area for the Solar and Energy Storage Park itself and further details of these will therefore be included in the TA and ES.



Table 13-9. Future Baseline Traffic Flows (2026) – Total Vehicles – Links

Location	on		ev Pea 0-08:00			ev Pea 0-19:00		Daily (24 Ho	urs)	
Ref	Link	Total	HGVs	% HGVs	Total	HGVs	% HGVs	Total	HGVs	% HGVs
ATC1	A156 Gainsborough Road (south of Kexby Lane)	860	48	5.6%	520	13	2.4%	10,021	560	5.6%
ATC2	A156 Gainsborough Road (south of Willingham Road)	864	44	5.1%	517	13	2.5%	10,045	553	5.5%
ATC3	Clay Lane (east of A156)	1	0	0.0%	1	0	0.0%	23	1	2.7%
ATC4	Willingham Road (east of A156)	15	0	1.4%	11	0	2.0%	237	14	5.8%
ATC5	A1500 Stow Park Road (east of A156)	432	17	4.0%	282	11	3.7%	4,708	236	5.0%
ATC6	A156 Gainsborough Road (south of A1500)	440	35	8.0%	308	11	3.5%	6,116	411	6.7%
ATC7	High Street (east of Marton Road)	168	8	4.7%	138	4	2.7%	2,605	116	4.5%
ATC8	B1241 Gainsborough Road (south of Kexby Lane)	179	11	6.0%	143	4	2.5%	2,669	145	5.4%
ATC9	Marton Road (south of Gainsborough Road)	16	1	3.9%	13	0	1.6%	260	12	4.8%
ATC10	B1241 Kexby Lane (east of Upton Road)	56	3	5.5%	58	2	3.6%	1,123	71	6.4%
ATC11	A156 Gainsborough Road (north of Kexby Lane)	974	53	5.5%	678	17	2.6%	12,703	640	5.0%
ATC14	B1241 High Street (north of A1500)	219	14	6.4%	160	4	2.6%	2,843	143	5.0%
ATC15	A1500 Tillbridge Road (east of High Street)	581	24	4.1%	336	13	3.9%	5,930	273	4.6%
ATC16	Saxilby Road (south of A1500)	309	17	5.4%	309	17	5.4%	3,745	193	5.2%



Table 13-10. Future Baseline Traffic Flows (2026) - Total Vehicles - Junctions

Location		AM De 08:00)	ev Peak (07:00-	PM Dev Peak (18:00- 19:00)		
Ref	Junction	Total	HGVs	% HGVs	Total	HGVs	% HGVs
MCC1	A156 High Street/ A1500 Stow Park Road	962	41	4.3%	565	11	2.0%
MCC2	A1500 Tillbridge Road/ Saxilby Road	869	35	4.0%	522	5	1.0%
MCC3	B1241 High Street/ Marton Road	207	13	6.5%	125	3	2.5%
MCC4	A156 Gainsborough Road/ Willingham Road	1,010	34	3.4%	654	11	1.7%

13.7.47 The consideration of cumulative effects as a result of committed developments is set out within Section 13.12 of this report.

13.8 Potential Impacts

- 13.8.1 Mitigation measures being incorporated in the design and construction of the proposed Scheme are set out below in Section 13.9. Prior to the implementation of the mitigation, the proposed Scheme has the potential to adversely affect the following, during the construction and decommissioning phases:
 - Increase in HGV movements (with the potential to increase severance, congestion, as well as fear & intimidation to pedestrians and cyclists for example);
 - Abnormal Indivisible Loads (AILs) including cranes (with the potential to create disruption to the surrounding highway network unless carefully managed with police escort for example);
 - Travel to and from site by construction staff (with the potential to increase congestion and driver delay for example);
 - Increase in delay to vehicles, pedestrians, cyclists and equestrians due to increase in vehicle movements (as above), as well as reduction in pedestrian/ cycle amenity;
 - Change in route connections and amenity for pedestrians, cyclists and equestrians due to Scheme (potential PRoW closures and/ or road diversions during the construction phase); and
 - Impacts on operational road or rail safety due to glint and glare impacts, and/ or rail assets such as bridges and level crossings due to HGV movements.
- 13.8.2 Consideration has also been given to those users of local facilities which could be impacted by the Scheme. For example, PRoW potentially impacted by the Solar and Energy Storage Park have been reviewed to determine whether they will need to be temporarily diverted to provide safe access for members of the public during construction.



13.9 Mitigation Measures

The embedded measures which have been incorporated into the Scheme 13.9.1 design, with detailed proposals and locations to be submitted with the DCO submission, are identified in Table 13-11 below. These embedded measures form the basis of the assessment of likely impacts and effects (Section 13.10).

Table 13-11. Embedded Mitigation

Category **Assessment Description Gate Burton Examples (not exhaustive)**

determining significant effects.

Embedded Factored into These form an integral, committed and deliverable part of the scheme design or standard construction practices and will be included within the DCO submission.

Construction and decommissioning phases:

Implementation of a Framework CTMP (including a construction staff travel plan chapter) and Framework CEMP (construction) and Framework DEMP (decommissioning)

Providing suitable points of access for construction vehicles (with appropriate vegetation clearance, if necessary)

Providing internal construction routes through the Solar and Energy Storage Park

Maintaining access to/ along PRoW or providing temporary diversions, if necessary i.e. for the Grid Connection Route

Managing areas where the proposed construction route crosses any local access roads

Restricting HGV movements to certain routes and times of the day

Implementing Temporary Traffic Management (TTM) where required

Encouraging local construction staff to car share Implementing a shuttle service (at least eight shuttle services with capacity of 50 staff per vehicle) to transfer staff to/ from nearby catchment areas

Implementing minibuses to transfer staff internally within the Solar and Energy Storage Park as required, to minimise external trips on the surrounding highway network

Positioning banksmen at proposed access points. Overseeing the management of Abnormal Indivisible Loads (AILs) and cranes travelling to and from the Scheme

Construction vehicles to avoid level crossings as well as the Clay Lane underpass (by utilising the Kexby Lane South access) in the interest of operational rail safety

Operational phase:

Providing suitable access points Converting internal construction routes to maintenance routes

Maintaining access to all existing PRoW Controlling areas where internal maintenance routes cross existing PRoW or local access roads.



Category	Assessment	Description	Gate Burton Examples (not exhaustive)
			Vehicles to avoid level crossings and (subject to the outcomes of the Glint & Glare Assessment which will be conducted at ES stage), additional screening to be provided where necessary to ensure operational rail safety

13.9.2 Additional mitigation measures which have been considered, where standard (embedded) measures are not sufficient to avoid significant effects (Section 13.10), are identified in Table 13-12 below. These additional measures form the basis of the assessment of residual effects (Section 13.11).

Table 13-12. Additional Mitigation

Category	Assessment	Description	Gate Burton Examples (not exhaustive)
Additional	Factored into determining residual significant effects.	Additional measures where standard (embedded) measures are not sufficient to avoid significant effects. Committed and deliverable as part of the Scheme and will be included within the DCO submission.	All phases: No additional measures proposed/ expected to be required at this stage (potential carriageway widening and vegetation clearance etc. will be determined if necessary, as part of the abnormal load route review).

13.9.3 Enhancement measures which are aspirational measures that would have additional beneficial outcomes but have not been factored into the determination of residual effects are identified in Table 13-13 below.

Table 13-13. Enhancement Measures

Category	Assessment	Description	Gate Burton Examples (not exhaustive)
Enhancement	Not factored into determination of residual significant effects.	Aspirational measures which would have additional beneficial outcomes.	Construction phase: Stage 1 Road Safety Audit (RSA) for preliminary design of access points (for example). The approach for the Stage 1 RSA will be reviewed at ES stage to determine whether this will form part of the DCO submission or will be conducted post-submission.
			Operational phase: None proposed
			Decommissioning phase: None proposed



Construction and Decommissioning

Embedded Mitigation

- 13.9.4 The Scheme will minimise construction and decommissioning impacts through:
 - Implementation of the Framework CTMP and Framework Construction Environmental Management Plan (CEMP) during the construction phase, as well as an Framework Decommissioning Environmental Management Plan (DEMP) during the decommissioning phase, to detail and formalise the measures that will mitigate construction-related and decommissioning-related effects.
 - Providing suitable points of access for construction vehicles with adequate visibility, with any supporting improvements (e.g. vegetation clearance) to take place within the highway boundary and the DCO Site boundary if required;
 - Delivering internal construction routes through the Solar and Energy Storage Park, to allow vehicles to access all areas via the site access points;
 - Prohibiting construction vehicles from using any level crossings and the Clay Lane underpass to ensure operational rail safety (construction vehicles will be able to use the Kexby Lane South access and internal construction routes to access all areas of the Solar and Energy Storage Park);
 - Maintaining access to/ along PRoW, or otherwise providing temporary PRoW diversion routes where necessary to avoid any PRoW closures or potential conflicts with the Scheme (i.e. the Grid Connection Route) where possible. The diversion routes will be agreed with the local authorities prior to construction;
 - Managing areas where the proposed construction route crosses any
 existing local access roads, including by maximising visibility between
 construction vehicles and other users (pedestrians and road users),
 implementing traffic management e.g. advanced signage to advise other
 users of the works, as well as manned controls at each crossing point
 (marshals/ banksmen), with a default priority that construction traffic will
 give-way to other users;
 - Restricting HGV movements to certain routes (see HGV routing plan in PEI Report Volume 2: Figure 13-3);
 - Reducing HGV movements during certain times of the day (e.g. between 07:00 and 09:00, as well as between 17:00 and 19:00), to avoid increasing traffic levels on the surrounding highway network during the traditional weekday peak hours;
 - Implementing a Delivery Management System to control the bookings of HGV deliveries from the start of the construction period. This will be used to regulate the arrival times of HGVs via timed delivery slots, as well as to monitor compliance of HGV routing;



- Implementing a monitoring system to record the route of all HGVs travelling to and from the Scheme, to record any non-compliance with the agreed routing plan/ delivery hours and to communicate any issues to the relevant suppliers to ensure the correct routes are followed;
- Developing a communications strategy including regular meetings with contractors to review and address any issues associated with travel to/ from the Scheme, as well as to relay information including any restrictions and requirements which should be followed;
- Utilising the existing access arrangements for Cottam Power Station to access the Substation via Cottam Road, which will be managed and maintained by National Grid;
- Implementing Temporary Traffic Management (TTM) where required during the period when the Grid Connection Cables are installed to connect Cottam Substation with the Solar and Energy Storage Park. Further details with respect to any TTM arrangements and timeframes for installing the cables will be set out within the Framework CTMP and the ES once known;
- Encouraging local construction staff to car share to reduce single
 occupancy car trips, by promoting the benefits of car sharing such as
 reduced fuel costs and by providing dedicated parking spaces for those
 car sharing within the compounds. A Car Share Scheme will be
 implemented to match potential sharers and to help staff identify any
 colleagues who could potentially be collected along their route to/ from
 site:
- Implementing a shuttle service to transfer staff to/ from nearby catchment areas to reduce vehicle trips on the surrounding highway network. At this stage it is expected that shuttle services would travel to/ from Gainsborough (north), Lincoln (south), Retford (west) and Newark on Trent (south) to collect/ drop off construction staff from 'hubs' at each of these four locations. A total of eight shuttle buses will be provided, each with a capacity of 50 staff, to transfer the expected peak demand (220 construction workers) to/ from the site. All shuttle services will utilise the main site access on the A156 Gainsborough Road;
- Implementing minibuses to transfer staff internally within the Solar and Energy Storage Park as required e.g. between the eastern and western parts of the site via the Clay Lane railway underpass, to minimise external trips on the surrounding highway network;
- In terms of construction compounds, the main construction compound for the Solar and Energy Storage Park will be served by the proposed access on the A156. There are also expected to be three smaller secondary compounds across the Solar and Energy Storage Park, served by alternative access points or the internal construction access routes;
- Providing sufficient on-site car parking within the main compound (A156 Gainsborough Road) to accommodate the expected peak parking demand of construction staff within the Solar and Energy Storage Park;



- Providing limited on-site car parking within the smaller compounds (Kexby Lane North, Kexby Lane South and Marton Road) to accommodate the required parking demand of construction staff within the Solar and Energy Storage Park, but to encourage use of the main compound on the A156 Gainsborough Road to minimise vehicle trips on the local highway network. Construction workers will also be able to access other areas of the site using the internal minibus service if required;
- Positioning of suitably qualified banksmen at the proposed accesses for the Solar and Energy Storage Park, to allow all vehicle arrivals and departures to be safely controlled during the construction period;
- Vegetation clearance at the proposed access points where required to achieve appropriate levels of visibility at these locations;
- Providing sufficient cycle parking spaces within the Solar and Energy Storage Park to encourage construction staff to travel by bicycle where viable; and
- A specialised haulage service will be employed to allow abnormal loads to transport components with the necessary escort, permits and traffic management, with the contractor consulting with the relevant highways authorities to ensure the correct permits are obtained. The police will also be given advanced notification under the Road Vehicle Authorisation of Special Types Order 2003.

Additional Mitigation

13.9.5 No additional mitigation measures are proposed for the construction phase following the above embedded measures, given that there are not expected to be any significant effects as a result of the Solar and Energy Storage Park (see Section 13.10). However, additional measures will be considered should these be needed, e.g. following the completion of the full assessment which includes the Grid Connection Route.

Enhancement Measures

- 13.9.6 The following enhancement measures are proposed for the construction and decommissioning phases to provide added benefits at either ES stage (as part of the DCO submission) or post-submission:
 - Conduct a Stage 1 Road Safety Audit (RSA) on the preliminary design
 of access points for example (to be secured as part of the Framework
 CTMP or detailed CTMPs). A Designer's Response will then be
 prepared so that any road safety concerns are addressed as part of the
 final design. The approach for the Stage 1 RSA will be reviewed at ES
 stage to determine whether this will form part of the DCO submission or
 will be conducted post-submission.

Operation

Embedded Mitigation

13.9.7 The proposed Scheme minimises operational impacts by:



- Providing suitable points of access for operational vehicles, including on the A156, Kexby Lane (North and South) and Marton Road;
- Converting the internal construction routes to maintenance routes, to allow operational vehicles to access all areas of the Solar and Energy Storage Park via the proposed access points during the operational phase;
- Prohibiting vehicles from using any level crossings and, subject to the findings of the Glint & Glare Assessment (to be carried out at ES stage), providing additional screening where required to ensure operational rail safety;
- Maintaining access to all existing PRoW within the Scheme, with no diversions or closures; and
- Controlling areas where the internal maintenance route crosses any
 existing PRoW or local access roads (such as providing gates),
 permitting only operational traffic to utilise these internal routes within
 the Solar and Energy Storage Park. Operational traffic should give-way
 to other users (pedestrians and road users) when utilising the crossing
 points. Visibility will be maximised between operational vehicles and
 other users, with warning signage provided if required.

Additional Mitigation

13.9.8 No additional mitigation measures are currently proposed for the operational phase following the above embedded measures, given that there are not expected to be any significant effects as a result of the Scheme, however, additional measures will be considered should these be needed at ES stage.

Enhancement Measures

13.9.9 No enhancement measures are proposed for the operational phase following the above embedded measures.

Monitoring

- 13.9.10 As no potential significant effects have been identified for transport and access (see Section 13.10 below), no monitoring of significant effects is proposed. Nonetheless, the following monitoring will be carried out during the construction and decommissioning phases of the Scheme, and secured as part of the Framework CTMP, Framework CEMP or detailed CTMPs when these are prepared in due course:
 - Construction vehicles (HGVs) will be monitored to ensure HGV drivers are adhering to the agreed routing plan (see PEI Report Volume 2: Figure 13-3);
 - Road safety will be monitored within the DCO Site including at any PRoW crossing points, temporary PRoW diversion points, and crossing points of the local highway network; and
 - Temporary Traffic Management (TTM) will be monitored when this is required.



13.10Assessment of Likely Impacts and Effects

- 13.10.1 Taking into account the embedded mitigation measures as detailed in Section 13-9 above, the potential for the Scheme to generate effects has been assessed using the methodology as detailed in Section 13-6 of this Chapter. Please see paragraphs 13.10.8 and 13.10.9 below for further details of the potential impacts. Further details of road link and PRoW receptors are set out under each assessment where relevant e.g. paragraph 13.10.11 for severance.
- 13.10.2 The effects have been assessed following consideration of the potential impacts outlined in Section 13.8 and the embedded mitigation measures in Section 13.9.
- 13.10.3 The environmental effects have been classified using the matrix contained within Table 5-1 of **Chapter 5: EIA Methodology** of this PEI Report, based on the sensitivity of receptor and magnitude of impact.

Construction (assumed 2025 to 2027) and Decommissioning (assumed 2088)

Initial Highway Impact Assessment (Solar and Energy Storage Park)

- 13.10.4 The full traffic impact methodology will be set out within the TA which will form part of the ES. The forecast increases in vehicle movements during the proposed development weekday peak hours and across the day (24 hours), both in terms of actual increases and percentage increases relative to the future baseline traffic flows are presented in Table 13-14 and Table 13-15 below.
- 13.10.5 It should be noted that this assessment considers construction trips associated with the Solar and Energy Storage Park only and focuses on the highway network in the vicinity, where the majority of trips associated with the Solar and Energy Storage Park are expected. A full assessment including consideration of the Grid Connection Route will be carried out as part of the ES.



Table 13-14. 2026 Construction Traffic Impact – Solar and Energy Storage Park – Development Peak Hours

Ref Location		AM Development Peak (07:00-08:00)				PM Development Peak (18:00-19:00)			
		Base	Dev	Total	% Uplift	Base	Dev	Total	% Uplift
ATC1	A156 Gainsborough Road (south of Kexby Lane)	860	74	934	8.6%	520	74	594	14.2%
ATC2	A156 Gainsborough Road (south of Willingham Road)	864	85	949	9.9%	517	85	602	16.5%
ATC3	Clay Lane (east of A156)	1	0	1	0.0%	1	0	1	0.0%
ATC4	Willingham Road (east of A156)	15	0	15	0.0%	11	0	11	0.0%
ATC5	A1500 Stow Park Road (east of A156)	432	33	465	7.6%	282	33	315	11.7%
ATC6	A156 Gainsborough Road (south of A1500)	440	52	492	11.9%	308	52	360	17.0%
ATC7	High Street (east of Marton Road)	168	0	168	0.0%	138	0	138	0.0%
ATC8	B1241 Gainsborough Road (south of Kexby Lane)	179	12	191	7.0%	143	12	155	8.7%
ATC9	Marton Road (south of Gainsborough Road)	16	12	28	78.2%	13	12	25	95.6%
ATC10	B1241 Kexby Lane (east of Upton Road)	56	41	97	72.6%	58	41	99	70.8%
ATC11	A156 Gainsborough Road (north of Kexby Lane)	974	49	1,023	5.0%	678	49	727	7.2%
ATC14	B1241 High Street (north of A1500)	219	0	219	0.0%	160	0	160	0.0%
ATC15	A1500 Tillbridge Road (east of High Street)	581	33	613	5.7%	336	33	369	9.8%
ATC16	Saxilby Road (south of A1500)	309	0	309	0.0%	309	0	309	0.0%
MCC1	A156 High Street/ A1500 Stow Park Road	962	85	1,047	8.9%	565	85	650	15.1%
MCC2	A1500 Tillbridge Road/ Saxilby Road	869	33	902	3.8%	522	33	555	6.3%
MCC3	B1241 High Street/ Marton Road	207	12	219	6.0%	125	12	138	10.0%
MCC4	A156 Gainsborough Road/ Willingham Road	1,010	86	1,097	8.5%	654	86	740	13.2%



Table 13-15. 2026 Construction Traffic Impact – Solar and Energy Storage Park – Daily (24 Hours)

Ref	Ref Location		Daily (24 hours)					
		Base	Dev	Total	% Uplift			
ATC1	A156 Gainsborough Road (south of Kexby Lane)	10,021	238	10,259	2.4%			
ATC2	A156 Gainsborough Road (south of Willingham Road)	10,045	260	10,305	2.6%			
ATC3	Clay Lane (east of A156)	23	0	23	0.0%			
ATC4	Willingham Road (east of A156)	237	0	237	0.0%			
ATC5	A1500 Stow Park Road (east of A156)	4,708	66	4,773	1.4%			
ATC6	A156 Gainsborough Road (south of A1500)	6,116	194	6,310	3.2%			
ATC7	High Street (east of Marton Road)	2,605	0	2,605	0.0%			
ATC8	B1241 Gainsborough Road (south of Kexby Lane)	2,669	41	2,710	1.5%			
ATC9	Marton Road (south of Gainsborough Road)	260	41	301	15.8%			
ATC10	B1241 Kexby Lane (east of Upton Road)	1,123	134	1,257	11.9%			
ATC11	A156 Gainsborough Road (north of Kexby Lane)	12,703	188	12,891	1.5%			
ATC14	B1241 High Street (north of A1500)	2,843	0	2,843	0.0%			
ATC15	A1500 Tillbridge Road (east of High Street)	5,930	66	5,996	1.1%			
ATC16	Saxilby Road (south of A1500)	3,745	0	3,745	0.0%			

- 13.10.6 The results shown in Table 13-14 and Table 13-15 indicate that the following parts of the network are expected to experience increases of at least 30 additional vehicle trips and at least a 10% increase compared to baseline flows during the development peak hours and/ or across the day (thresholds of 10%, 30%, 60% and 90% have been adopted for consistency with later assessment criteria):
 - ATC1 and ATC2 A156 Gainsborough Road (south of Kexby Lane and Willingham Road)
 - +10% increase during PM development peak hour; although the future baseline traffic flows with development traffic remain below the future baseline traffic flows without development traffic during the AM development peak hour.
 - In addition, construction vehicle trips represent a <10% increase compared to future baseline flows during the AM development peak hour.
 - Therefore, the Scheme is not expected to cause congestion on this part of the network during the AM and PM development peak hours.
 - ATC5 A1500 Stow Park Road (east of A156)



- +10% increase during PM development peak hour; although the future baseline traffic flows with development traffic remain below the future baseline traffic flows without development traffic during the AM development peak hour.
- In addition, construction vehicle trips represent a <10% increase compared to future baseline flows during the AM development peak hour.
- Therefore, the Scheme is not expected to cause congestion on this part of the network during the AM and PM development peak hours.
- ATC6 A156 Gainsborough Road (south of A1500)
 - +10% increase during AM development peak hour (52 additional trips as a result of construction traffic)
 - +10% increase during PM development peak hour (52 additional trips as a result of construction traffic)
- ATC9 Marton Road (south of Gainsborough Road)
 - Fewer than 30 additional vehicle trips during each of the development peak hours
 - +10% increase across the day (24 hours)
- ATC10 B1241 Kexby Lane (east of Upton Road)
 - +60% increase during AM development peak hour (41 additional trips as a result of construction traffic)
 - +60% increase during PM development peak hour (41 additional trips as a result of construction traffic)
 - +10% increase across the day (24 hours)
- MCC1 A156 High Street/ A1500 Stow Park Road
 - +10% increase during PM development peak hour; although the future baseline traffic flows with development traffic remain below the future baseline traffic flows without development traffic during the AM development peak hour.
 - In addition, construction vehicle trips represent a <10% increase compared to future baseline flows during the AM development peak hour.
 - Therefore, the Scheme is not expected to cause congestion on this part of the network during the AM and PM development peak hours.
- MCC4 A156 Gainsborough Road/ Willingham Road
 - +10% increase during PM development peak hour; although the future baseline traffic flows with development traffic remain below the future baseline traffic flows without development traffic during the AM development peak hour.
 - In addition, construction vehicle trips represent a <10% increase compared to future baseline flows during the AM development peak hour.
 - Therefore, the Scheme is not expected to cause congestion on this part of the network during the AM and PM development peak hours.



- 13.10.7 In view of the above for the A156 High Street/ A1500 Stow Park Road and A156 Gainsborough Road/ Willingham Road junctions and given the temporary nature of construction trips and the minimal anticipated levels of additional traffic movements for the remaining junctions, it is not anticipated that any junction modelling will be required in support of the TA and ES. This approach is set out within the Transport Scoping Note (PEI Report Volume 3: Appendix 13-C), for agreement with the local highway authorities (LCC and NCC).
- 13.10.8 Following the above, the anticipated impacts for each of the assessment criteria is set out below.
- 13.10.9 Impacts on road link receptors during construction of the Scheme could include:
 - Severance;
 - Driver delay;
 - Pedestrian delay;
 - Pedestrian and cyclist amenity;
 - · Fear and intimidation; and
 - Accidents and safety.
- 13.10.10 Impacts on PRoW receptors during construction of the Scheme could include:
 - Severance;
 - Pedestrian delay;
 - Pedestrian and cyclist amenity; and
 - Fear and intimidation.

Severance

- 13.10.11 It is anticipated that as a worst case during the peak construction period, there would be up to 60 HGVs per day to/ from the Solar and Energy Storage Park representing 120 movements and 30 LGVs per day to/ from the Solar and Energy Storage Park representing 60 movements. In addition, there will be up to 138 cars and 16 shuttle services per day associated with staff for the Solar and Energy Storage Park, representing 308 movements.
- 13.10.12 The following road link receptors have been examined for the assessment of severance in relation to the Solar and Energy Storage Park:
 - A156 Gainsborough Road (north of Kexby Lane);
 - A156 (south of Clay Lane);
 - A156 (south of Marton);
 - B1241 Kexby Lane;
 - A1500 Stow Park Road;



- A1500 (east of Saxilby Road);
- Station Road;
- Clay Lane (within the Solar and Energy Storage Park);
- Willingham Road (within the Solar and Energy Storage Park);
- High Street (Willingham by Stow);
- B1241 Gainsborough Road (Willingham by Stow);
- Marton Road (Willingham by Stow); and
- Saxilby Road (Sturton by Stow).
- 13.10.13The proposed construction access roads within the Solar and Energy Storage Park are not expected to cross any PRoW and there are not expected to be any temporary PRoW diversions or closures as a result of the Solar and Energy Storage Park proposals. Furthermore, the exact location of the Grid Connection Route (within the redline boundary) has yet to be defined. As such, no PRoW receptors have been examined for the assessment of severance. This will be reviewed at ES stage when an assessment of the Grid Connection Route is conducted.
- 13.10.14 Details of receptor sensitivity are set out within Table 13-16 below. It should be noted that these receptors and receptor sensitivities have also been adopted for the assessments of pedestrian delay, pedestrian and cyclist amenity, as well as fear and intimidation.

Table 13-16. Receptor Sensitivity (Severance, Pedestrian Delay, Pedestrian and Cyclist Amenity, and Fear and Intimidation)

Receptor	Sensitivity	Justification
A156 Gainsborough Road (north of Kexby Lane)	Medium	Main vehicular route in built-up area with ped/ cycle facilities
A156 (south of Clay Lane)	Low	Rural setting with limited pedestrian/ cycle facilities
A156 (south of Marton)	Low	Rural setting with limited pedestrian/ cycle facilities
B1241 Kexby Lane	Low	Rural setting with limited pedestrian/ cycle facilities
A1500 Stow Park Road	Very Low	Rural setting with no pedestrian/ cycle facilities
A1500 (east of Saxilby Road)	Low	Rural setting with limited pedestrian/ cycle facilities
Station Road	Low	Rural setting with limited pedestrian/ cycle facilities
Clay Lane (within Solar and Energy Storage Park)	Very Low	Rural setting with no pedestrian/ cycle facilities
Willingham Road (within Solar and Energy Storage Park)	Very Low	Rural setting with no pedestrian/ cycle facilities
High St (Willingham by Stow)	Medium	Main vehicular route in built-up area with ped/ cycle facilities
B1241 Gainsborough Road (Willingham by Stow)	Medium	Main vehicular route in built-up area with ped/ cycle facilities
Marton Rd (Willingham by Stow)	Low	Rural setting with limited pedestrian/ cycle facilities
Saxilby Rd (Sturton by Stow)	Medium	Main vehicular route in built-up area with ped/ cycle facilities



13.10.15 IEMA guidelines suggest that 30%, 60% and 90% increases in traffic flows would result in low, medium, and high changes in magnitude with respect to severance, respectively. Based on the initial construction traffic impact assessment summarised above for the Solar and Energy Storage Park, there is expected to be less than a 30% increase in traffic flows across the majority of road link receptors within the study area, except for the following where there will be at least 30 additional trips per hour:

B1241 Kexby Lane

- +60% increase during AM development peak hour (41 additional trips as a result of construction traffic)
- +60% increase during PM development peak hour (41 additional trips as a result of construction traffic)
- 13.10.16 The Scheme is expected to result in a medium magnitude of change with respect to severance on Kexby Lane during the construction phase.
- 13.10.17 In terms of the remaining road link receptors, the Scheme is expected to result in a very low magnitude of change with respect to severance during the construction phase. This includes Marton Road where there is only expected to be an additional 12 vehicle trips per hour as a result of the Scheme.
- 13.10.18 The impact of severance on road link receptors has been assessed as **minor adverse** (Kexby Lane) or **negligible** (all other receptors) and is considered to be not significant. The impact of severance on PRoW has been assessed as negligible and not significant. A summary of the results (non-significant effects) is set out within **PEI Report Volume 3: Appendix 13-C**.

Driver Delay

- 13.10.19 The High Street/ A1500 Stow Park Road junction and the A156 Gainsborough Road/ Willingham Road junction are both expected to experience a greater than 10% increase in traffic flows during the PM development peak hour as a result of construction traffic associated with the Solar and Energy Storage Park. However, the total junction flows at this time (with development traffic included) will remain well below future baseline flows during the AM development peak hour without development traffic, which is considered to represent the overall network peak when peak congestion is expected. There will also be a less than 10% increase in traffic flows at these two junctions during the AM development peak hour. The remaining junctions within the study area are also expected to experience a less than 10% increase in traffic flow during all periods. As such and given the temporary nature of construction trips and the minimal anticipated levels of additional traffic movements, it is not anticipated that any junction modelling will be required in support of the TA and ES.
- 13.10.20 The requirement for any junction modelling and hence a driver delay assessment will be agreed through further scoping discussions with both LCC and NCC once further details of the Grid Connection Route are known. An assessment of driver delay will then be carried out as part of the ES Chapter, subject to the completion of any junction modelling, if required.



Pedestrian Delay

- 13.10.21 The road link receptors and receptor sensitivities have been determined using the same criteria as severance above. The proposed construction access roads within the Solar and Energy Storage Park are not expected to cross any PRoW and there are not expected to be any temporary PRoW diversions or closures as a result of the Solar and Energy Storage Park proposals. Furthermore, the exact location of the Grid Connection Route (within the redline boundary) has yet to be defined. As such therefore, no PRoW receptors have been examined for the assessment of pedestrian delay. This will be reviewed at ES stage when an assessment of the Grid Connection Route is conducted.
- 13.10.22 In general, increases in traffic levels and/ or traffic speeds are likely to lead to greater increases in pedestrian delay on road links. Based on the initial construction traffic impact assessment summarised above for the Solar and Energy Storage Park, there is expected to be a less than 30% increase in traffic flows across the majority of road link receptors within the study area, except for the following where there will be at least 30 additional trips per hour:
 - B1241 Kexby Lane
 - +60% increase during AM development peak hour (41 additional trips as a result of construction traffic)
 - +60% increase during PM development peak hour (41 additional trips as a result of construction traffic)
- 13.10.23 The Scheme is expected to result in a medium magnitude of change with respect to pedestrian delay on Kexby Lane during the construction phase.
- 13.10.24In terms of the remaining road link receptors, the majority of vehicles will be cars (associated with construction staff) with up to 60 HGVs per day to/ from the Solar and Energy Storage Park and a peak of 12 HGV movements per hour on any given link. It is not expected that vehicle speeds would change on the surrounding highway network as a result of the additional vehicles to be generated by the Solar and Energy Storage Park.
- 13.10.25 In view of the above, the Solar and Energy Storage Park is expected to have a very low magnitude of change with respect to pedestrian delay across the remaining road link receptors during the construction phase. This includes Marton Road where there is only expected to be an additional 12 vehicle trips per hour as a result of the Scheme.
- 13.10.26 The impact of pedestrian delay on road link receptors has been assessed as minor adverse (Kexby Lane) or negligible (all other receptors) and is considered to be not significant. The impact of pedestrian delay on PRoW has been assessed as negligible and not significant. A summary of the results (non-significant effects) is set out within PEI Report Volume 3: Appendix 13-C.



Pedestrian and Cyclist Amenity

- 13.10.27 The receptors and receptor sensitivities are determined using the same criteria as severance and pedestrian delay above.
- 13.10.28 The proposed construction access roads within the Solar and Energy Storage Park are not expected to cross any PRoW and therefore are not expected to result in any temporary PRoW diversions or closures as a result of the Solar and Energy Storage Park proposals. Furthermore, the exact location of the Grid Connection Route (within the redline boundary) has yet to be defined. As such, no PRoW receptors have been examined for the assessment of pedestrian and cyclist amenity. This will be reviewed at ES stage when an assessment of the Grid Connection Route is conducted.
- 13.10.29 The guidance for pedestrian and cyclist amenity suggests that a tentative threshold for judging the significance of changes in pedestrian and cycle amenity would be where the traffic flow is halved or doubled. As identified above, there are no areas of the highway network where the Solar and Energy Storage Park would be expected to result in a 50% reduction (i.e. halving) or 100% increase (i.e. doubling) in traffic flows. The Solar and Energy Storage Park is therefore expected to have a very low magnitude of change with respect to pedestrian and cyclist amenity across all road link receptors during the construction phase.
- 13.10.30 The impact of pedestrian and cyclist amenity on road link receptors has been assessed as negligible and not significant. The impact of pedestrian and cyclist amenity on PRoW has been assessed as **negligible** and not significant. A summary of the results (non-significant effects) is set out within **PEI Report Volume 3: Appendix 13-C**.

Fear and Intimidation

- 13.10.31 The receptors and receptor sensitivities are determined using the same criteria as severance, pedestrian delay, as well as pedestrian and cyclist amenity as set out above.
- 13.10.32 Fear and intimidation are affected by the volume of traffic, its HGV composition, and its proximity to people or the lack of protection caused by factors such as narrow pavement widths. As identified above, there is expected to be fewer than 30 additional vehicle trips or a less than 30% hourly and daily increase in traffic flows across the majority of links within the study area as a result of the Solar and Energy Storage Park except for on Kexby Lane.
- 13.10.33 The Scheme is expected to result in a medium magnitude of change with respect to fear and intimidation on Kexby Lane during the construction phase.
- 13.10.34 For the remaining road link receptors, the majority of vehicles will be cars (associated with construction staff) with up to 60 HGVs per day to/ from the Solar and Energy Storage Park and a peak of 12 HGV movements per hour on any given link. The Solar and Energy Storage Park is therefore expected to have a very low magnitude of change with respect to fear and intimidation across the remaining road link receptors during the construction phase. This



- includes Marton Road where there is only expected to be an additional 12 vehicle trips per hour as a result of the Scheme.
- 13.10.35 The impact of fear and intimidation on road link receptors has been assessed as **minor adverse** (Kexby Lane) or **negligible** (all other receptors) and is considered to be not significant. The impact of fear and intimidation on PRoW has been assessed as negligible and not significant. A summary of the results (non-significant effects) is set out within **PEI Report Volume 3: Appendix 13-C**.

Accidents and Safety

- 13.10.36A high-level review of Personal Injury Collision (PIC) data obtained from CrashMap (Ref. 13-18) has been carried in Section 13.7 for the study area shown in **PEI Report Volume 2: Figure 13-1**, for the most recent five year period available (start of 2017 to end of 2021).
- 13.10.37The review indicates that a total of five collisions occurred at the A1500 Tillbridge Road/ B1241 High Street/ Saxilby Road junction during the five year period, equivalent to one collision per year. As such, this part of the network has been assigned a medium level of sensitivity in terms of accidents and safety.
- 13.10.38 For the remainder of the network within the study area, fewer than five collisions have occurred at any junction or link between junctions within the five year period, equivalent to less than one collision per year. In addition, none of the accidents which occurred within the study area involved a vulnerable road user. As such, the remainder of the network has been assigned a very low level of sensitivity in terms of accidents and safety.
- 13.10.39 As identified above, there is expected to be a less than 30% hourly and daily increase in traffic flows across the majority of links and junctions within the study area as a result of the Solar and Energy Storage Park including at the A1500 Tillbridge Road/ B1241 High Street/ Saxilby Road junction where there is expected to be a less than 10% increase in traffic flows. As such, the Scheme is expected to result in a very low magnitude of change with respect to accidents and safety across all receptors during the construction phase except for Kexby Lane (medium magnitude of change).
- 13.10.40 The impact of accidents and safety on road link and junction receptors has been assessed as **negligible** and is considered to be not significant. This includes Kexby Lane which has been assigned a very low level of sensitivity in terms of accidents and safety with just one collision recorded within a five year period see Table 13-6. A summary of the results (non-significant effects) is set out within **PEI Report Volume 3: Appendix 13-C**.
- 13.10.41 A full assessment of accidents and safety including the network within Nottinghamshire as this relates to the Grid Connection Route will be carried out as part of the ES Chapter following the completion of the TA.

Operation (2028)

13.10.42The Scheme is expected to attract a low level of vehicle trips during the operational phase i.e. up to 15 vehicle arrivals and 15 vehicle departures



daily, and a detailed assessment of this scenario has therefore been excluded from this PEI Report, as agreed in the Scoping Opinion ref ID 3.8.1 (see **PEI Report Volume 3: Appendix 1-C**).

13.10.43 A Glint and Glare Assessment will be carried out at ES stage and a review of the findings will be carried out as part of the ES Chapter.

Summary of Effects

13.10.44 Following the above assessment for the Solar and Energy Storage Park, no significant effects have been identified as a result of the Scheme on transport and access during any phase as all effects have either been categorised as minor adverse or negligible. As such, no additional mitigation is necessary.
PEI Report Volume 3: Appendix 13-C presents a summary of non-significant effects.

13.11Residual Effects and Conclusions

13.11.1 Following the above assessment for the Solar and Energy Storage Park, no significant effects and therefore significant residual effects have been identified as a result of the Scheme on transport and access during any phase. A full assessment which includes the Grid Connection Route will be carried out as part of the ES and TA.

13.12Cumulative Assessment

- 13.12.1 As set out in Section 13.7, TEMPRO growth factors have been applied to 2022 surveyed traffic flows to reflect local housing and employment growth and derive future baseline traffic flows for the peak construction year of 2026.
- 13.12.2 In addition, once the schemes for consideration in the cumulative assessment have been agreed with the LHAs, this section in the ES will present an assessment of cumulative effects between the Scheme and nearby developments. The assessment will be made with reference to the methodology and guidance to be set out in **Chapter 5: EIA Methodology** of the ES.
- 13.12.3 The Schemes identified in **Chapter 16: Cumulative Effects** will be screened for spatial and temporal overlaps with the Scheme. For Transport and Access this relates to the local vehicle routes which are expected to be used to access each Scheme during the peak construction period of 2026.
- 13.12.4 At this stage, an initial review has been carried out for the West Burton Solar Farm Project¹ and the Cottam Solar Farm Project² which are being developed by Island Green Power (IGP) and are identified on **PEI Report Volume 2: Figure 13-6**. Discussions are currently on-going with IGP to allow a 'joined up' approach to be identified and presented to the LHAs for agreement on the cumulative assessment methodology within the ES. Further details are set out below based on the EIA scoping reports (Ref. 13-

¹ https://infrastructure.planninginspectorate.gov.uk/projects/east-midlands/west-burton-solar-project/

² https://infrastructure.planninginspectorate.gov.uk/projects/east-midlands/cottam-solar-project/



- 19 and Ref. 13-20) which were submitted to the LHAs for the two IGP projects in January 2022. Further details are also available on the Planning Inspectorate website.
- 13.12.5 It should be noted that in addition to the above, the cumulative assessment within the ES will consider any other significant developments in the area which are likely to overlap with the peak construction phase (2026) of the Scheme. The cumulative assessment will identify for each receptor those areas where the predicted effects of the Scheme could interact with effects arising from other committed developments on a spatial and/ or temporal basis.

West Burton Solar Farm

- 13.12.6 West Burton Solar Farm consists of four land parcels (as indicated by **PEI Report Volume 2: Figure 13-6**) and is expected to be constructed over a two-year period (starting in 2024 at the earliest), with a planned grid connection date of 2029. Therefore, whilst West Burton Solar Farm may be complete prior to the peak construction phase of the Scheme (2026), there is likely to be some form of overlap which will be reflected within the cumulative assessment of the ES to provide a worst-case assessment.
- 13.12.7 West Burton Solar Farm parcels WB1, WB2 and WB3 are all located to the south of the A1500 Till Bridge Lane, towards Sturton-by-Stow, whereas WB4 is located to the south of the A631, to the east of Clayworth. At this stage, it is not anticipated that any construction trips relating to parcel WB4 would pass through the study area for the Scheme and the cumulative assessment is therefore expected to focus on the other three parcels. A summary of each parcel is set out below and further details related to the proposed access point(s) for each parcel are provided within the West Burton Solar Farm EIA Scoping Report (Ref 13-16).

Parcel WB1

- 13.12.8 Parcel WB1 is located to the south of the A1500 and is the smallest of the four parcels. It is currently expected that during construction, the parcel would be accessed via two junctions on the unclassified road to the east of Broxholme which connects to the A1500.
- 13.12.9 At this stage, the HGV routing for WB1 is proposed via the A15 and the A1500 (from the east), therefore HGV trips related to WB1 would not be expected to utilise parts of the highway network located within the Scheme's study area.

Parcel WB2

- 13.12.10 Parcel WB2 is located to the west of WB1 and to the south of the A1500. It is currently expected that during construction, the parcel would be accessed via four junctions, two from B1241 Sturton Road (as the road bisects the parcel) and two additional junctions on Broxhome Lane which connects to the A1500.
- 13.12.11 At this stage, the HGV routing for WB2 is proposed via the A46, A57 and B1241, therefore HGV trips related to WB2 would not be expected to utilise parts of the highway network located within the Scheme's study area.



Parcel WB3

- 13.12.12 Parcel WB3 is located to the north-west of WB2, and to the south of the A1500. The Sheffield to Lincoln railway line dissects the land parcel in a south-east to north-west alignment. It is currently expected that during construction, the parcel would be accessed via two junctions, both on the A1500.
- 13.12.13At this stage, the HGV routing for WB3 is proposed via the A15 and A1500 (from the east), therefore HGV trips related to WB3 would not be expected to utilise parts of the highway network located within the Scheme's study area.

Parcel WB4

- 13.12.14 Parcel WB4 is located to the south of the A631, to the east of Clayworth. It is currently expected that during construction, the parcel would be accessed via a junction on B1403 Clayworth Road.
- 13.12.15 At this stage, the HGV routing for WB4 is proposed via the A1(M), A614 and A631, therefore HGV trips related to WB4 would not be expected to utilise parts of the highway network located within the Scheme's study area.

Construction Trips

13.12.16 The construction worker numbers related to West Burton Solar Farm are not yet defined. However, it is envisaged that non-local workers would typically stay at local accommodation and be transported to the parcels by minibus to minimise the impact on the surrounding highway network. The proposed number of average daily HGVs for each parcel as well as the construction durations envisaged at this stage is summarised in Table 13-17 below. It is unclear whether there would be any overlap between the construction phases of each of the four parcels at this stage.

Table 13-17. West Burton Solar Farm – Forecast Construction Programme and HGVs

Parcel	Duration	Average Daily HGVs (Vehicles)*
WB1	11 weeks	2
WB2	41 weeks	7
WB3	44 weeks	8
WB4	29 weeks	7

^{*}average daily HGVs, rather than peak daily HGVs

Additional considerations

- 13.12.17 There is likely to be some overlap between West Burton Solar Farm and the Scheme, therefore, discussions will be held with IGP to review how both projects can work together to minimise any cumulative effects where viable such as considering the potential of consolidating trips in order to reduce the impact on local roads. Any discussions held with IGP will be detailed within the ES.
- 13.12.18 Proposed mitigation measures for West Burton Solar Farm are set out within the West Burton EIA Scoping Report (Ref. 13-19) and include:



- Avoiding HGV movements during the traditional AM peak hour (08:00-09:00) and PM peak hour (17:00-18:00);
- Commitment to seek to coordinate deliveries with other developments in the area; and
- Banksmen to be provided at site access points and PRoW to ensure the safe movement of all construction vehicles.
- 13.12.19 Further details related to West Burton Substation (point of connection into the National Grid) and the Grid Connection Route for West Burton Solar Farm will be provided within the ES when these details are available.

Cottam Solar Farm

- 13.12.20 Cottam Solar Farm consists of three land parcel sites (as indicated by **PEI Report Volume 2: Figure 13-6**) and is expected to be constructed over a two-year period (starting in 2024 at the earliest), with a planned grid connection date of 2028. Therefore, whilst Cottam Solar Farm may be complete prior to the peak construction phase of the Scheme (2026), there is likely to be some form of overlap which will be reflected within the cumulative assessment of the ES to provide a worst-case assessment.
- 13.12.21 Cottam Solar Farm parcels C1, C2 and C3 are all located to the west of the A15 between Lincoln and Scunthorpe. At this stage, it is not anticipated that any construction trips relating to parcels C2 (located to the north of A631) and C3 (to the east of A159) would pass through the study area for the Scheme and the cumulative assessment is therefore expected to focus on the trips related to parcel C1 (to the east of B1241). A summary of each parcel is set out below and further details related to the proposed access point(s) for each parcel are provided within the Cottam Solar Farm EIA Scoping Report (Ref. 13-20).

Parcel C1

- 13.12.22 Parcel C1 is located to the north of the A1500 and is the largest of the three parcels. It is currently expected that during construction, the parcel could potentially be accessed via 11 junctions; one from Thorpe Lane, one from Stow Lane, one from Ingham Road, two from Fleet Lane, one from South Lane, three from Willingham Road and two via an existing farm track to the west of Coates.
- 13.12.23 At this stage, the construction vehicle routing for C1 is proposed via either the A1500 or Ingham Lane/ Stow Lane, accessing the parcel via the A15, from either the M180 to the north or the A46 from the south. Therefore HGV trips related to C1 would not be expected to utilise parts of the highway network located within the Scheme's study area.

Parcel C2

13.12.24 Parcel C2 is located to the north of C1 and is located to the east of the village of Corringham, to the north of the A631. It is currently expected that during construction, the parcel would be accessed via a junction on the A361 to the east of Corringham.



13.12.25 At this stage, the construction vehicle routing for C2 is proposed via the A631 from the A15, HGV trips related to C2 would not be expected to utilise parts of the highway network located within the Scheme's study area.

Parcel C3

- 13.12.26 Parcel C3 is located to the north of C2 and is split into two distinct areas, C3a is located around the village of Blyton whist C3b is located to the east of Pilham. It is currently expected that during construction, parcel C3a would be accessed via two junctions on the B1205, to the east of Blyton. For parcel C3b, it is currently expected that access would be via a junction to the west of the parcel (the specific location of the access has not been defined at this stage).
- 13.12.27At this stage, the construction vehicle routing for C3 is proposed via the B1205 from the A15, therefore HGV trips related to C3 would not be expected to utilise parts of the highway network located within the Scheme's study area.

Construction Trips

13.12.28 The construction worker numbers related to Cottam Solar Farm are not yet defined. However, it is envisaged that non-local workers would typically stay at local accommodation and be transported to the parcels by minibus to minimise the impact on the surrounding highway network. The proposed number of average daily HGVs for each parcel as well as the construction durations envisaged at this stage is summarised in Table 13-18 below. It is unclear whether there would be any overlap between the construction phases of each of the three parcels at this stage.

Table 13-18. Cottam Solar Farm – Forecast Construction Programme and HGVs

Parcel	Duration	Average Daily HGVs (Vehicles)*
C1	28 weeks	23
C2	18 weeks	3
C3	20 weeks	4

^{*}average daily HGVs, rather than peak daily HGVs

Additional considerations

- 13.12.29 There is likely to be some overlap between Cottam Solar Farm and the Scheme, therefore discussions will be held with IGP to review how both projects can work together to minimise any cumulative effects including sharing the Grid Connection Route where viable and considering the potential of consolidating trips (such as HGVs or shuttle services for construction workers) in order to reduce the impact on local roads. Any discussions held with IGP will be detailed within the ES.
- 13.12.30 Proposed mitigation measures for Cottam Solar Farm are set out within the scoping report (Ref 13-17) and include those set out above for West Burton Solar Farm.



13.12.31 Further details related to Cottam Substation (point of connection into the National Grid) and the Grid Connection Route for Cottam Solar Farm will be provided within the ES when these details are available.

Summary

13.12.32 In summary, whilst a full cumulative assessment will be conducted within the ES, no significant cumulative effects are anticipated at this stage based on the details set out above with respect to the HGV numbers identified for West Burton Solar Farm (see Table 13-7 above) and Cottam Solar Farm (see Table 13-8 above). Any overlaps between the construction vehicle trips associated with the Scheme and West Burton/ Cottam Solar Farms are likely to be primarily confined to wider strategic routes.



References

Ref.	13-1	The Planning Inspectorate (PINS) (2021) Scoping Opinion: Proposed Gate Burton Energy Park		
Ref.	13-2	Department of Energy and Climate Change (DECC) (2011) National Policy Statement for Energy (EN-1)		
Ref.	13-3	DECC (2021) Draft Overarching National Policy Statement for Energy (EN-1)		
Ref.	13-4	DECC (2011) National Policy Statement for Renewable Energy Infrastructure (EN-3)		
Ref.	13-5	DECC (2021) Draft National Policy Statement for Renewable Energy Infrastructure (EN-3)		
Ref.	13-6	DECC (2011) National Policy Statement for Electricity Networks Infrastructure (EN-5)		
	13-7	DECC (2021) Draft National Policy Statement for Electricity Networks Infrastructure (EN-5)		
Ref.	13-8	Ministry of Housing, Communities and Local Government (MHCLG) (2021) National Planning Policy Framework (NPPF).		
Ref.	13-9	MHCLG (2014) Planning Practice Guidance: Travel plans transport assessments and statements.		
Ref.	13-10	Lincolnshire County Council (LCC) (2020) Lincoln Transport Strategy 2020-2036		
Ref.	13-11	Central Lincolnshire Joint Strategic Planning Committee (CLJSPC) (2017) Central Lincolnshire Local Plan		
Ref.	13-12	LCC (2013) Fourth Lincolnshire Local Transport Plan 2013/14 – 2022/23		
	13-13	LCC (2010) Gainsborough Transport Strategy Final Report		
	13-14	Bassetlaw District Council (2021) Bassetlaw Local Plan 2020-2037: Publication Version		
Ref.	13-15	Nottinghamshire County Council (NCC) (2011) Nottinghamshire Local Transport Plan 2011-2026		
Ref.	13-16	NCC (2011) Nottinghamshire Local Transport Plan Implementation Plan 2018/19–2020/21		
Ref.	13-17	Institute of Environmental Management and Assessment (IEMA) (1993) Guidelines for Environmental Assessment of Road Traffic. Lincoln: IEMA.		
Ref.	13-18	Department for Transport (DfT) (2022) CrashMap Data: Great Britain 1999 – 2021 (verified) – 2021 provisional data to June		
Ref.	13-19	West Burton Solar Project Limited (2022) West Burton Solar Farm Environmental Impact Assessment Scoping Report		
Ref.	13-20	Cottam Solar Project Limited (2022) Cottam Solar Farm Environmental Impact Assessment Scoping Report		



14. Human Health and Wellbeing

14.1 Introduction

- 14.1.1 This chapter of the Preliminary Environmental Information (PEI) Report presents the findings of an assessment of the likely significant effects on human health and wellbeing as a result of the Scheme. For more details about the Scheme, refer to **Chapter 2: The Scheme** of this PEI Report.
- 14.1.2 This chapter identifies and proposes measures to address the potential impacts and likely significant effects of the Scheme on human health and wellbeing, during the construction, operation, and decommissioning phases of the Scheme. This chapter presents a summary of the information on health and wellbeing provided in Chapter 11: Noise and Vibration, Chapter 12: Socio-economics and Land Use, Chapter 13: Transport and Access and Chapter 15: Other Environmental Topics (including Air Quality).
- 14.1.3 This chapter is supported by the following appendices in **PEI Report Volume** 3:
 - Appendix 14-A Legislation and Policy

14.2 Consultation

14.2.1 A request for an Environmental Impact Assessment (EIA) Scoping Opinion was sought from the Secretary of State through the Planning Inspectorate in November 2021 as part of the EIA Scoping Process. Consultation responses in relation to human health and wellbeing, to date, are presented in **PEI Report Volume 3: Appendix 1-C**.

14.3 Legislation and Planning Policy

- 14.3.1 Relevant policy documents are listed below. More detailed information regarding these policies can be found in **PEI Report Volume 3: Appendix 14-A.**
- 14.3.2 National planning policy and guidance to be considered includes:
 - National Policy Statement EN-1, EN-3 and EN-5 (Ref. 14-1);
 - National Planning Policy Framework (2021) (Ref. 14-2);
 - NHS Long Term Plan (2019) (Ref. 14-3);
 - Spatial Planning for Health: An evidence resource for planning and designing healthier places (2017) (Ref. 14-4); and
 - National Planning Practice Guidance (Ref. 14-5).
- 14.3.3 Local planning policy and guidance to be considered includes:
 - Central Lincolnshire Local Plan (2017) (Ref. 14-6);
 - Bassetlaw Core Strategy and Development Management Policies (2011) (Ref. 14-7);
 - Joint Health and Wellbeing Strategy for Lincolnshire (2018) (Ref. 14-8);



- Nottinghamshire Health and Wellbeing Strategy (2018) (Ref. 14-9);
- Nottinghamshire Joint Strategic Needs Assessment (Ref. 14-10); and
- Nottinghamshire Spatial Planning and Health Framework (2019) (Ref. 14-11).

14.4 Assumptions and Limitations

- 14.4.1 This assessment is based on baseline and design information available at the time of writing this PEI Report. A full assessment is being undertaken as part of the EIA and will be reported in the Environmental Statement (ES) that will be submitted with the Development Consent Order (DCO) application. The assessment of the significance of effects has been carried out against a benchmark of current human health and wellbeing baseline conditions prevailing around the Scheme, as far as is possible within the limitations of such a dataset. Baseline data is also subject to a time lag between collection and publication. As with any dataset, these conditions may be subject to change over time which may influence the findings of the assessment. Baseline Conditions reported in Section 14.7 regarding human health and wellbeing are based on latest data available at the time of writing. It is likely that current conditions may have changed owing to the ongoing effect of the Covid-19 pandemic. The assessment of effects reported in Section 14.10 are based on the conditions as reported wherever relevant and it is not expected that the assessment of significance would change if they were based on current conditions.
- 14.4.2 This assessment is based on professional judgement and considered both the adverse and beneficial impacts that the Scheme will have on the surrounding receptors. It provides an indication of human health and wellbeing effects on people and the local community.
- 14.4.3 Effects on human health and wellbeing during the construction, operation and decommissioning phases are based on preliminary assessments taking into consideration the results from the relevant environmental studies. These studies comprise Chapter 11: Noise and Vibration, Chapter 12: Socioeconomics and Land Use, Chapter 13: Transport and Access and Chapter 15: Other Environmental Topics (including Air Quality). These will be further investigated and reported in the ES when completed assessments are available. However, the information that is available at the time of writing (May 2022) is sufficient to enable an assessment of the effect on Human Health and Wellbeing.
- 14.4.4 In terms of the transport assessment (as set out in **Chapter 13: Transport and Access**), the traffic flows and non-road mobile machinery during the construction period are based on a worst-case scenario of all infrastructure being built to its maximum Design Principles, which may slightly overestimate the number of vehicles and equipment. A Framework Construction Traffic Management Plan (CTMP) will be produced at Environmental Statement stage, which will consider mitigation measures in more details. During the operational phase, the Scheme will be manned by a nominal amount of people across the Site. Therefore, due to the low level of trips likely to be generated within network peak hours, an assessment of the operational phase has been excluded from this PEI Report.



- 14.4.5 The noise methodology (as set out in **Chapter 11: Noise and Vibration**) requires specific locations to be modelled for operational phase noise sources, which has been achieved by modelling the parameters set out in **Chapter 2:**The **Scheme** and compiling data:
 - Sound level data, which is based on industry sound pressure level measurement data;
 - Surrounding ground conditions, which have been modelled as soft;
 - Air temperature, which is assumed to be 10 degrees and humidity 70%;
 - One order of reflection;
 - Land topography; and
 - All receptor points have set a standard height of 1.5m above local ground levels.
- 14.4.6 As set out in **Chapter 11: Noise and Vibration**, the assessment of construction noise (and vibration) has considered construction activities that have the potential to result in significant effects on identified receptors based on information presented in **Chapter 2: The Scheme**, previous experience of construction sites and professional judgement. Construction noise predictions have been undertaken using computer modelling software (CadnaA® 2019). Noise predictions were carried out to represent a conservative scenario where construction plant is operational nearest to the identified receptors and does not take into account quieter periods when limited activities take place or at further distances. Therefore, noise predictions may overestimate construction noise levels and be considered to be a reasonable likely worst case.
- 14.4.7 Operational noise has been predicted with all plant being in maximum operation. This is likely to overestimate the actual effects from operational noise as typically, the transformers will not be operational or operating at maximum capacity during night-time, early morning or evening hours. BESS cooling fans would also operate dependent on ambient temperatures and would not be in full mode of operation during cooler temperatures.
- 14.4.8 The air quality methodology (as set out in **Chapter 15: Other Environmental Topics**) is based on baseline environmental conditions and Scheme design information available at the time of writing. An updated assessment will be undertaken as part of the EIA and will be reported in the ES that will be submitted with the DCO application.
- 14.4.9 This assessment has also considered the socio-economic assessment (Chapter 12: Socio-economics and Land Use), which presents population, labour force and local economy information which is based on the latest data available at the time of writing. It is likely that the current conditions are greatly changed owing to the ongoing effect of the Covid-19 pandemic on the labour market, businesses and the economy. Effects on local amenities and land use during the construction, operation and decommissioning phases are based on preliminary assessments.
- 14.4.10 In advance of a detailed construction programme, which will be prepared following the granting of the DCO, all temporary effects during construction are assessed as occurring simultaneously and for the entire 24-month programme. The same is assumed for decommissioning. Whilst a phased



construction or decommissioning programme may be possible, the approach taken to assuming a 24-month duration means that the likely 'worst case' is assessed. This may result in the overestimation of predicted adverse health effects but is considered a robust approach to the assessment. Should the construction phase be extended or delivered in phases, the predicted effects would be the same or less than those outlined in this chapter.

- 14.4.11 As noted in **Chapter 2: The Scheme**, the construction period is expected to be a minimum of 24 months for the Scheme. This is expected to be a realistic worst-case assumption for this assessment, as it represents the expected minimum build time and therefore the most intense activity onsite (and therefore greatest impacts associated with traffic, noise, dust, visual, etc). Should the build period be a longer duration, the intensity would be less and the impact on the community therefore the same or lower. This approach may mean the maximum number of jobs during peak construction has been overestimated, it should not affect the average number presented in this chapter or the associated spending benefits attributed to this phase of the Scheme.
- 14.4.12 Decommissioning is assessed as occurring after 60 years of operation and for the purposes of this assessment is treated as taking place no earlier than 2088, based on a 60-year design life. It is possible that the Scheme will be operational for a longer period of time and it is also possible that certain elements of the Scheme may be decommissioned prior to the end of the 60-year period. Should parts of the Scheme be decommissioned in advance of the main decommissioning phase, the predicted effects would be the same or less than those outlined in this chapter. Similar to the construction period, the assessment of a 24-month decommissioning period therefore represents a realistic worst case.

14.5 Study Area

- 14.5.1 The study area was defined to include human health and wellbeing features likely to be at risk from possible direct and indirect impacts that might arise from the Scheme. The study area for human health is based on the extent and characteristics of the Scheme and the communities/wards directly and indirectly affected by the project. Based on this, it is determined that human health impacts are likely to occur in an area which is composed of the following five wards:
 - Rampton and Sturton wards in Bassetlaw District; and
 - Lea, Stow and Torksey wards in the West Lindsey District.
- 14.5.2 Dependent on the human health indicator being analysed, ward level data is available from the 2011 Census (Ref. 14-12) or 2018 electoral wards. Whilst the geographic extents of the 2011 Census and 2018 electoral wards differ, both types of wards provide an indication of local health in proximity to the Scheme and are therefore considered suitable for assessing the existing baseline conditions for human health. Where ward level data is not available, the local authorities of West Lindsey and Bassetlaw have been used as the study area as referenced in the text.



14.6 Assessment Methodology

Sources of Information

- 14.6.1 The following assessment seeks to establish the potential human health effects and assesses these against the current baseline conditions at the DCO Site and in the surrounding area.
- 14.6.2 Baseline data illustrating the existing conditions surrounding the DCO Site has been collected through a desk-based research exercise using publicly available sources, documents, and web-based applications. These sources include:
 - ONS Census 2011 (Ref. 14-12);
 - Mid-Year Population Estimates 2021 (Ref. 14-13);
 - Annual Population Survey 2021 (Ref. 14-14);
 - Indices of Multiple Deprivation 2019 (Ref. 14-15); and
 - Public Health England; Health Profiles (Ref. 14-16).

Impact Assessment Methodology

- 14.6.3 There is no consolidated methodology or practice for the assessment of effects on human health. Best practice principles are provided in NHS England's Healthy Urban Development Unit's (HUDU) Rapid Health Impact Assessment (HIA) Toolkit 2019 (Ref. 14-17) and forms the basis of the approach adopted to assess impacts on health and wellbeing in this chapter. In addition, consideration has been given to the Health and Wellbeing checklist of the Wales Health Impact Assessment Support Unit (WHIASU) (2020) (Ref. 14-18) to help with the identification of which health determinants are relevant. Based on this, the impacts of the Scheme on human health are assessed qualitatively using professional judgement, best practice, and draw upon other assessments within the PEI Report and therefore, the assessment does not follow the methodology outlined in **Chapter 5: EIA Methodology.** The methodology for the assessment is outlined below.
- 14.6.4 This qualitative assessment of human health effects considers the following health and well-being determinants of relevance:
 - Access to healthcare services and other social infrastructure;
 - Air quality, noise and neighbourhood amenity;
 - · Accessibility and active travel;
 - Access to work and training; and
 - Social cohesion and neighbourhoods.
- 14.6.5 The assessment has considered the potential consequences for health and wellbeing from construction, operation, and decommissioning phases of the Scheme and draws upon the information and conclusions reported within the transport and access assessment (Chapter 13: Transport and Access), the noise and vibration assessment (Chapter 11: Noise and Vibration), the air quality assessments (Chapter 15: Other Environmental Topics) and the socio-economics assessment (Chapter: 12: Socio-Economics and Land Use).
- 14.6.6 A qualitative assessment of human health has been undertaken, with evidence provided to support the conclusions. The assessment of human health effects



describes the likely qualitative health outcomes. When describing the impact on each health determinant, where possible, we identify the duration of the change and the population exposed to this.

- 14.6.7 There is no accepted definition of significance for health effects. The description of the changes to health determinants, the characteristics and sensitivity of the receptor population, and the likelihood of negative or positive health effects has been undertaken in accordance with HUDU and WHIASU guidance. The description provides information to inform stakeholders and decision makers of the likely direction of change in terms of health and wellbeing outcomes. Therefore, in line with current knowledge and methods of assessment, the consideration of health outcomes reports effects as being positive, negative, or neutral, rather than indicating a level of significance.
- 14.6.8 The potential health effects during construction, operation, and decommissioning are described using the criteria as outlined in Table 14-1 Where an impact is identified, actions have been proposed to mitigate any negative impact on health, or to realise opportunities to create health benefits. It should be noted that in many cases, mitigation is embedded within the Scheme and the implementation of this is an underlying assumption of the assessment (see Section 14.9).

Table 14-1 Human health impact categories

Impact Category	Impact Symbol	Description
Positive	+	A beneficial impact is identified
Neutral	0	No discernible health impact is identified
Negative	-	An adverse impact is identified
Uncertain	?	Where uncertainty exists as to the overall impact

14.7 Baseline Conditions

Existing Baseline

- 14.7.1 This section describes the baseline environmental characteristics for the Scheme and surrounding areas with specific reference to human health and wellbeing.
- 14.7.2 **Chapter 12: Socio Economics and Land Use** of this PEI Report provides a review of the local area as part of its baseline analysis. This section summarises receptors identified as part of that review which are relevant to the health assessment, including residential properties, community facilities and recreational routes such as Public Rights of Way (PRoW).

Demographic profile

14.7.3 As shown in Figure 14-1, according to 2020 mid-year population estimates (Ref. 14-13), the total population of the study area is 12,058. The population in Lea is 2,106; in Stow is 2,379; in Torksey is 2,930; in Rampton is 2,273; and in Sturton is 2,370.



- 14.7.4 In 2020 the average proportion of residents of working age (16-to-64-year-olds) in the study area was 55.7%. This is lower than the average for the East Midlands (61.8%) and England (62.3%).
- 14.7.5 In addition, the average proportion of residents aged 65 and over in the study area is 30.2%. This is considerably higher than the rates recorded in the East Midlands (19.6%) and nationally (18.5%).

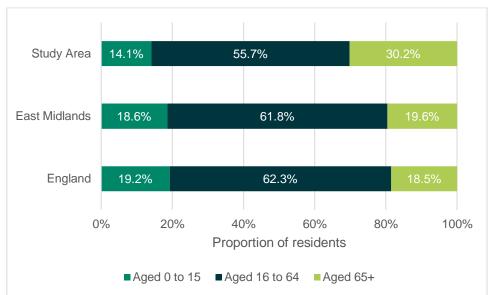


Figure 14-1 Age Breakdown by Geography

Source: ONS (2020) (Ref 14-13)

14.7.6 As shown in Table 14-2, the proportion of White residents living in the study area is 98.5%, a higher share than in the East Midlands (89.3%) and England more widely (85.4%). Conversely, there are proportionally fewer residents of each ethnic minority group living in the study area than in the East Midlands or England. For example, Asian and Asian British residents make up 0.3% of the population of the study area whereas this group accounts for 6.5% and 7.8% of the population in the East Midlands and England respectively.

Table 14-2 Ethnic Group by Geography

Ethnic Group	Study Area	East Midlands	England
White (%)	98.5	89.3	85.4
Mixed/multiple ethnic groups (%)	0.6	1.9	2.3
Asian/Asian British (%)	0.3	6.5	7.8
Black/African/Caribbean/Black British (%)	0.4	1.8	3.5
Other ethnic group (%)	0.1	0.6	1.0

Source: Census (2011) (Ref. 14-12)

14.7.7 The 2019 Indices of Deprivation (Ref. 14-15) provide a set of relative measures of deprivation for Local Authorities and Lower Super Output Areas (LSOAs)¹ across England. The local authorities that the DCO Site falls within are Bassetlaw and West Lindsey. West Lindsey is the 146th most deprived

¹ Lower Layer Super Output Areas are a geographic hierarchy designed to improve the reporting of small area statistics in England and Wales. Lower Layer Super Output Areas are built from groups of contiguous Output Areas and have been automatically generated to be as consistent in population size as possible, and typically contain from four to six 'Output Areas'.



local authority of 317 districts in England (where 1 is most deprived). Within West Lindsey, four of the LSOAs are within the top 10% most deprived LSOAs in England. Regarding the health deprivation domain, West Lindsey is the 143rd most deprived local authority.

14.7.8 In comparison, Bassetlaw is the 108th most deprived local authority in England. Within the local authority, five LSOAs are within the top 10% most deprived in England. For health deprivation, Bassetlaw is ranked as the 68th most deprived local authority in England.

Health Profile

- 14.7.9 This section provides a human health profile of the study area, focusing on key determinants of health relevant to the assessment criteria provided within the HUDU / NHS England guidance (Ref. 14-17). This local health baseline will be used to assess potential health effects of the Scheme.
- 14.7.10 Based on 2011 Census data (Ref. 14-12), which is the latest dataset available for self-assessment of health, 5.1% of residents in the study area believed that they were living in 'bad' or 'very bad' health. This rate is similar to the proportion of residents in the East Midlands (5.5%) and England as a whole (5.5%). This assessment accounts for overall rating of mental and physical health and is self-assessed. This is shown below in Figure 14-2.

50 45 40 35 Proportion (%) 30 25 20 15 10 5 0 Very good Good health Fair health Bad health Very bad health health ■ Study Area ■ East Midlands England

Figure 14-2 Self-Assessment of Health

Source: Census (2011) (Ref. 14-12)

14.7.11 In addition, Figure 14-3 illustrates a self-assessment of long-term health or disability. This is a problem that limits a person's daily activities and has lasted at least 12 months. The proportion of residents within the study that experience limitations to their daily activities a little or a lot is 21.4%. This is slightly higher than 18.6% in the East Midlands and 17.6% in England as a whole.



Study Area 9.3 12.1 78.6

East Midlands 8.7 9.9 81.4

England 8.3 9.3 82.4

0 20 40 60 80 100

Figure 14-3 Self-Assessment of Long-Term Health or Disability

Source: Census (2011) (Ref. 14-12)

■ Day-to-day activities not limited

14.7.12 Wider determinants of health (Ref. 14-16) can also give an insight into the health profile of an area. The following indicators are compared to regional and national figures to illustrate how the area performs:

■ Day-to-day activities limited a lot ■ Day-to-day activities limited a little

 Life expectancy: ONS data states that the average life expectancy at birth for the study area is 81.9. This is in line with both the average for the East Midlands (81.1) and England (80.9);

Proportion of residents (%)

- Childhood obesity: The average proportion of children in reception school year who are obese is 22.5% in the study area, in line with rates for the East Midlands (22.7%) and England (22.6%);
- Adulthood obesity: At ward level, obesity data is only available for Sturton. The proportion of adults there who are obese is 37.5%, a much higher rate than in the East Midlands (21.8%) and England (22.6%);
- Smoking prevalence: At age 15, the prevalence of regular smokers in the study area is 5.6%. This is similar to the proportion in England of 5.4%; and
- Deaths from respiratory diseases (standardised mortality ratio (SMR)):
 The average SMR for this indicator in the study area is 64.9, lower (i.e. better) than the figure for the East Midlands (100.6) and England (100).
 An SMR below 100 indicated fewer than expected deaths, whilst an SMR above 200 indicates that there are excess deaths.

Infrastructure Baseline

Healthcare Facilities

- 14.7.13 The nearest hospital (with an accident and emergency department) to the DCO Site is Lincoln County Hospital which is approximately 18km to the south east of the site.
- 14.7.14 There are two GP surgeries within close proximity of the DCO site. These are Marton Branch Surgery and Willingham-by-Stow Surgery both approximately 1km away from the Site.



- 14.7.15 The latest General Practice (March 2022) data published by NHS digital indicates that the two branches, both attached to the Willingham Surgery have a total of 2 GPs and provide care to 4,241 registered patients. This corresponds to 2,120 patients per GP, which exceeds the Royal College of General Practitioners target of 1,800 patients per GP.
- 14.7.16 More widely, there is a total of 14 practices within the relevant Primary Care Networks (IMP PCN and Trent Care PCN), for a total of 71 GPs with a total of 109,441 patients registered. This corresponds to 1,541 patients per GP, which is below and therefore meeting the RCGP target of 1,800 patients per GP.

Social Infrastructure

- 14.7.17 There are three schools located near to the DCO site. These are Frances Olive Anderson Church of England Primary School approximately 1km to the north, The Marton Academy Primary School 1km to the south, and Sturton by Stow Primary School 2km to the south east.
- 14.7.18 There are no police or fire stations in direct proximity of the DCO Site. The nearest are Gainsborough Police Station and Gainsborough Fire Station both located approximately 5km north of the DCO Site.

Community and Recreational Facilities

14.7.19 There is a range of community and recreational facilities within the Study Area. Table 14-3 illustrates these facilities and their distances from the site boundary.

Table 14-3 Community and Recreational Facilities nearby the Site

Receptor	Description	Approximate distance from the DCO Site
St Mary Church	Church in the village of Knaith	0.5km
Church of St Helen	Church in the village of Gate Burton	0.5km
St Helen's Church	Church in the village of Willingham	0.5km
Marton and Gate Burton Village Hall	Village Hall in the village of Marton	0.5km
Fox and Hounds Pub	Public house in the village of Willingham	0.5km
Black Swan Guest House	Accommodation in the village of Marton	0.5km
Rose and Crown Pub	Public house in the village of Upton	1km
Park Springs Community Centre	Community centre in the town of Gainsborough	2km
Lincoln Golf Club	Golf Club in the village of Torksey	2km
Gainsborough Model Railway	Tourist attraction in the town of Gainsborough	4km

Public Rights of Way ("PRoW")

- 14.7.20 PRoW are primarily located west of the River Trent, outside the Solar and Energy Storage Park.
- 14.7.21 There is one PRoW located within the Solar and Energy Storage Park boundary: LL|Knai|44/2 (footpath), which is the prolongation of LL|Knai|44/1



(footpath). These two PRoWs connect Kexby Lane (east) to Station Road / Knaith Hill (west). The two PRoW cover a combined distance of circa 1.2km (about 600m each).

- 14.7.22 In addition to LL|Knai|44/1 (footpath) a few PRoWs are also located within proximity to the site, such as:
 - LL|Lea|513/1 (footpath c.100m), north of the Site, connecting Station Road to Willingham Road;
 - LL|Mton|69/1 (footpath c.500m), on the south-east border of the Site, connecting Willingham Road to Stow Park Road; and
 - LL|Mton|68/1 (footpath c.700m), south of the Site, on the north border of the Grid Connection Route, connecting the High Street to Stow Park Road.
- 14.7.23 The Grid Connection Route will pass through:
 - LL|Mton|66/4 (footpath c.600m) going from Trent Port Road to LL|Bram|66/1 (footpath – c.500m) connecting to Gainsborough Road;
 - NT|Cottam|FP1 (footpath c.150m) which runs along the River Trent and forms part of a wider footpath route;
 - NT|Cottam|FP3 (footpath c.1km) connecting Headstead Bank (west) to NT|Cottam|FP1 (east);
 - NT|Cottam|RB4 (restricted byway c.1km) connecting Broad Land (north) to Overcoat Lane (south);
 - NT|South Leverton|BOAT16 (byway open to all public c.1km) connecting Broad Land (north) to Overcoat Lane (south); and
 - NT|Rampton|FP5 (footpath c.1.1km) connecting Torksey Ferry Road (south) to NT|Treswell|FP5 (footpath) which boarders Cottam Power Station.

Residential Properties

14.7.24 The area around the DCO Site is mostly rural and relatively sparsely populated. There are two residential properties within the DCO Site on Clay Lane to the south of the Solar and Energy Storage Park. Larger groups of residential properties are located to the west of the Site in Knaith, to the south west of the Site in Gate Burton and to the north of the Site in Knaith Park

14.8 Potential Impacts

- 14.8.1 Mitigation measures being incorporated in the design and construction of the Scheme are set out below. Prior to the implementation of the mitigation, the Scheme has the potential to affect human health and wellbeing (positively or negatively), during construction, operation and during decommissioning, in the following ways:
 - Access to Healthcare Services and Other Social Infrastructure;
 - Air Quality, Noise and Neighbourhood Amenity;
 - Accessibility and Active Travel;



- Access to Work and Training; and
- Social Cohesion and Lifetime Neighbourhoods.

14.9 Mitigation Measures

- 14.9.1 Embedded and additional mitigation measures are incorporated and secured into the Scheme as set out in the respective chapters to reduce other construction and operational effects (such as noise and vibration, air quality, transport and access and socio-economics and land use) which in turn will mitigate the effects on the local community and existing facilities from a human health and wellbeing perspective
- 14.9.2 The health assessment is presented in Table 14-4 to Table 14-8. Where there are assessed to be negative health impacts in the assessment, the implementation of additional mitigation measures has been considered in order to avoid or minimise the human health impact.

14.10 Assessment of Likely Impacts and Effects

- 14.10.1 Table 14-4 to Table 14-8 below sets out the potential health and wellbeing impacts associated with the Scheme during construction, once the Scheme is complete and operational, and during decommissioning. The potential health and wellbeing impacts are described in accordance with the methodology as set out in Section 14.6.
- 14.10.2 In the below table, the term 'n/a' indicates that an assessment of the health criteria was not applicable to a particular phase



Table 14-4 Access to Healthcare Services and Other Social Infrastructure

Assessment	
Criteria	

Relevant to the proposed development

Details and Evidence

Potential Health Impact or Mitigation

Further Action Recommended

Does the proposal assess the impact on healthcare services?

Yes

During construction

As identified in the baseline, there are two GPs located within 1 km of the Scheme (Marton Branch Surgery in Stow ward, within West Lindsey and Willingham-by-Stow surgery in Torkey ward also within West Lindsey). The nearest hospital (Lincoln County hospital) is in the ward of Abbey, Lincoln which is 18km southeast of the Scheme. The construction workers (400 on average each day) required to build the Scheme may place some demand on healthcare services if they move to the area or if emergency treatment is required. If any of the workers reside locally already, they will be registered at a practice currently and will not therefore place additional demand for services on these GPs. Whereas the current level of patients per GP located within the two surgeries within 1km of the Scheme exceeds and is therefore worse than the national average, the average per GP within the relevant Primary Care Networks is noticeably better than the national average across a much greater number of surgeries. It is unlikely that many workers would move to live in the immediate area and access these two surgeries given it is relatively sparsely populated with a lack of sufficient available accommodation. Assuming a worst-case whereby all of the 228 construction workers who are likely to live locally would require places at surgeries within the wider PCN area where there is more accommodation available, this would increase the patients per GP provision at this geographic level from 1,541 patients per GP to 1,545 patients per GP, which would remain better than the national target. The actual demand is likely to be less than this because, as stated above, workers would likely continue to access services where they live. It can be concluded therefore that even in the worst case, additional demand generated from the Scheme would unlikely have any noticeable impact on service provision for current patients.

Residents of properties in the villages surrounding the Scheme attempting to access these healthcare facilities are likely to use the same strategic roads (including the A1 (M), A614 and A57) as construction traffic associated with the Scheme and workers attempting to access the DCO Site. The presence of this additional traffic is not likely to affect local residents' ability to access healthcare facilities, as the existing road network is expected to remain within capacity at all times during the construction period, without any considerable changes in journey time. The Framework Construction Traffic Management Plan (CTMP) will also be secured through the DCO submission and will form part of the Environmental Statement. The CTMP will further analyse the traffic related impacts in detail and set out any relevant mitigation measures.

0 during construction 0 during operation 0 during decommission ing

During construction None proposed During operation None proposed During decommissioning None proposed



Assessment Criteria

Relevant to the proposed development **Details and Evidence**

Potential

Further Action Health Impact or Mitigation Recommended

As referred to in Chapter 13: Transport and Access, there is forecasted to be a maximum 154 twoway vehicle trips during the morning peak hour (07:00- 08:00) and also 154 two-way vehicle trips during the evening peak hour (18:00- 19:00). The greatest proportional increase in traffic flow (excluding Marton Road where there will only be an increase of 12 vehicle trips during each peak hour) is expected on B1241 Kexby Lane (east of Upton Road) which is predicted to experience a 72.6% increase in the AM peak and 70.8% increase in the PM peak. This is an increase of 41 additional trips during peak hours and averages out to a 11.9% increase across a 24-hour period, thus representing a modest increase in flows, which is not significant. .

Therefore, the potential health impact on access to healthcare services during the construction period is assessed to be **neutral**.

During operation

During the operational phase, there are expected to be fourteen full time staff working within the DCO Site per day. Therefore, the Scheme will generate very low levels of traffic and it will not impact local residents' ability to access healthcare facilities.

Therefore, the potential health impact on access to healthcare facilities during operation is assessed to be **neutral**.

During decommissioning

Traffic flow cannot be accurately forecasted for over 60 years into the future, however the Scheme's impact on local residents' ability to access healthcare facilities in the decommissioning phase is expected to be the same or less as during construction, based on the expected similar number of trips and duration of these phases. A Framework Decommissioning Environmental Management Plan (DEMP) will be provided at ES stage and secured through the DCO, which will provide details of the outline mitigation measures which will need to be adhered to during decommissioning. This will be updated and finalised prior to the decommissioning phase.

The potential health effect on access to healthcare facilities during the decommissioning period is assessed to be **neutral**.

Does the proposal assess the capacity, location and accessibility of **During construction**

There are three schools located near to the Scheme:

Frances Olive Anderson C of E Primary School, located 1km to the north (in Lea ward, Gainsborough, West Lindsey).

0 durina construction 0 during operation

Durina construction None proposed **During operation** None proposed

Yes



Assessment
Critoria

Relevant to the proposed development

Details and Evidence

Potential

Further Action Health Impact or Mitigation Recommended

other social infrastructure, e.g. schools, social care and community facilities?

The Marton Academy Primary School, located 1km to the south (in Torksey ward, Gainsborough, West Lindsey).

0 during Durina decommission decommissioning ing None proposed

Sturton-by-Stow Primary School, located 2km to the south east (in Stow ward, Gainsborough, West Lindsey).

Local residents are likely to travel to Gainsborough town to access the vast majority of services, which is located 8.8km to the North. Public Houses are located in the villages of Willingham and Upton (which are located 0.5km and 1.0km away respectively) and accommodation is available within Marton (0.5km away). It is anticipated that workers will either already live within the local area or will live temporarily within the area in temporary accommodation such as hotels (likely within Gainsborough town centre or Lincoln city centre). Therefore, they will likely not move to the local area with their families for the duration of the 24-month construction period, and that the capacity of social infrastructure will not be impacted.

Residents of villages and single residential properties surrounding the Scheme are likely to use the same strategic roads (A1 (M), A614 and A57) as construction traffic associated with the Scheme and workers attempting to access the DCO Site. However, the presence of this additional traffic is not likely to affect local residents' ability to access this social infrastructure. There is forecast to be minor adverse or negligible implications on the surrounding road network and is considered to be nonsignificant. A CTMP will be secured as part of the next stage of review, as part of the ES for the DCO. This will consider measures to manage construction traffic resulting from the Scheme at peak hours in order to limit any potential disruptions and implications on the wider transport network as well as for existing road users.

Therefore, at this stage, the potential health impact on access to social infrastructure during the construction period is assessed to be **neutral**.

During operation

During the operational phase, there are expected to be fourteen full time staff working within the DCO Site per day. Therefore, the Scheme will generate very low levels of traffic and it will not impact local residents' ability to access social infrastructure.

Therefore, the potential health impact on access to social infrastructure during operation is assessed to be neutral.

During decommissioning

Traffic flow cannot be accurately forecasted for over 60 years into the future, however the Scheme's impact on local residents' ability to access social infrastructure in the decommissioning phase is

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Assessment Criteria

Relevant to the proposed development

Details and Evidence

Potential Health Impact or Mitigation

Further Action Recommended

expected to be the same as during construction, based on the expected similar number of trips and duration of these phases.

The Framework DEMP will be secured at ES stage for the DCO, which will provide the outline mitigation measures to be adhered to during decommissioning. This will be updated and finalised prior to the decommissioning phase. The potential health effect on access to healthcare facilities during the decommissioning period is assessed to be **neutral**.



Assessment Criteria	Relevant to the Scheme?	Details and Evidence	Potential Health Impact	Further Action or Mitigation Recommended
Does the proposal minimise construction impacts such as dust, noise, vibration and odours?	Yes	During construction An assessment of the risk of dust and particulate matter impacts during the construction stage is provided in the Chapter 15: Other Environmental Topics of the PEI Report. This includes a section on Air Quality. The assessment considers dust risk emitted across pre-defined zones up to 350m from the DCO Site. These zones are presented in PEI Report Volume 2: Figure 15-1. Air pollution resulting from earthworks, construction and trackout activities are considered (demolition assessment is scoped out as this is not required and no residential, community or commercial receptors within the DCO site require relocation). According to PEI Report Volume 3: Appendix 15-A, there are estimated to be over 100 residential dwellings within 20m of the DCO site and the Combined Sensitivity of the area to human health Impacts is considered to be low (although Annual Mean PM₁₀ concentrations of <24 μg/m³ is considered medium sensitivity). Due to low background particulate matter concentrations in the area and the presence of 10-100 sensitive receptors within 20m of the DCO Site Boundary, the overall risk is classified as low risk to human health.	ing	During construction None proposed During operation N/A During decommissioning None proposed

An assessment of the impact of construction of the Scheme on noise and vibration is provided in Chapter 11: Noise and Vibration of the PEI Report The assessment states that there will be no significant construction noise, traffic noise or vibration arising from the construction of the Scheme. It does state however, this is dependent on the final Grid Connection Route as receptors within 15m may experience significant noise effects. Occupants of nearby receptors are likely to be more tolerable of high noise events if they are regularly communicated to and kept informed of timings and duration of high noise generating events. The Framework Construction Environmental Management Plan (CEMP) which is secured through the DCO, will be produced at ES stage will outline measures to mitigate and minimise the adverse noise effects during construction.

The above assessments conclude that when the measures set out to control dust and noise are followed, there is likely to be minimal impacts on surrounding receptors and the potential health impact is assessed to be neutral. No discernible health or wellbeing impact is identified.

During operation

Not applicable as assessment criteria refers to construction impacts and no effects are anticipated during the operational phase.

During decommissioning

Yes



Assessment Relevant to Criteria the Scheme?

Details and Evidence

Potential Health Impact

Further Action or Mitigation Recommended

Assessments of the impact of decommissioning of the Scheme on air quality and noise is provided in **Chapter 15: Other Environmental Topics** (including Air Quality) and **Chapter 11: Noise and Vibration** of the PEI Report, respectively.

The assessments conclude that the impact of decommissioning of the Scheme is likely to be similar to the construction period. Therefore, the Scheme will result in dust emissions which are assessed to have a low risk to human health. It will have negligible to minor adverse noise and vibration impacts on surrounding residential properties which will be mitigated through the measures outlined in the Framework DEMP, which will be secured at ES stage as part of the DCO and will outline the mitigation measures to be adhered to during decommissioning. This will be updated and finalised prior to this phase.

Overall, there is likely to be no discernible health or wellbeing impacts on surrounding receptors, as per the construction phase, and the potential health impact is assessed to be **neutral**.

Does the proposal minimise air pollution caused by traffic during the operational phase??

During construction

Not applicable as assessment criteria refers to operational impacts. Air pollution impacts related to the construction phase are analysed above.

During operation

An assessment of the risk of dust and particulate matter impacts during the operation stage is provided in the **Chapter 15**: **Other Environmental Topics** of the PEI Report. It is anticipated that there will be up to fourteen permanent (on-site) operational jobs. Traffic generation from operational staff is not expected to induce significant changes to traffic flows on the local road network. Therefore, the Air Quality Assessment has concluded that Scheme is not anticipated to have a significant impact on local air quality and the effect during this phase will therefore be negligible (as per the assessment made in **Chapter 15**: **Other Environmental Topics**). Overall, there is likely to be no discernible health impacts on the surrounding receptors from air pollution during the operational phase.

The potential health impact during operation is assessed to be **neutral**.

During decommissioning

Not applicable as assessment criteria refers to operation impacts. Air pollution impacts related to the decommissioning phase are analysed above.

N/A during construction

0 during operation

N/A during decommission ing

N/A

During

During operation

None proposed

construction

During decommissionin

g N/A



Assessment Relevant to Criteria the Scheme?

Details and Evidence

Potential Health Impact Further Action or Mitigation Recommended

Does the proposal minimise noise pollution caused by traffic and commercial uses during the operational phase?

During construction

Not applicable as assessment criteria refers to operation impacts. Noise pollution impacts related to the construction phase are considered above.

During operation

An assessment of the impact of operation of the Scheme on noise levels is provided in **Chapter 11: Noise and Vibration.** The assessment states that the night-time period provides the most onerous assessment criteria and operational noise is assumed to be consistent, therefore at this stage, only night-time noise has been considered as a worst-case scenario. The assessment presented in the full ES will cover all time periods.

Reasonable steps to reduce noise are covered embedded mitigation section and have been applied in noise predictions. Consequently, although adverse levels of noise are identified, NPSE requirements are complied with through provision of embedded mitigation.

In addition, the impact of Electro-Magnetic Field (EMF) generated by the cable route on local receptors was considered. Only the cable that connects the onsite substation to Cottam involves cables above 132 kv, all other cables on site would be a max 33kv, below the recommended threshold. The grid connection route that has been selected avoids receptors as far as possible.

Therefore, potential health and wellbeing impact during the operational phase on local residents is assessed to be **neutral** (although this will continue to be reviewed at ES stage).

During decommissioning

Not applicable as assessment criteria refers to operation impacts. Noise pollution impacts related to the decommissioning phase are considered above.

N/A during construction

during operation

N/A during decommission ing

During construction

N/A **During** operation

During

n decommissionin
q

N/A



Table 14-6 Accessibility and Active Travel

Assessment Criteria	Relevant to the Scheme?	Details and Evidence	Potential Health Impact	Further Action or Mitigation Recommended
Does the proposal prioritise and encourage walking (such as through shared spaces)?	Yes	cyclist amenity on PRoW has been assessed as negligible and not significant. Roads bordering the DCO Site may also be used to travel between small settlements. There is expected to be a less than 30% increase in traffic flows across the majority of the road link receptors within the study area except for Marton Road and B1241 Kexby Lane. Both of these links have high proportional increases due to the previous low baseline flows. However, this is just 12 extra trips on Marton Road and 41 extra trips on Kexby Lane as a result of construction traffic in the peak hours. This results in a very low magnitude of change with respect to pedestrian delay at Marton Road and a medium magnitude of change at Kexby Lane, during the construction phase. Therefore, there will be limited impact on pedestrian and cyclist facilities during construction. This will result in a potential health and wellbeing impact which is assessed to be neutral . During operation As it is confirmed that during the construction phase, access roads are not expected to cross any PRoW links, these will not need to be re-opened during the operational phase. The Scheme is expected to attract low level of vehicle trips during operational phase (i.e. up to 15 vehicle arrivals and 15 vehicle departures daily). As stated in Chapter 13: Transport and Access , a detailed assessment of this scenario has therefore been excluded from this PEI Report. Therefore, at this stage, the potential health and wellbeing impact during the operational phase is assessed to be neutral . During decommissioning	0 during construction 0 during operation 0 during decommission ing	During construction None proposed During operatio None proposed During decommissionin None proposed
		During the decommissioning phase, the Scheme would be dismantled, and the infrastructure will be removed. The DEMP, which will be secured through the DCO, will provide the outline mitigation measures to be adhered to during decommissioning. This will be updated and finalised prior to the decommissioning phase. It is again expected that there will be similar implications on the PRoW links and pedestrian and cyclist facilities as in the construction period. The proposed access roads within the DCO Site are not		

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Assessment Relevant to Details and Evidence Potential Further Action the Scheme? Health or Mitigation Impact Recommended

closures as a result of the Scheme. Therefore, the impact on health and wellbeing during decommissioning is assessed to be **neutral**.



Table 14-7 Access to Work and Training

Assessment Criteria

Relevant to the Scheme? **Details and Evidence**

Potential Health Further Action **Impact**

or Mitigation Recommended

None proposed

Does the proposal provide access to local employment and training opportunities, including temporary construction and permanent end-use jobs?

Yes

During construction

An assessment of the number of jobs created during the construction phase is provided in Chapter 12: Socio-Economics and Land Use. The Applicant estimates that the Scheme will support, on average, approximately 400 full-time employment construction jobs per annum. Once leakage, displacement and multiplier effects have been accounted for, this number rises to 450 total net jobs per annum during the construction period of the Scheme. Of these, 257 jobs per annum will be expected to be taken up by residents within a 60-minutes travel area of the DCO Site.

The potential health and wellbeing impact during construction is therefore assessed to be positive.

During operation

There are currently 1.5 existing jobs within the DCO Site, all relating to agricultural activities. There is expected to be some slight employment loss as a result of the Scheme. The Applicant has estimated that fourteen jobs will be directly generated by the Scheme when operational, which will potentially provide some local employment opportunities in the form of permanent jobs. When existing employment activity is accounted for, the total net employment generated would be slightly increased (2.5 FTEs) although overall based on the scale of this the health impact is assessed to be neutral.

During decommissioning

A DEMP will be secured at ES stage, which will outline mitigation measures to be adhered to during decommissioning. This will be updated and finalised prior to the decommissioning phase. An assessment of the number of jobs created during the decommissioning period is provided in Chapter 12: Socio-Economics and Land Use of the PEI Report The assessment concludes that this will reflect the number of employment opportunities created during the construction phase, with approximately 400 full-time employment decommissioning jobs per annum. Once leakage, displacement and multiplier effects have been accounted for, this number rises to 450 total net jobs per annum during the de-commissioning period of the Scheme. Of these, 257 jobs per annum will be expected to be taken up by residents within a 60-minutes travel area of the DCO Site limits.

+durina During construction construction 0 durina None proposed operation **During operation** + during None proposed decommissioning Durina decommissioning



Assessment Criteria

Relevant to the Scheme? **Details and Evidence**

Potential Health Further Action **Impact**

or Mitigation Recommended

The potential health and wellbeing impact during decommissioning is assessed to be positive.

Does the proposal include opportunities for work for local people via local procurement arrangements?

Yes

During construction

An assessment of the number of jobs created during the construction phase is provided in Chapter 12: Socio-Economics and Land Use of the PEI Report. The Applicant estimates that the Scheme will support, on average, approximately 400 fulltime employment construction jobs per annum. Once leakage, displacement and multiplier effects have been accounted for, this number rises to 450 total net jobs per annum during the construction period of the Scheme. Of these, 1257 jobs per annum will be expected to be taken up by residents within 60-minute travel area of the DCO Site, including in the supply chain (provision of aggregates, fencing, landscaping, etc). The potential health and wellbeing impact during construction is assessed to be positive.

During operation

There are currently 1.5 existing jobs within the DCO Site, all relating to agricultural activities. There is expected to be some employment loss as a result of the Scheme. The Applicant has estimated that fourteen jobs will be directly generated by the Scheme when operational, which will potentially provide some local employment opportunities in permanent jobs.

When existing employment activity is accounted for, the total net employment generated would be slightly increased (net +2.5 FTE roles) and the health impact is assessed to be **neutral**.

During decommissioning

A Framework DEMP will be provided at ES stage, which will provide the outline mitigation measures to be adhered to during decommissioning. This will be updated and finalised prior to the decommissioning phase.

An assessment of the number of jobs created during the decommissioning period is provided in Chapter 12: Socio-Economics and Land Use of the PEI Report. The assessment concludes that the impact of decommissioning of the Scheme is likely to be similar to the construction period. Therefore, the Scheme is expected to support, on average, 450 total net jobs per annum during the decommissioning period (once leakage, displacement and other multiplier effects are accounted for). Of these 257 jobs per annum will be expected to be taken-up by residents within 60-minute travel

+ during construction 0 during operation + during decommissioning

During construction None proposed During operation None proposed During

decommissioning None proposed

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Assessment Criteria Relevant to the Scheme?

Details and Evidence

Potential Health Further Action Impact

or Mitigation Recommended

area of the Scheme. The potential health and wellbeing impact during decommissioning is assessed to be positive.



Table 14-8 Social Cohesion and Lifetime Neighbourhoods

Assessment Criteria	Relevant to the Scheme?	Details and Evidence	Potential Health Impact	Further Action or Mitigation Recommended
Does the proposal connect with existing communities, i.e., layout and movement which avoids physical barriers and severance, and land uses and spaces which encourage social interaction?	Yes	Within Chapter 13: Transport and Access, it states that the proposed construction access roads within the DCO Site are not expected to cross any PRoW and there are not expected to be any temporary PRoW diversions or closures as a result of the Scheme. As such, no PRoW receptions have been examined for the assessment of severance. Roads bordering the DCO Site may also be used to travel between small settlements. There is expected to be a less than 30% increase in traffic flows across the majority of the road link receptions within the study area except for Marton Road and B1241 Kexby Lane. Both of these links have high proportional increases due to the previous low baseline flows. However, this is just 12 extra trips on Marton Road and 41 extra trips on Kexby Lane as a result of construction traffic in the peak hours. This results in a very low magnitude of change with respect to pedestrian delay at Marton Road and a medium magnitude of change at Kexby Lane, during the construction phase. The impact on pedestrian and cyclist amenity on road link receptors has been assessed as negligible and not significant. The impact of pedestrian and cyclist amenity on PROW has been assessed as negligible and not significant. A summary of the results (non-significant effects) is set out within PEI Report Volume 3: Appendix 13-C. A CTMP will be secured as part of the next stage of review, as part of the Environmental Statement. This will consider measures to manage construction traffic resulting from the Scheme at peak hours in order to limit any potential disruptions and implications on the wider transport network as well as for existing road users. Therefore, at this stage, there is forecast to be limited impact on pedestrian and cyclist facilities during construction. This will result in a potential health and wellbeing impact which is assessed to be neutral. During operation As it is confirmed that during the construction phase, access roads are not expected to cross any PROW links, these will not need to be re-opened	0 during construction 0 during operation 0 during decommission ing	During construction None proposed During operation None proposed During decommissioning None proposed



Assessment Criteria

Relevant to the Scheme?

Details and Evidence

Potential Health Impact Further Action or Mitigation Recommended

During decommissioning

During the decommissioning phase, the Scheme would be dismantled, and the infrastructure will be removed.

It is again expected that there will be similar implications on the PRoW links and pedestrian and cyclist facilities as in the construction period. The proposed access roads within the DCO site are not expected to cross any PRoW and there are not expected to be any temporary PRoW diversions or closures as a result of the Scheme.

A Framework DEMP will be secured as part of the ES, which will assess the impacts in further detail and propose relevant mitigation measures.

At this stage, the potential health and wellbeing impact during the decommissioning phase is assessed to be **neutral**.



14.12Summary of Effects

- 14.12.1 This assessment has followed the 'HUDU Rapid Health Impact Assessment Matrix' and has assessed the principal health benefits and disbenefits to residents of the local community, including:
 - a) Access to healthcare services and other social infrastructure- it is unlikely that there will be any severance between local residents and the healthcare facilities or other social infrastructure which they use during the construction, operation or decommissioning phase. This is because neither the additional construction/decommissioning traffic flow nor the traffic flow generated during the operational phase will exceed the future baseline traffic flows (without the Scheme). No road closures are anticipated at any point during the Scheme.
 - During construction, the impact on human health and wellbeing is assessed as: neutral
 - During operation, the impact on human health and wellbeing is assessed as: neutral
 - During decommissioning, the impact on human health and wellbeing is assessed as: neutral
 - b) Air quality, noise and neighbourhood amenity the assessment does not identify any significant negative impacts on the amenity of residents. Air particulate concentrations are forecast to remain low on account of the low background levels and good industry practice control measures, and noise levels from the construction and decommissioning phases are not anticipated to lead to any impacts on health or wellbeing. During construction, the impact on human health and wellbeing is assessed as: neutral
 - During operation, the impact on human health and wellbeing is assessed as neutral.
 - During de-commissioning, the impact on human health and wellbeing is assessed as: neutral
 - c) Accessibility and active travel- the proposed construction access roads within the DCO Site are not expected to cross any PRoW and so there are not expected to be any temporary PRoW diversions or closures as a result of the Scheme. This is projected to be similar during the decommissioning phase. As there are no closures during the construction phase, these links will not need to be reopened during the operational phase. The Scheme is therefore expected to result in a neutral health and wellbeing impact.
 - During construction, the impact on human health and wellbeing is assessed as: neutral
 - During operation, the impact on human health and wellbeing is assessed as: neutral



- During Commissioning, the impact on human health and wellbeing is assessed as: neutral
- d) Access to work and training- the construction phase of the Scheme will support 450 net jobs per annum, with 257 per annum being taken up by residents within 60 minutes of the DCO Site. The decommissioning phase is expected to support the same number of jobs and local jobs as the construction phase. During these periods, the Scheme is therefore expected to lead to a positive health and wellbeing impact on access to work and training. During the operation phase, the Scheme is assessed to have a positive impact as there is assessed to be provision of 4 jobs as a result of the Scheme.
- During construction, the impact on human health and wellbeing is assessed as: positive
- During operation, the impact on human health and wellbeing is assessed as: neutral
- During de-commissioning, the impact on human health and wellbeing is assessed as: positive
- e) Social cohesion and lifetime neighbourhoods the proposed construction access roads within the DCO site are not expected to cross any PRoW and so there are not expected to be any temporary PRoW diversions or closures as a result of the Scheme. This is projected to be similar during the decommissioning phase. As there are no closures during the construction phase, these links will not need to be reopened during the operational phase. The Scheme is therefore expected to result in a neutral health and wellbeing impact.
- During construction, the impact on human health and wellbeing is assessed as: neutral
- During operation, the impact on human health and wellbeing is assessed as: neutral
- During Commissioning, the impact on human health and wellbeing is assessed as: neutral

14.13Residual Effects and Conclusions

14.13.1 There are no residual effects identified related to human health and wellbeing. Non-significant effects are listed in **PEI Report Volume 3: Appendix 12-B**.

14.14Cumulative Assessment

- 14.14.1 This section presents an assessment of cumulative effects between the Scheme and other proposed and committed plans and projects including other developments.
- 14.14.2 This assessment has been made with reference to the methodology and guidance set out in **Chapter 5: EIA Methodology** of this PEI Report.



- 14.14.3 All cumulative Schemes and submitted applications listed in **Chapter 16: Cumulative Effects and Interactions** will generate additional effects (both positive and negative) on human health and wellbeing either in the Study Area or in the surrounding areas to the Study Area if they were to go ahead. It should also be noted that a further review of the cumulative effects will be undertaken at ES stage.
- 14.14.4 The assessment of 'Access to Healthcare Services and other Social Infrastructure' is inherently cumulative as the traffic data which the assessment is based on already includes the change in traffic generated by other cumulative developments. As presented in **Chapter 13: Transport and Access**, at this stage, it is proposed to consider the potential impact of the West Burton Solar Farm Project and the Cottam Solar Farm Project. The cumulative assessment will consider any other significant committed developments which are likely to overlap with the peak construction phase (2026) of the Scheme. A full cumulative assessment will be conducted at ES stage, but there are no major effects anticipated at this stage, based on the two schemes identified above.
- 14.14.5 The assessment of potential effects on 'Accessibility and Active Travel' considers both physical changes to pedestrian and cyclist infrastructure in the vicinity of the DCO Site as well as changes to the environment that these road users are exposed to. Cumulative effects on pedestrian and cyclists are difficult to quantify from a physical infrastructure perspective, however as there are no proposed changes to the PRoW within this scheme A full assessment of the cumulative effects from surrounding developments will be considered at ES stage.
- 14.14.6 For 'Access to Work and Training', **Chapter 12: Socio-economics and Land-Use** states that the construction phases of the Scheme and the other cumulative developments would both be expected to generate employment. In the absence of commercially sensitive information relating to the construction costs of each of the cumulative Schemes, it is not possible to make a quantitative assessment of the employment likely to be generated from the construction stage of the other development Schemes. It is expected that there would be a cumulative temporary minor beneficial effect on construction related employment within the local area. The impact on PRoW is also considered to be negligible.
- 14.14.7 During operation, there is predicted to be negligible effect on additional employment from the cumulative Schemes, as well as the effect on the PRoW. There is considered to be no effect on residential properties, business premises and community facilities.
- 14.14.8 Within **Chapter 15: 'Other Environmental Topics' (Air Quality**), it states that there are no anticipated cumulative effects on air quality as any cumulative schemes will also be mitigating for construction phase impacts on air quality; however, this will be further assessed in the ES.
- 14.14.9 **Chapter 11: Noise and Vibration** states that the cumulative Schemes are currently being agreed in consultation with Lincolnshire and Nottinghamshire County Council, and so the cumulative effects will be reviewed within the ES. Cumulative noise effects during construction and operation phases may occur when developments are within 500m of a common receptor. It is therefore not

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possible to definitely state the significance of cumulative impacts, however, based on an initial review, it is not expected that cumulative Schemes would elevate any of the residual effects identified. However, the cumulative effect of any cumulative schemes within 500m of the DCO Site will be reviewed as part of the ES.



14.15References

- Ref. 14-1 Department of Energy and Climate Change (2011); Overarching National Policy Statement for Energy (EN-1). Available at: 1938-overarching-nps-for-energy-en1.pdf (publishing.service.gov.uk)
- Ref. 14-2 Ministry of Housing, Communities and Local Government (2021); National Planning Policy Framework. Available at: National Planning Policy Framework (publishing.service.gov.uk)
- Ref. 14-3 NHS (2019); The NHS Long Term Plan. Available at: NHS Long Term Plan v1.2 August 2019
- Ref. 14-4 Public Health England (2017); Spatial Planning for Health: An evidence resource for planning and designing healthier place. Available at: Spatial Planning for Health: an evidence resource for planning and designing healthier places (publishing.service.gov.uk)
- Ref. 14-5 Planning Practice Guidance (2019); Guidance on promoting healthy and safe communities. Available at: Healthy and safe communities GOV.UK (www.gov.uk)
- Ref. 14-6 Central Lincolnshire Joint Strategic Planning Committee (2019); Central Lincolnshire Local Plan. Available at: Local Plan | Central Lincolnshire (n-kesteven.gov.uk)
- Ref. 14-7 Bassetlaw District Council (2011); Core Strategy and Development Management Policies.

 Available at: Core strategy and development policies | Bassetlaw District Council
- Ref. 14-8 Lincolnshire County Council (2018); Joint Health and Wellbeing Strategy and Lincolnshire. Available at: <u>Joint Health and Wellbeing Strategy for Lincolnshire</u>
- Ref. 14-9 Nottinghamshire County Council (2018); Nottinghamshire Health and Wellbeing Board: Joint Health and Wellbeing Strategy. Available at: the-joint-health-and-wellbeing-strategy-2018-2022.pdf (nottinghamshire.gov.uk)
- Ref. 14-10 Nottinghamshire Health and Wellbeing Board (2021); Nottinghamshire County Joint Strategic Needs Assessment: Evidence Summary 2021. Available at: <u>JSNA evidence summary (2021)</u> Nottinghamshire Insight
- Ref. 14-11 Nottinghamshire County Council (2019); Nottinghamshire Spatial Planning and Health Framework. Available at: notts-spatial-planning-health-framework.pdf (nottinghamshire.gov.uk)
- Ref. 14-12 Office for National Statistics (2011); 2011 Census. Available at: <u>2011 Census Office for National Statistics (ons.gov.uk)</u>
- Ref. 14-13 Office for National Statistics (2020); Mid-Year Population Estimates 2020. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/timeseries/ukpop/pop.
- Ref. 14-14 Office for National Statistics ONS (2021); Annual Population Survey (January 2020-December 2020). Available at:

 https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/mid2019estimates.
- Ref. 14-15 Ministry of Housing, Communities and Local Government (2019); English indices of deprivation 2019. Available at: English indices of deprivation 2019 GOV.UK (www.gov.uk)
- Ref. 14-16 Public Health England; Local Authority Heath Profiles. Available at: Local Authority Health Profiles OHID (phe.org.uk)
- Ref. 14-17 NHS London Healthy Urban Development Unit (HUDU) (2019); HUDU Planning for Health: Rapid Health Impact Assessment Tool. Available at: <u>HUDU Rapid HIA Tool October 2019</u> (healthyurbandevelopment.nhs.uk)
- Ref. 14-18 Wales Health Impact Assessment Support Unit (WHIASU); (2020) Health Impact Assessment (HIA) Overview. Available at: WHIASU HIA Overview.pdf (phwwhocc.co.uk)



15. Other Environmental Topics

15.1 Introduction

- 15.1.1 The purpose of this Preliminary Environmental Information (PEI) Report chapter is to present the assessment of environmental topics that do not warrant individual chapters. These topics are not scoped out of the environmental assessment; rather they are included within this single chapter either due to the brevity of the assessment or the limited nature of their impact.
- 15.1.2 This chapter describes and assesses the potential effects of the Scheme on:
 - Air Quality (Section 15.3);
 - Glint and Glare (Section 15.4);
 - Ground Conditions (Section 15.5);
 - Major Accidents and Disasters (Section 15.6);
 - Telecommunications, Television Reception and Utilities (Section 15.7);
 and
 - Waste (Section 15.8).

15.2 Development Parameters Assessed

- 15.2.1 **Chapter 2: The Scheme** presents a description of the Scheme, against which this chapter has been assessed. The assessment has been based on likely worst-case parameters using the Rochdale Envelope approach; the actual impact may therefore be less than anticipated if the Scheme is built to a lesser scale or differing design within the worst-case parameters.
- 15.2.2 Chapter 5: Environmental Impact Assessment (EIA) Methodology sets out the worst-case parameters. The peak construction year for the purpose of the EIA is anticipated to be 2026; this assumes commencement of construction in Q1 2025 and that the Scheme is built out rapidly over a 24 to 36 month period. 24 months is considered a worst case for most environmental aspects because it compresses the onsite activity into a shorter duration and represents the greatest impact. This is the case with respect to Air Quality; the other issues dealt with in this chapter are not expected to be influenced to the same extent by the construction duration.

15.3 Air Quality

Introduction

15.3.1 This section of the PEI Report provides a baseline report and presents the findings of an assessment of the likely significant effects from Air Quality as a result of the Scheme. Measures to address potential impacts and effects of the Scheme on Air Quality during construction, operation, and decommissioning phases are identified.



- 15.3.2 This section is supported by the following appendices:
 - Appendix 15-A Dust Risk Assessment; and
 - Appendix 15-B Air quality table of non-significant effects.

Consultation

15.3.3 A request for an EIA Scoping Opinion was sought from the Secretary of State through the Planning Inspectorate in 2021 as part of the EIA Scoping Process. Consultation responses in relation to Air Quality, to date, are presented in **PEI Report Volume 3: Appendix 1-C**.

Legislation and Planning Policy

15.3.4 Legislation, planning policy, and guidance relating to Air Quality, and pertinent to the Scheme, is presented below.

Legislation

UK Air Quality Strategy

15.3.5 The UK Air Quality Strategy (AQS) (Ref 15-1) identifies nine ambient air pollutants that have the potential to cause harm to human health and two for the protection of vegetation and ecosystems. The AQS defines objectives for these pollutants that aim to reduce the impacts of these pollutants to negligible levels. The objectives are not mandatory but rather targets that local authorities should try to achieve.

European Air Quality Directives

- 15.3.6 The UK is no longer a member of the European Union. EU legislation as it applied to the UK on 31 December 2020 is now a part of UK domestic legislation, under the control of the UK Parliament and devolved administrations.
- 15.3.7 The Clean Air for Europe (CAFE) programme consolidated and replaced (with the exception of the 4th Daughter Directive) preceding directives, through the Ambient Air Quality and Cleaner Air for Europe Directive 2008/50/EC (hereafter referred to as the 'EU Air Quality Framework Directive') (Ref 15-5). This directive is transcribed into legislation in England by the Air Quality Standards Regulations 2010 (the "2010 Regulations") which came into force on 11 June 2010 (Ref 15-3). The 2010 Regulations were amended by the Air Quality Standards (Amendment) Regulations 2016 (Ref 15-4), which came into force on 31 December 2016. The limit values defined therein are legally-binding and are considered to apply everywhere in England, with the exception of the carriageway and central reservation of roads (where the public do not normally have access), on factory premises or at industrial locations (subject to health and safety at work) and any locations where the public do not have access and there is no fixed habitation.
- 15.3.8 The 2010 Regulations (as amended) set legally binding limits for concentrations of certain air pollutants in outdoor air ("Limit Values"), with the aim of avoiding, preventing or reducing harmful effects on human health and on the environment as a whole. Where the concentrations exceed Limit



Values, the Secretary of State is required to develop an air quality plan that set out measures in order to attain compliance with the Limit Values. The Court of Justice of the European Union (CJEU) ruled in March 2021 that the UK has 'systematically and persistently' exceeded legal limits for nitrogen dioxide (NO₂) since 2010 (Ref 15-6).

- 15.3.9 For the purposes of this assessment, the pollutants considered are particulate matter (PM₁₀ and PM_{2.5}) and NO₂.
- 15.3.10 The UK's national air quality objective values for the pollutants of relevance to this assessment are summarised in Table 15.

Table 15-1 Key Air Quality Strategy Objectives

Pollutant	Objective	Averaging Period	Maximum Permitted Exceedances
Nitrogen Dioxide	200 μg/m³	1 hour	18 times per year (i.e. 99.79 th percentile)
(NO ₂)	40 μg/m ³	Annual	-
Particulate	40 μg/m ³	Annual	-
Matter (PM ₁₀)	50 μg/m³	24-hour	35 times per year (i.e. 90.4 th percentile)
Particulate Matter (PM _{2.5})	25 μg/m³	Annual	-

Assessment Assumptions and Limitations

15.3.11 This assessment is based on baseline environmental conditions and Scheme design information available at the time of writing this PEI Report. An updated assessment will be undertaken as part of the EIA and will be reported in the Environmental Statement (ES) that will be submitted with the DCO application.

Study Area

- 15.3.12 The study area includes features that may be at risk from direct and indirect impacts that might arise from the Scheme, termed the Zone of Influence (ZoI). The potential ZoI for Air Quality includes sensitive human receptors within 350m of the DCO Site; and within 50m of the roads expected to be used by the construction phase traffic, and up to 500m from the DCO Site access points, will be considered, following IAQM Guidance (Ref 15-8). The potential ZoI for ecological receptors is 50m from the boundary of the site; or 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s). The closest sensitive ecological receptor is Ashton's Meadow Site of Special Scientific Interest (SSSI), which is approximately 1.5km to the west from the DCO Site. As such, ecological impacts from air quality emissions are scoped out of the assessment, as there are no sensitive ecological receptors close enough to the DCO Site to have any risk of being affected by the Scheme.
- 15.3.13 The assessment relates to dust generation, and additional road traffic and plant emissions during the construction and decommissioning phases. The potential for operational impacts is also addressed.



15.3.14 The potential impact of the Scheme on local air quality will be determined at sensitive receptors (human) which have been identified in the vicinity of the DCO Site.

Assessment Methodology

- 15.3.15 There is currently no statutory guidance on the methodology for air quality impact assessments. Several non-statutory bodies have published their own guidance relating to air quality and development control, such as that by Environmental Protection UK and the Institute of Air Quality Management (IAQM) (Ref 15-7). This assessment has been undertaken based on this guidance. The IAQM is the professional body for air quality professionals. They act as the voice of air quality in the UK by producing useful and timely guidance on matters affecting air quality professionals and by responding to Government consultations. The mission of the IAQM is to be the authoritative voice for air quality by maintaining, enhancing and promoting the highest standards of working practices in the field and for the professional development of those who undertake this work.
- 15.3.16 This section details the methods used to assess the potential effects on air quality during the construction, operational and decommissioning phases of the Scheme.
- 15.3.17 The potential for fugitive emissions of particulate matter from construction and decommissioning-phase activities has been qualitatively assessed via a dust risk assessment (see **PEI Report Volume 3: Appendix 15-A**). At the time of writing this PEI Report, construction-phase road traffic volumes are not expected to meet thresholds above which detailed modelling is required (see paragraph 15.3.26). If details of the Scheme subsequently change, then, if required, road traffic emissions will be quantitatively assessed via a detailed dispersion modelling exercise as part of the EIA and reported within the ES.
- 15.3.18 As set out in the Scoping Report (see PEI Report Volume 3: Appendix 1-A) and agreed in the Scoping Opinion (see PEI Report Volume 3: Appendix 1-B), due to the nature of the Scheme, a significant change to traffic flows is not anticipated to occur once the Scheme is complete and operational and there are no other likely significant air quality impacts predicted during operation. A detailed assessment of emissions from operational road traffic and the subsequent impact upon local air quality is therefore not required and will not be considered further within this assessment.

Methodology for Assessment of Fugitive Emissions of Particulate Matter during Construction Phase

- 15.3.19 A qualitative risk-based assessment has been undertaken to assess the significance of any effects on sensitive receptors associated with the construction phase. The assessment is based on IAQM guidance (Ref 15-8) and considers potential sources of emissions on the basis of the four main activity groupings:
 - Demolition (not required in this assessment);
 - Earthworks:



- Construction; and
- Trackout.
- 15.3.20 The emphasis within the guidance is on clarifying the risk of dust impacts from the Scheme, which will allow mitigation measures commensurate with that risk to be identified.
- 15.3.21 For each activity group, the following steps are applied with respect to identifying the potential effects, before coming to an overall conclusion about the significance of the effects predicted.
 - Identify the nature, duration and the location of activities being undertaken;
 - Establish the risk of significant effects occurring as a result of these activities;
 - Review the proposed or embedded mitigation against good site practice;
 - Identify additional mitigation measures, if necessary, to reduce the risk of a significant adverse effect occurring at receptors; and
 - Summarise the overall effect of the works with respect to fugitive emissions of particulate matter and report the significance of the effects.
- 15.3.22 A Dust Risk Assessment (DRA) has been undertaken based on the IAQM Guidance (Ref 15-8) and the findings are presented within **PEI Report Volume 3: Appendix 15-A**. Construction of the Scheme will take place over a number of phases (not all potentially dusty activity taking place at the same time) and as such potential fugitive emissions may be lower than expected compared to the size of the DCO Site, when considering the DCO Site in reference to the IAQM Guidance (Ref 15-8).
- 15.3.23 Based on the information available at the time of completing this PEI Report, non-road mobile machinery (NRMM) emissions and construction phase road traffic emissions have been scoped out of the preliminary air quality assessment in accordance with the Scoping Opinion. If required, consideration will be given as part of the ES.

NRMM Emissions

- 15.3.24 Emissions from NRMM will have the potential to increase NO₂ and PM₁₀ concentrations locally when in use during construction. Experience of assessing the exhaust emissions from on-site plant and site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed (Ref 15-8).
- 15.3.25 Emissions from NRMM will be temporary and localised and will be controlled through best-practice mitigation measures such as ensuring all vehicles switch off engines when stationary i.e. no idling vehicles. For that reason, construction phase NRMM emissions should not be significant and, therefore, these emissions have not been modelled nor are required to be considered any further in this assessment.



Construction Phase Road Traffic Emissions

- 15.3.26 The construction phase of the Scheme is likely to lead to a small increase in the number of vehicles on the local highway network for the duration of the construction works (refer to **Chapter 13: Transport and Access**). IAQM (Ref 15-7) set out criteria to establish the need for an air quality assessment for the construction phase of a development as being a change of HGV) flows of more than 100 Above Average Daily Traffic (AADT) outside an Air Quality Management Area (AQMA).
- 15.3.27 At this PEI Report stage, it is anticipated that as a worst case during the construction period, there would be an average of 16 HGV deliveries (32 movements) per day. As this is a worst case, and would be distributed across the road network, detailed dispersion modelling is not proposed to be undertaken; however, should there be any changes to anticipated vehicle movements that subsequently trigger threshold levels, dispersion modelling will be undertaken as part of the EIA and reported in the ES in order to quantitatively determine the potential impacts on ambient pollutant concentrations within the study area.

Sources of Information

- 15.3.28 The following sources of information that define the Scheme have been reviewed and form the basis of the assessment of likely significant effects on air quality:
 - Indicative Site Layout Plan (see PEI Report Volume 3: Figure 2-4);
 - Review of Defra Air Quality Background Concentration Maps (Ref 15-10); and
 - Examination of Local Authority Review and Assessment Reports (Ref 15-11 and Ref 15-12).

Impact Assessment Methodology

- 15.3.29 Receptors of interest for the air quality assessment are those which represent locations where people are likely to be present as the assessment is most concerned with human health. The national air quality objective values for pollutants have been set at concentrations that provide protection to all members of society, including more vulnerable groups such as the very young, elderly or unwell. As such, the sensitivity of receptors has been accounted for in the definition of the air quality objective values and therefore all receptors that represent exposure of the public are of equal sensitivity as any member of the public could be present at those locations.
- 15.3.30 Receptors to be considered against the annual mean objective will include members of the public present in areas affected by regular exposure. This includes residential properties, schools, hospitals, care homes, etc. Receptors to be considered against the short-term objective include members of the public present in areas where the annual mean objective applies, but also areas with less regular exposure, such as any outdoor locations where the public might reasonably be expected to spend one hour or longer.



15.3.31 Sensitive receptors that have the potential to be affected by the Scheme have been considered for the construction phase. The methodology for determining sensitive receptors is described below.

Construction Phase Sensitive Receptors

- 15.3.32 For the purposes of the DRA, potentially affected air quality sensitive receptors have been identified for the assessment through a review of Ordnance Survey (OS) mapping and aerial photography.
- 15.3.33 Based upon guidance for qualitatively assessing the risk of dust impacts from demolition and construction (Ref 15-8), a number of high sensitivity residential properties are to be included with regards to construction phase dust soiling and PM₁₀ receptors.
- 15.3.34 The presence of sensitive ecological receptors holding a National or European designation within 50m of the DCO Site, or within 50m from a route used by construction vehicles on the public highway (up to 500m from the DCO Site access point) has also been established. Sites with the following designations have been explicitly considered within the DRA:
 - Sites of Special Scientific Interest (SSSI);
 - Special Protection Areas (SPA);
 - Special Areas of Conservation (SAC);
 - Ramsar Sites:
 - National Nature Reserves (NNR); and
 - Local Nature Reserves (LNR).
- 15.3.35 Sites possessing the following designations have also been reviewed; however, explicit consideration as part of the DRA is not required in accordance with the IAQM guidance (Ref 15-8).
 - Ancient Woodland (AW); and
 - Local Wildlife Sites (LWS).
- 15.3.36 Ammonia-emitting developments, such as intensive livestock and poultry units, in close proximity to AW sites can cause a greater abundance of nitrogen tolerant plant species which out-compete and impact on many characteristic ancient woodland plants. Ammonia can be released in small quantities from engine exhausts; however, because of the low numbers of construction traffic, the Scheme will not be a significant emitter of ammonia, and therefore this impact has been scoped out as significant effects are not anticipated.
- 15.3.37 For this Scheme, there are no ecological sites likely to be affected by the scheme due to their distance from the site, so the effect on ecological receptors is not significant (see **PEI Report Volume 3: Appendix 15-B** Air Quality non-significant effects table) with the embedded avoidance and mitigation below:
 - The Framework Construction Environmental Management Plan (CEMP) will detail and formalise the measures that will be implemented during



- construction of the Scheme to mitigate construction-related effects on biodiversity associated with dust deposition, air pollution, pollution incidents, water quality, light, noise and vibration.
- The design of the Scheme will comply with industry good practice and environmental protection legislation during both construction and operation e.g. prevention of surface and ground water pollution, fugitive dust management, noise prevention or amelioration. AW will be avoided with buffers of >20m during both construction and operation. Buffers will include either grassland or naturally regenerating scrub or woodland.
- 15.3.38 Designated ecological sites in the study area and the presence of sensitive species within these ecological sites is discussed in **Chapter 8: Ecology and Nature Conservation**.

Significance Criteria

- 15.3.39 When assessing the significance of dust impacts during the construction phase, the IAQM recommends that significance is only assigned to an effect after considering the construction activity with mitigation (Ref 15-8).
- 15.3.40 During the construction phase, it is expected that the aim is to prevent likely significant effects on receptors through the implementation of effective mitigation, thereby resulting in a residual effect that can be considered 'not significant'. Where this is not possible, it is important to consider the specific characteristics of the DCO Site and the surrounding area to determine whether construction-phase dust impacts are likely to be significant in the context of the Scheme (Ref 15-8).

Baseline Conditions

15.3.41 This section describes the baseline environmental characteristics for the Scheme and surrounding areas with specific reference to Air Quality.

Existing Baseline

- 15.3.42 West Lindsey District Council (WLDC) undertakes routine ongoing monitoring of ambient air quality monitoring as part of their Local Air Quality Management (LAQM) at 12 locations in the District.
- 15.3.43 There are no Air Quality Management Areas declared in WLDC. Concentrations of NO₂ and PM₁₀ are considered to be very good across the District, which is rural with no large conurbations.
- 15.3.44 All existing NO₂ diffusion tube monitoring sites operated by WLDC recorded concentrations below the relevant annual mean objective value of 40 micrograms per cubic metre (μg/m³) since monitoring began. Monitoring locations are in Gainsborough and Market Rasen. There are none in Gate Burton or otherwise near the DCO Site

Background Pollutant Concentrations

15.3.45 The total concentration of a pollutant comprises those contributions from explicit local emission sources such as roads, chimney-stacks, etc, and those that are transported into an area from indeterminate sources by wind from further away. If all the explicit local sources were removed, all that would



remain is that which comes from indeterminate sources; it is this component that is called 'background'. A good understanding of background concentrations is important when completing air quality assessments as it allows for a better understanding of local pollutant sources.

15.3.46 Background data for the relevant 1km x 1km grid squares (related to the study area) was sourced from Defra's 2018-based Background Maps for the assessment year of 2026; this data is presented in Table 15-2. It is noted that the projections in the 2018 LAQM background maps are based on assumptions which were current before the Covid-19 pandemic in the UK. In consequence these maps do not reflect short or long-term impacts on emissions in 2020 and beyond resulting from behavioural change during the national or local lockdowns (Ref 15-9). The pandemic has been shown to have reduced pollutant concentrations during the lockdowns, but the long-term impact is highly uncertain, as it is unknown how many people will continue to work from home. The pandemic may also affect the assumptions made in the background maps about future fleet breakdown, as a financial downturn may result in fewer new cars being purchased. However, at present the published maps are the best estimate of future conditions available.

Table 15-2 Background Pollutant Concentrations 2026, µg/m³

X coordinate	Y coordinate	NO ₂	PM ₁₀	PM _{2.5}
482500	383500	6.2	14.8	7.9
481500	382500	6.3	14.7	7.9
481500	381500	6.4	15.0	8.0
481500	380500	6.8	15.0	8.0
482500	380500	6.8	14.8	8.0
480500	379500	6.6	15.0	8.0
480500	378500	6.5	15.1	8.1
484500	384500	6.2	14.8	7.9
483500	383500	6.4	15.0	8.0
484500	383500	6.2	14.8	7.9
485500	383500	6.3	14.9	7.9
486500	383500	6.2	14.9	7.9
484500	382500	6.3	14.9	7.9
484500	381500	6.5	14.9	8.0
483500	380500	6.5	15.1	8.0
	MAX	6.8	15.1	8.1
	MIN	6.2	14.7	7.9
	MEAN	6.4	14.9	8.0



Baseline Dust Climate

- 15.3.47 A background level of dust exists in all urban and rural locations in the UK. Dust can be generated on a local scale from vehicle movements and from the action of wind on exposed soils and surfaces. Dust levels can be affected by long range transport of dust from distant sources into the local vicinity.
- 15.3.48 This baseline rate of soiling is considered normal and varies dependent on prevailing climatic conditions. The tolerance of individuals to deposited dust is therefore shaped by their experience of baseline conditions.
- 15.3.49 Existing local sources of particulate matter includes wind-blown dust from exhaust emissions from energy plant and road vehicles, brake and tyre wear from road vehicles and the long-range transport of material from outside the study area.

Future Baseline

- 15.3.50 The future baseline scenarios are set out in **Chapter 5: EIA Methodology**.
- 15.3.51 In the absence of the Scheme, traffic flows on the surrounding highway network would be expected to increase as a result of housing and employment growth. Therefore, projected background traffic growth has been applied to the traffic flows derived from the traffic surveys (March/ April 2022) to represent conditions during the future baseline (and construction peak assessment year) of 2026. Considering the predicted background concentrations for 2026 presented in Table 15-2, are lower than current backgrounds, the air quality across the study area is anticipated to remain largely unchanged from baseline conditions. We do not anticipate the introduction of new receptors and resources in the area and are not aware of other new developments that may have a potential change to the baseline.

Potential Impacts

- 15.3.52 Mitigation measures being incorporated in the design and construction of the proposed Scheme are set out below. Prior to the implementation of the mitigation, the proposed Scheme has the potential to affect sensitive receptors (positively or negatively), during construction, and during decommissioning, in the following ways:
 - Dust deposition and subsequent soiling of surfaces;
 - Visible dust plumes; and
 - Elevated PM₁₀ concentrations as a result of dust generating activities on-site.

Mitigation Measures

15.3.53 The adoption of good site practice will be implemented through measures to control dust as outlined within the IAQM's 'Guidance on the assessment of Dust from Demolition and Construction' document that are commensurate with the level of risk identified in the assessment and the construction phase activities (Ref 15-8).



15.3.54 The mitigation measures to be incorporated into the Framework CEMP, which will be submitted alongside the ES) for the Scheme are summarised in Table 15-3 and Table 15-4 based on any mitigation that is 'highly recommended' in the IAQM dust guidance.



Table 15-3 Mitigation

Category	Activity	Mitigation Measure	
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Additional

Communications Develop and implement a stakeholder communications plan that includes community engagement before work commences on-site

> Display the name and contact details of person(s) accountable for air quality and dust issues on the DCO Site. This may be the environment manager/engineer or the site manager.

Display the head or regional office contact information

Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site. The DMP may need to include monitoring of dust deposition, dust flux, real-time PM₁₀ continuous monitoring and/or visual inspections. This will be confirmed at EIA stage.

Site Management

Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.

Make the complaints log available to the local authority when asked

Record any exceptional incidents that cause dust and/or air emissions, either on-site or offsite, and the action taken to resolve the situation in the logbook.

Hold regular liaison meetings with other high-risk construction sites within 500m of the DCO Site (if applicable), to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes.

Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked

Increase the frequency of site inspections by the person accountable for air quality and dust issues on-site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.

Agree dust deposition, dust flux, or real-time PM₁₀ continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on-site or, if it a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.



Category	Activity	Mitigation Measure
	Preparing and	Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
	Maintaining the Site	Erect solid screens or barriers around dusty activities that are at least as high as any stockpiles on-site where stockpiles (if required) are within 100m of receptors.
		Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period where operations are within 100m of receptors.
		Avoid site runoff of water or mud.
		Keep site fencing, barriers and scaffolding clean using wet methods.
		Remove materials that have a potential to produce dust from the DCO Site as soon as possible, unless being re-used on-site. If they are being re-used on-site cover as described below.
		Cover, seed or fence stockpiles to prevent wind whipping.
	Operating Vehicles / Machinery and Sustainable Travel*	Ensure all vehicles switch off engines when stationary - no idling vehicles.
		Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable.
		Impose and signpost a maximum-speed-limit of 15mph on surfaced and 10mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate)
		Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials
		Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and carsharing)
	Operations	Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g.: suitable local exhaust ventilation systems.
		Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate



Category Activity		Mitigation Measure		
		Ensure equipment is readily available on-site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.		
	Waste Management	Avoid bonfires and burning of waste materials.		



Table 15-4 Activity-Specific Mitigation Measures

Activity	Mitigation Measure
	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable
Earthworks	Use Hessian, mulches or tackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable
	Only remove the cover in small areas during work and not all at once
Construction	Avoid scabbling (roughening of concrete surfaces) if possible
	Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
	Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
	For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.
	Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.
	Avoid dry sweeping of large areas.
	Ensure vehicles entering and leaving site are covered to prevent escape of materials during transport
	Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
	Record all inspections of haul routes and any subsequent action in a site logbook.
Trackout	Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
	Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).
	Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
	Access gates to be located at least 10m from receptors where possible.



Assessment of Likely impacts and effects

- 15.3.55 Taking into account the mitigation measures as detailed in the Mitigation section above (Paragraph 15.3.54), the potential for the Scheme to generate effects was assessed using the methodology as detailed in Paragraph 15.3.29 of this section.
- 15.3.56 Dust generation during construction and decommissioning will be short-term and temporary and is not anticipated to induce significant effects on local air quality providing the adequate implementation of mitigation measures as outlined in the section titled 'Mitigation Measures'. Air quality impacts during the construction and decommissioning phases are therefore expected to be negligible. Effects of this magnitude are not considered to be significant (see **PEI Report Volume 3: Appendix 15-B**).
- 15.3.57 Potential impacts on local air quality arising during the operation of the Scheme are considered to be negligible. Effects of this magnitude are not considered to be significant (see **PEI Report Volume 3: Appendix 15-B**).

Dust Risk Assessment

- 15.3.58 The DRA considers the potential dust emissions magnitude at each stage of the works in conjunction with the sensitivity of the surrounding area. Based on the magnitude and sensitivity parameters, the site will be classified as low, medium or high risk, and mitigation measures corresponding to the perceived level of risk can then be proposed. The DRA is provided in **PEI Report Volume 3: Appendix 15-A**.
- 15.3.59 The assessment considers the potential dust risk across a set of pre-defined zones, up to 350m from the DCO Site. These zones are presented in **PEI Report Volume 2**: **Figure 15-1**: Dust Risk Assessment Zones.

Demolition

15.3.60 The development of the DCO Site will not require any demolition, and there are no residential, community or commercial receptors within the DCO Site that will require relocation. Demolition phase impacts have therefore been scoped out of the DRA and will not be considered further.

Earthworks

- 15.3.61 The Scheme area is approximately 1,436 ha (including the Grid Connection Route).
- 15.3.62 The preparation of the DCO Site for construction activities will include localised site levelling (where required, for example for the onsite substation and BESS); construction of the internal access roads; establishment of the perimeter fence; location mark-up for Scheme infrastructure; and import of construction materials, plant and equipment.
- 15.3.63 Due to the size of the DCO Site, and the anticipation of there being more than ten heavy earth-moving vehicles active on-site at any one time, the potential dust emissions magnitude associated with earthworks is considered to be large.



- 15.3.64 The sensitivity of the area to dust soiling during the ground-enabling and earthworks phase is high due to the presence of between 10 to 100 sensitive receptors within 20m of the DCO Site. The DCO Site has consequently been determined to pose a high risk of dust soiling.
- 15.3.65 The sensitivity of the area is low for human health impacts due to low background particulate matter concentrations, and the presence of 10-100 sensitive receptors within 20m of the DCO Site. Therefore, the risk of dust impact for earthworks activities is classified as a low risk to human health.
- 15.3.66 Sensitivity of ecological sites within the study area to dust-related impacts is low due to their distance to the DCO Site, and therefore a low risk to ecology has been predicted.

Construction

- 15.3.67 Dust generation during the construction phase is anticipated to occur for the duration of the works.
- 15.3.68 Trenching will be undertaken to allow for the installation of electric cabling. Piling is understood to be required on-site for the erection of module mounting structures, with foundations to a depth of 2m below ground.
- 15.3.69 The sensitivity of the area to dust soiling during the construction phase is high due to the proximity of sensitive receptors, therefore, the risk of dust impact for construction activities is classified as high risk to dust soiling.
- 15.3.70 The sensitivity of the area is low for human health impacts due to low background particulate matter concentrations (<24 µg/m³). Therefore, the risk of dust impact for construction activities is classified as posing a low risk to human health.
- 15.3.71 Sensitivity of ecological sites within the study area to dust-related impacts is low due to their distance to the DCO Site, and therefore a low risk to ecology has been predicted.

Trackout

- 15.3.72 There are anticipated to be a maximum of 60 HGV movements per day during the peak construction phase (refer to **Chapter 13: Transport and Access**), which is below the AADT criteria for detailed assessment of ambient air quality impacts.
- 15.3.73 Considering the size of the DCO Site in conjunction with the anticipated HGV movements, the potential dust emissions magnitude for the trackout of materials is considered to be large.
- 15.3.74 The sensitivity of the area to dust soiling is high due to the presence of highsensitivity receptors within 50m of the DCO Site, and within 50m of the routes used by construction traffic, up to 500m from the DCO Site access point.
- 15.3.75 Due to low background particulate matter concentrations, the sensitivity of the area to impacts on human health is considered to be low.



15.3.76 Sensitivity of ecological sites within the study area to dust-related impacts is low due to their distance to the DCO Site, and therefore a low risk to ecology has been predicted as a result of trackout of materials.

Summary

15.3.77 A summary of the magnitude of emissions, sensitivity of receptor and the significance of effect is provided in Table 15-5, Table 15-6, and Table 15-7.

Table 15-5 Summary of Potential Dust Emission Magnitudes for Construction Phase Activities

Activity	Potential Dust Emission Magnitude
Demolition	N/A
Earthworks	Large
Construction	Large
Trackout	Large

Table 15-6 Summary of Area Sensitivity to Construction Phase Activities

Activity Sensitivity of the Surrounding			ng Area		
	Demolition	Earthworks	Construction	Trackout	
Dust Soiling	N/A	High	High	High	
Human Health (PM10 effects)	N/A	Low	Low	Low	
Ecology	N/A	Low	Low	Low	

Table 15-7 Summary of Risk of Dust Effects for Construction Phase Activities (Without Mitigation)

Activity	Summary of Dust Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	N/A	High	High	High
Human Health (PM ₁₀ effects)	N/A	Low	Low	Low
Ecology	N/A	Low	Low	Low

- 15.3.78 The IAQM Guidance (Ref 15-8) recommends that mitigation measures be commensurate to the highest risk category identified during the DRA. The Site is therefore classified as 'High-Risk', and mitigation measures for a high-risk site will therefore be proposed for implementation as set out in Table 15-3 and Table 15-4.
- 15.3.79 The implementation of mitigation is expected to prevent the occurrence of significant impacts arising from dust generation during the construction phase. Residual effects are therefore not expected to be significant.

Operation (2028)

15.3.80 During the operational phase, the Scheme will be manned by a nominal amount of people across the DCO Site (maximum of 14 FTE staff per day), predominantly undertaking maintenance tasks. In addition, a maximum of



three to four visitors per week (equating to one visitor per day) are assessed for the purpose of deliveries, and replacement of any components that fail. Staff vehicles and those used for maintenance will primarily be four wheeled drive vehicles and vans, with HGVs rarely accessing the site during this phase. The operation of the Scheme is therefore not anticipated to have a significant impact on local air quality.

Decommissioning (2088)

- 15.3.81 Decommissioning is assumed to generate similar effects to those anticipated during the construction phase, and therefore the mitigation measures proposed for implementation during the construction phase will be appropriate for application to decommissioning. A Framework Decommissioning Environmental Management Plan (DEMP) will be prepared for the Scheme.
- 15.3.82 Removal of equipment and reinstatement of ground is anticipated to span a duration of 24-48 months. Impacts on local air quality as a result of dust generation are expected to be confined to this timeframe, and therefore be short-term and temporary. Effects are not considered to be significant assuming the appropriate mitigation measures are implemented.

Residual Effects and Conclusions

- 15.3.83 This section summarises the residual significant effects of the Scheme on Air Quality following the implementation of mitigation.
- 15.3.84 The DRA (**PEI Report Volume 3: Appendix 15-A**) has concluded that, in the absence of mitigation, the construction phase of the Scheme will likely pose a high risk of adverse effects. Following the implementation of the Framework CEMP, which will incorporate the mitigation measures outlined above, the effect on ecology, dust deposition, and human health is not anticipated to be significant. It is anticipated that the residual effects will be at worst minor adverse (not significant).
- 15.3.85 Given the relatively good air quality conditions at the DCO Site and surrounding area, in addition to the below-threshold traffic generation, it is not expected that the additional road traffic will lead to any exceedances of the national air quality strategy objectives. The effect is expected to be negligible and no worse than minor adverse.

Cumulative Effects

15.3.86 No cumulative impacts upon the air quality are envisaged at this point as any cumulative schemes will also be mitigating for construction phase impacts on air quality; however, this will be further assessed in the ES.

15.4 Glint and Glare

Introduction

- 15.4.1 This section summarises the potential effects of the Scheme on glint and glare for surrounding receptors. The definition of glint and glare for the purposes of this assessment is the effect of reflected sunlight causing harm or discomfort to a sensitive receptor. A glint is further defined as the momentary receipt of a bright light and a glare as the receipt of a bright light over an extended or continuous period of time (Ref 15-21).
- 15.4.2 This PEI Report assumes a PV table angle of between 5 and 45 degrees, with various heights across the DCO Site. Throughout and following statutory consultation, the design may be altered slightly and the parameters for the PV Arrays refined to respond to stakeholder comments. Any amendments to the design parameters will be presented in the ES upon finalisation of the Scheme for the DCO Application.

Consultation

- 15.4.3 A request for an EIA Scoping Opinion was sought from the Secretary of State through the Planning Inspectorate in 2021 as part of the EIA Scoping Process. Consultation responses in relation to Glint and Glare, to date, are presented in **PEI Report Volume 3: Appendix 1-C**.
- 15.4.4 The glint and glare assessment will be provided within the ES. The assessment will include sections on methodology, assessment of potential effects and any required mitigation measures. At this stage it is not expected that there would be any significant effects from glint and glare. This is because, if glint and glare effects are identified as the design progresses, they can be relatively easily mitigated through a number of measures including adjusting the position of panels, removing panels, or vegetation planting to remove the line of site and risk of glint and glare. It is therefore anticipated that glint and glare effects will not be significant on local road users, the Sheffield to Lincoln railway line, aviation receptors, public rights of way or at residential dwellings.

Legislation and Planning Policy

15.4.5 UK national Planning Practice Guidance dictates that in some instances, a glint and glare assessment is required; however, there is no specific guidance with respect to the methodology for assessing the impact of glint and glare. Planning Practice Guidance from the Department for Communities and Local Government emphasises the need to consider the landscape effects as well as neighbouring uses and aircraft safety with regard to glint and glare assessments.



15.5 Ground Conditions

Phase 1 Preliminary Risk Assessment

- 15.5.1 A Phase 1 Preliminary Risk Assessment (PRA) is equivalent to a Stage 1 Tier 1 level of assessment, as defined by the Environment Agency's Land Contamination Risk Management (LC:RM) (2020) guidance. The objective of the PRA is to identify and evaluate potential land quality risks and development constraints associated with the Scheme and to construct an initial conceptual site model that can be used to inform future decision making and the design of future ground investigation which may be required. A Phase 1 PRA report has been prepared, covering land within the Solar and Energy Storage Park boundary, and is available in the **PEI Report Volume 3: Appendix 15-C**. As part of the ES, the Phase 1 PRA will be updated to include the Grid Connection Route.
- 15.5.2 The Phase 1 PRA includes the following:
 - Details of land within the Solar and Energy Storage Park Boundary and surrounding land including development history, geology, hydrogeology, hydrology, soil and groundwater quality and environmental setting;
 - A review of the environmental data in an Envirocheck Report;
 - Details of land designated for Mineral Safeguarding;
 - Details of any available site investigation reports for land within the DCO Site;
 - Details from a site walkover from publicly accessible locations documenting:
 - The existing layout, current operations and condition of land within the DCO Site, the property boundaries and immediately surrounding land;
 - A visual inspection of any potential indicators of any land contamination, for example, spillages, disturbed ground; and;
 - The visual inspection of any geohazards or ground conditions constraints.
 - An initial Conceptual Model (CM) and an evaluation of potential contamination linkages; and
 - Conclusions and recommendations based on the findings.

Consultation

15.5.3 A request for an EIA Scoping Opinion was sought from the Secretary of State through the Planning Inspectorate in 2021 as part of the EIA Scoping Process. Consultation responses in relation to Ground Conditions, to date, are presented in **PEI Report Volume 3: Appendix 1-C**.

Preliminary Risk Assessment Findings

15.5.4 The principle of risk assessment for land contamination is outlined in the Statutory Guidance to Part 2A (2012) and LC:RM (Ref 15-23). The risk



assessment process for environmental contaminants is based on a source-pathway-receptor analysis. These terms can be defined as follows:

- Source: hazardous substance that has the potential to cause adverse impacts;
- **Pathway**: route whereby a hazardous substance may come into contact with the receptor: examples include ingestion of contaminated soil and leaching of contaminants from soil into watercourses; and
- Receptor: target that may be affected by contamination: examples include human occupants/ users of site, water resources (surface waters or groundwater), or structures.
- 15.5.5 For a risk to be present, there must be a relevant/viable contaminant linkage; i.e. a mechanism whereby a source impacts on a sensitive receptor via a pathway.
- 15.5.6 The following sources, pathways and receptors have been identified in Table 15-8.

Table 15-8 Source, Pathways and Receptors.

Sources	Pathway	Receptor
S1: On site - Agricultural land and associated facilities	P1: Direct contact, dermal absorption or ingestion of soil / water.	R1: Human Health (Future users)
S2: On site - Railway and sidings	P2: Inhalation of soil particulates or soil vapour derived from soils.	R2: Human Health (off site – commercial/residential properties)
S3: On site - Potentially infilled land associated with historic quarries and pits	P3: Migration of hazardous gases/vapours via permeable	R3: Water Environment: Superficial Aquifers
S4: On site - Potential Made Ground associated	strata into confined spaces (asphyxiation/explosion)	R4: Water Environment: Surface waters
with utilities infrastructure (Antennae, drainage, roadways)	P4: Spillage/loss/run off from surface direct to receiving water	R5: Water Environment: Bedrock Aquifers
S5 – Off site Agricultural land and associated facilities	P5: Lateral migration of impacted shallow groundwater towards surface water receptors.	R6: Buildings & Infrastructure: Concrete foundations associated with buildings, solar PV, utilities
Railway and sidings Potentially infilled land associated with historic quarries and pits Potential Made Ground	P6: Leaching of chemicals and vertical migration via permeable unsaturated strata to shallow and/ or deep groundwater	services.
associated with utilities (gas) infrastructure Former Sewage works Former Brick Yard	P7: Vertical migration of impacted shallow groundwater to the deeper aquifer.	
	P8: Direct contact of buried concrete with contaminated soils (i.e. hydrocarbons) and	



Sources	Pathway	Receptor	
	aggressive ground co (pH and sulphate).	aggressive ground conditions (pH and sulphate).	
	P9: Direct contact of sand supply pipes with contaminated soils.		
	P10: Migration of hazardous gases/vapours via permeable strata into enclosed spaces and service/utility trenches		

- 15.5.7 Using criteria broadly based on those presented in the National House Building Council/Environment Agency/Chartered Institute of Environmental Health publication R&D 66 (NHBC/EA/CIEH, 2008), the magnitude of the risk associated with potential contamination at the Site was assessed. To do this an estimate was made of:
 - The magnitude of the potential consequence (i.e. severity); and
 - The magnitude of probability (i.e. likelihood).
- 15.5.8 The classifications of severity and likelihood and the risk rating based on the comparison severity and likelihood are presented in the Phase 1 PRA report.
- 15.5.9 The key findings of the risk assessment are detailed below. Full details outlining all the source-pathway-receptor linkages for all of the sources, pathways and receptors detailed above are provided in the Phase 1 PRA report.
- 15.5.10 Given the proposed Scheme, the likely low levels of contamination anticipated from the sources identified or isolated sources identified together with the nature of the likely exposure (transient, infrequent) to existing human health receptors and future users of the Solar and Energy Storage Park (maintenance workers), the risk to human health is considered to be low.
- 15.5.11 Risks to controlled waters has been identified to be low to moderate/low based on the Phase 1 PRA. The severity has been assessed to be "mild". This is because of the presence of numerous on site drains as receptors. These may also provide potential pathways to the River Till and River Trent and due to the lack of protection to the underlying aquifers, the likelihood an event could occur has to be deemed as "likely".
- 15.5.12 However, despite the moderate/low rating, under LC:RM the risk to human health and controlled waters is considered acceptable. Therefore, the Scheme is not considered to pose an unacceptable risk to human health or the environment either during construction, during operation or decommissioning.
- 15.5.13 During construction the proposed development works will be undertaken in compliance with Construction Design and Management (CDM) 2015 regulations. Mitigation to prevent surface runoff, discharge into watercourses and dust generation will form part of the construction phase obligations and requirements.



15.5.14 The Phase 1 PRA detailed recommendation for limited intrusive investigation to confirm the findings of the assessment which may be included as part of any geotechnical scope of works.



15.6 Major Accidents and Disasters

Introduction

- 15.6.1 This section provides a description of the potential effects of the Scheme on the environment deriving from the vulnerability of the development to risks of major accidents and/or disasters which are relevant to the project.
- 15.6.2 "Accidents" are an occurrence resulting from uncontrolled developments in the course of construction, operation and decommissioning (e.g. a major emission, fire or explosion).
- 15.6.3 "Disasters" are naturally occurring extreme weather events or ground related hazard events (e.g. subsidence, landslide, earthquake).

Legislation and Planning Policy

- 15.6.4 The EIA Regulations (Ref 15-19) require consideration to be given to the risks of major accidents and disasters.
- 15.6.5 The IEMA guidance document 'Major Accidents and Disasters in EIA' (Ref 15-13) has been taken into account in the assessment of major accidents or disasters.

Consultation

15.6.6 A request for an EIA Scoping Opinion was sought from the Secretary of State through the Planning Inspectorate in 2021 as part of the EIA Scoping Process. Consultation responses in relation to Major Accidents and Disasters, to date, are presented in **PEI Report Volume 3: Appendix 1-C**

Assessment Methodology

- 15.6.7 The following methodology has been adopted to assess major accidents or disasters; in general, major accidents or disasters, as they relate to the Scheme, fall into three categories:
 - Events that could not realistically occur, due to the nature of the Scheme or its location;
 - Events that could realistically occur, but for which the Scheme, and associated receptors, are no more vulnerable than any other development; and
 - Events that could occur, and to which the Scheme is particularly vulnerable, or which the Scheme has a particular capacity to exacerbate.
- 15.6.8 An exercise was undertaken to identify all possible major accidents or disasters that could be relevant to the Scheme. This list was drawn from several sources, including the UK Government's National Risk Register 2020 (Ref 15-14). Major accidents or disasters with little relevance in the UK were not included, such as volcanic eruptions.
- 15.6.9 The long list was screened to form a shortlist of events to be taken forward for further consideration. The shortlist of events and the list of relevant chapters



and assessments in which they have been scoped in to are summarised in Table 15-9 below.

- 15.6.10 Although the majority of the major accidents or disasters on the long list are already considered under other legislative or design requirements, this is not considered to be sufficient reason to automatically eliminate the major accident or disaster from any further consideration. This is consistent with the approach for other topics, for example that the need to comply with nature conservation legislation does not mean that ecology and nature conservation do not need to be considered in EIA. However, where it is concluded that the need for compliance is so fundamental, and the risk of any receptors being affected differently so remote, major accidents or disasters on the long list are not included on the shortlist.
- 15.6.11 Likewise, it is considered reasonable and proportionate to exclude certain receptor groups from the outset. Construction workers, as a receptor, can be excluded from the assessment, because existing legal protection is considered to be sufficient to minimise any risk from major accidents or disasters to a reasonable level. Legislation in force to ensure the protection of workers in the workplace includes:
 - Health and Safety at Work etc. Act 1974 (Ref 15-15);
 - The Management of Health and Safety at Work Regulations 1999 (Ref 15-16);
 - The Workplace (Health, Safety and Welfare) Regulations 1992 (Ref 15-17); and
 - Construction (Design and Management) (CDM) 2015 Regulations (Ref 15-18).

Table 15-9-Major accidents or disasters shortlisted for further consideration

Major Accident or Disaster	Potential Receptor	Comments
Floods	Property and people in areas of increased flood risk.	Both the vulnerability of the DCO Site to flooding, and the potential for the Scheme to exacerbate flooding, are covered in Chapter 9: Water Environment are covered in the Flood Risk Assessment (FRA) (PEI Report Volume 3: Appendix 9-C) and will be included in the ES.
Fire	Local residents, habitats and species	If there is a malfunction to one of the battery storage containers, there is a range of integrated controls that will activate depending on the extent and severity of the event. In case the malfunction progresses to a catastrophic fire event and so long as there are no lives under threat, the fire brigade would ensure surrounding elements and structures (intact battery arrays nearby, other electrical equipment, trees etc.) are kept adequately wet and cool to prevent the fire from expanding any further but the battery infrastructure may be allowed to burn within the controlled area. The battery safety



Major Accident or Disaster	Potential Receptor	Comments
		management plan will be prepared and will be secured via the DCO.
Road accidents	Aquatic environment Road users	An assessment of accidents and safety will be undertaken as part of the Chapter 13: Transport and Access in the ES, following the completion of the Transport Assessment. With regard to Hazardous and Dangerous Loads, the analysis of the road network within the study area indicates that there are no particular features, such as a significant vertical drop immediately beyond the carriageway, which would suggest that the transfer of materials poses a particular risk beyond that which would be expected on the general highway network. It is concluded that no further assessment on hazardous loads is required in the ES Chapter 13: Transport and Access). The risk posed by chemical spillage during construction or decommissioning will be
		considered in the Water Environment chapter of the ES (Chapter 9: Water Environment). At this stage it is not expected that there would be any significant effects from glint and glare, and if there were, these can be relatively easily mitigated through temporary hoarding and vegetation planting or removing panels, which then removes the line of site and risk of glint and glare. It is therefore anticipated that glint and glare effects will be negligible on sensitive receptors. The potential for glint and glare to affect road users will be reviewed in the ES and if they cannot be mitigated will be considered within a technical appendix to the ES. The Scheme design would be adapted wherever possible to reduce effects.
Rail accidents	Rail users	The Sheffield to Lincoln rail line passes through the centre of the Site. At this stage it is not expected that there would be any significant effects from glint and glare, and if there were, these can be relatively easily mitigated through adjusting panel positions, removing panels, or vegetation planting which removes the line of site and risk of glint and glare. However, the potential for glint and glare to affect trains will be considered within a technical appendix to the ES. Mitigation will be considered and, where necessary, incorporated into the Scheme design.
Aircraft disasters	Pilots and aircraft	The potential for glint and glare to affect trains and aircraft will be reviewed in the ES considered in the technical appendix covering glint and glare to the ES (see Section 15.4 above). Mitigation will be considered and,



Major Accident or Disaster	Potential Receptor	Comments
		where necessary, incorporated into the Scheme design.
Flood Defence Failure	Employees	The Scheme design at the PEI stage indicates development and solar PV panels will avoid areas of high flood risk; therefore, flood risk is not like to be increased to the development or elsewhere. This will be covered in the Flood Risk Assessment and will also be reported in the ES, both in terms of the risk to the Scheme and increased risk caused by the Scheme.
Utilities failure (gas, electricity, water, sewage, oil, communications)	Employees and local residents	The Scheme has the potential to affect existing utility infrastructure above and below ground. To identify any existing infrastructure constraints, both consultation and a desk based study will be undertaken prior to construction. It is known that there are overhead electricity lines located within the DCO Site.
Plant disease	Habitats and species	New planting may be susceptible to biosecurity issues, such as the increased prevalence of pests and diseases, due to climate change. The planting design will take account of biosecurity risks through a wider mix of species including some non-natives.

15.6.12 By their very nature, major accidents and disasters have the potential to lead to moderate or major adverse effects, irrespective of the Scheme. Therefore, the focus is on prevention and response planning to reduce any additional risk or effect of this happening which may arise as a result of the Scheme. This exercise is underway and on-going through design development and consultation with relevant statutory consultees. However, at this stage, it is not expected that there is a significant risk of major accidents and disasters during construction, operation or decommissioning as a result of the Scheme.



15.7 Telecommunications, Television Reception and Utilities

Introduction

15.7.1 This section summaries the effects of the Scheme on telecommunication, infrastructure, television reception and existing utilities.

Legislation and Planning Policy

15.7.2 Effects relating to existing infrastructure are not environmental effects and there is no requirement to include an assessment of these effects under the EIA Regulations (Ref 15-19). However, given the nature of solar park developments, they have the potential to affect existing utility infrastructure above and below ground.

Consultation

15.7.3 A request for an EIA Scoping Opinion was sought from the Secretary of State through the Planning Inspectorate in 2021 as part of the EIA Scoping Process. Consultation responses in relation to Telecommunications, Television Reception and Utilities, to date, are presented in **PEI Report Volume 3: Appendix 1-C**.

Assessment Methodology

15.7.4 To identify any existing infrastructure constraints, both consultation and a desk-based study will be undertaken. Consultation with relevant telecommunication and utilities providers is a routine part of solar development. Consultees include water, gas and electricity utilities providers and telecommunications providers. Telecommunications and television providers are unlikely to be affected by Electromagnetic Interference (EMI) unless transmitters are near electrical infrastructure associated with the solar PV array (Ref 15-20). A desk-based search will be undertaken for the presence of telecommunications, television reception and utilities infrastructure within the DCO Site and within the vicinity. A qualitative approach undertaken by competent experts is used to assess the likelihood of significant effects on telecommunications, television reception and utilities.

Assessment of Effects

Telecommunications

15.7.5 The Scheme is unlikely to interfere with telecommunications infrastructure and therefore no effects are anticipated in the construction, operation and decommissioning phases.

Television Reception

15.7.6 The Scheme consists of fixed low-lying infrastructure and is therefore unlikely to interfere with digital television signals and therefore no effects are anticipated in the construction, operation and decommissioning phases.



Utilities

- 15.7.7 The potential exists for utilities to be affected during the construction of the Scheme through damage caused as a result of excavation and engineering operations. Without any precautionary measures to avoid damage to utilities, this could lead to a short-term adverse effect. With precautionary measures, it is not expected for there to be any adverse effects.
- 15.7.8 Precautionary measures will be included as part of the embedded mitigation for the Scheme, which will include locating the Scheme outside of utilities protected zones; the use of ground penetrating radar before excavation to identify any unknown utilities; and consultation and agreement of construction/demobilisation methods prior to works commencing. These measures, along with those listed within the Framework CEMP, would reduce the likelihood of effects on utilities during construction. Therefore, no adverse effects are expected during construction.
- 15.7.9 The decommissioning phase would require below ground works to remove the grid connection cables; however, works would be undertaken within the footprint excavated during construction. Additionally, the embedded mitigation measures used during construction would also apply during decommissioning. Therefore, no adverse effects are predicted during decommissioning.
- 15.7.10 No effects on utilities are predicted as a result of the operational phase of the Scheme because no below-ground works will be required during operation.

Mitigation Measures

15.7.11 The risk of damage to utilities during construction would be minimised through embedded mitigation, which would involve those measures listed above and mapping infrastructure that crosses the Scheme and avoiding it through the design. The draft DCO will include protective provisions for the protection of electronic communication networks and utilities, and engagement with relevant statutory undertakers in this respect is ongoing. No further mitigation would be required.

Cumulative Assessment

15.7.12 The Scheme has been assessed to have no effect on telecommunication, television, or utilities. It is expected that the other solar developments included within the cumulative schemes shortlist would also have no effect on telecommunications and television reception and would adhere to the same mitigation as set out above to reduce the risk of damaging utilities. All developments will be managed through a CEMP and would include mitigation measures to reduce the risk of damaging utilities during construction. Therefore, no cumulative effects are expected on telecommunications, television reception, or utilities.



15.8 Waste

Introduction

- 15.8.1 This section discusses the expected waste streams from the Scheme and how they will be managed.
- 15.8.2 The legal definition of waste is "any substance or object which the holder discards or intends or is required to discard" (Ref 15-22). The legal definition of waste covers substances or objects, which fall outside of the commercial cycle or out of the chain facility. In particular, most items that are sold or taken off site for recycling are wastes, as they require treatment before they are reused or resold.
- 15.8.3 In practical terms, wastes include surplus spoil, scrap, recovered spills, unwanted surplus materials, packaging, office waste, wastewater, broken, worn-out, contaminated or otherwise spoiled plant, equipment, and materials.

Assessment of Effects

Construction

- 15.8.4 The type of waste generated during construction is likely to comprise:
 - General waste from site offices and welfare facilities;
 - Small quantities of waste from the maintenance of construction vehicles;
 - Packaging waste from incoming materials; and
 - Other waste from construction of fencing, access roads and other supporting infrastructure.
- 15.8.5 The PV modules, racks, inverters and other supporting equipment will be manufactured off-site to the specified sizes, and wastage during installation is expected to be minimal.
- 15.8.6 Large-scale earthworks are not expected, and therefore there is not expected to be either a surplus or shortfall of fill material requiring either export or import.
- 15.8.7 A Site Waste Management Plan (SWMP) will be prepared as part of the Framework CEMP, which will set out:
 - The waste streams that will be generated;
 - How the waste hierarchy will be applied to these wastes;
 - Good practice measures for managing waste; and
 - Roles and responsibilities for waste management.
- 15.8.8 All management of waste will be in accordance with the relevant regulations and waste will be transported by licensed waste hauliers to waste management sites which hold the necessary regulatory authorisation and/or permits for those wastes consigned to them.
- 15.8.9 Considering the above, it is concluded that significant waste impacts are not expected during construction.



Operation

- 15.8.10 During operation there are expected to be up to 14 FTE staff.
- 15.8.11 Waste arisings from this day to day operation would include:
 - Welfare facility waste; and
 - General waste (paper, cardboard, wood etc).
- 15.8.12 Waste arisings from these activities are expected to be minimal and as they would be considered to be commercial waste this will be managed by appropriately permitted carriers and facilities in line with the appropriate environmental permits and requirements. It is therefore not anticipated to result in a significant impact. Details of how waste during operation will be dealt with will be provided in the Framework OEMP, which will accompany the DCO Application.
- 15.8.13 During the anticipated 60-year operational life of the Scheme, it is expected that there will be requirement for periodic replacement of some or all of the Solar and Storage Energy Park elements, which could generate an additional waste stream. As such, the ES will include an assessment of the likely impact of component replacement (e.g. panels, batteries, inverters, transformers) and outline what measures will be put in place to ensure that these components are able to be diverted from the waste chain.

15.8.14 The ES will:

- identify relevant policy and assessment criteria;
- estimate the amount of waste that would be generated during operation;
- estimate how the waste will be managed, having regard to both current and future local waste management facilities;
- carry out an assessment of operational waste management against these criteria.

Decommissioning

15.8.15 At the end of the Scheme's operational life, it will be decommissioned. The effects of decommissioning are usually like or of a lesser magnitude than the construction effects. A Framework Decommissioning Environmental Management Plan (DEMP) will be prepared as part of the EIA, that will set out the general principles to be followed in the Detailed Decommissioning Plan that will be prepared prior to decommissioning occurring.



15.9 References

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16. Cumulative Effects and Interactions

16.1 Introduction

- 16.1.1 This chapter addresses the potential for effect interactions and cumulative effects. These effects result from incremental changes caused by other past, present and reasonably foreseeable plans and projects together (i.e. cumulatively) with the Scheme.
- 16.1.2 For this assessment, two types of effect are considered:
 - Effect Interactions the combined effect of individual impacts from the Scheme, which have been identified as part of the assessments reported within Chapters 6 to 15 of this Preliminary Environmental Information (PEI) Report, that are considered likely to result in a new or different likely significant effect, or an effect of greater significance, than any one of the impacts on their own. This can happen during construction for example, if a receptor is subjected to noise, dust, and visual impacts associated with site works; and
 - Cumulative Effects where there is the potential for two or more developments that are reasonably foreseeable and / or consented, but not yet forming part of the baseline environment, within close enough proximity to the Scheme to lead to cumulative effects on the same receptor. Where possible, Chapters 6 to 15 of this PEI Report provide high-level conclusions in regard to where there are likely to be cumulative effects. However, given the assessments for these types of effect are undertaken towards the end of the EIA process, and when data relating to other developments in the vicinity is available, it is not possible to identify likely significant effects with confidence at this stage.

16.2 Consultation

- 16.2.1 A request for an EIA Scoping Opinion was sought from the Secretary of State through the Planning Inspectorate in 2021 as part of the EIA Scoping Process. Consultation responses in relation to Cumulative Effects and Interactions, to date, are presented in **PEI Report Volume 3: Appendix 1-C**.
- 16.2.2 A list of cumulative developments has been prepared and is currently being discussed with Lincolnshire and Nottinghamshire County Council.

16.3 Legislative Context

16.3.1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (Ref 15-1) make explicit reference to the requirement for an assessment of the effect interactions between types of effect, and states that the EIA should contain:



- 16.3.2 "The EIA must identify, describe and assess in an appropriate manner, in light of each individual case, the direct and indirect significant effects of the proposed development on the following factors-
 - ...(e) the interaction between the factors referred to in sub-paragraphs (a) to (d)."
- 16.3.3 No further guidance or requirement beyond the need for the requirement for an assessment of the interrelationships between types of effect is provided.
- 16.3.4 Schedule 4 Part 5 of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 requires an ES to include:
- 16.3.5 "A description of the likely significant effects of the development on the environment resulting from, inter alia:
 - ...(e) the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources...

The description of the likely significant effects on the factors specified in regulation 5(2) should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development".

16.4 Assessment Methodology

Effect Interactions

16.4.1 The assessment of effect interactions is based on the methodology described in **Chapter 5**: **EIA Methodology** of this PEI Report and considers the potential for several direct or indirect effects arising from the Scheme to give rise to an effect on a single receptor. There are no specific, relevant guidelines on how the assessment of effect interactions should be undertaken, and so the assessment will be undertaken on a qualitative basis using the results of the individual assessments, informed by professional judgement.

Cumulative Effects

- 16.4.2 The cumulative effects assessment methodology is based on methodology described in **Chapter 5**: **EIA Methodology** which is based on The Planning Inspectorate's Advice Note 17 (Ref 16-3) on the assessment of cumulative effects which identifies a four-stage approach, which has been adopted for this assessment, as follows:
 - a. Stage 1 establish the study area and identify a long list of 'other development' (the 'development schedule');
 - b. Stage 2 identify a shortlist of 'other development' for the cumulative impact assessment;
 - c. Stage 3 information gathering; and
 - d. Stage 4 assessment.



16.5 Assessment

Effect Interactions

- 16.5.1 The combined effects of different environmental impacts from the proposed scheme on a single receptor are determined when the environmental assessments for the separate environmental topics have been completed, and as such this data is not available at this stage.
- 16.5.2 There is potential for both adverse and beneficial effect interactions associated with the proposed Scheme, for example, combined noise and visual impacts on receptors in close proximity during the construction phase. The likelihood of effect interactions resulting significant effects will be reported in the ES, following completion of the individual environmental topic assessments.

Cumulative Effects

- 16.5.3 The assessment of cumulative effects arising from the Scheme in combination with other proposed Schemes (inter-project effects) is based upon a review of current submitted planning applications as well as a study of planning policy documents.
- 16.5.4 The cumulative study for the proposed scheme is currently at Stage 1 and is focussed on the identification of relevant developments and land allocations within the Zone of Influence (ZoI) which have the potential to generate significant cumulative effects. A preliminary longlist of cumulative developments has been prepared and is currently being discussed with the relevant Local Planning Authorities. The final longlist, along with inclusionary criteria will be presented within the ES.

Study Area

16.5.5 Table 16-1 sets out the ZoI for potential cumulative impacts with other developments and has been defined by each environmental topic. These individual ZoIs have subsequently been combined to define an overall ZoI representing the search area within which other development has been identified, as shown on PEI Report Volume 2: Figure 16-1 Maximum Zone of Influence for Cumulative Developments. PEI Report Volume 2: Figure 16-2 Zone of Influence for PEI Report Chapters shows the ZoI for each environmental topic.

Table 16-1 Zol extents for assessment of potential cumulative impacts

Environmental Topic	Zone of Influence (ZoI)
Climate Change	Construction: 5km Operation: 5km
Cultural Heritage	Construction: 5km Operation: 1km
Ecology and Nature Conservation	Construction: 2km Operation:2km



Environmental Topic	Zone of Influence (ZoI)		
Water Environment	Construction & Operation: 1km ¹		
Landscape and Visual Amenity	Construction: 8km Operation: 8km		
Noise and Vibration	Construction: 500m Operation: 1km		
Socio-economics and Land Use	Construction: 10km Operation: 10km		
Transport and Access	Construction: See PEI Report Volume 2: Figure 13.1. Operation: N/A		
Health and Wellbeing	Construction: 5 wards – Rampton and Sturton in Bassetlaw District, Lea, Stow and Torksey in West Lindsey District		
	Operation: 5 wards – Rampton and Sturton in Bassetlaw District, Lea, Stow and Torksey in West Lindsey District		
Glint and Glare	Land: 1km Air: 10km		

- 16.5.6 Based on a review of the initial long list of developments and allocations, a number of developments are currently considered to have potential to generate cumulative impacts with the proposed Scheme based on their temporal scope, location and/or scale and nature, including:
 - West Burton Solar Project;
 - Cottam Solar Project; and
 - Cottam Power Station Priority Regeneration Area.
- 16.5.7 PEI Report **Chapters 6** to **14** include preliminary consideration of cumulative effects with the West Burton and the Cottam Solar Projects given their proximity to the DCO site. The consideration is based on the West Burton and Cottam Scoping Reports and publicly available information available on the project websites. At this stage, potential cumulative significant effects are identified within the Landscape and Visual assessment (refer to PEI Report **Chapter 10 Landscape and Visual**). These effects will be subject to further assessment and reporting within the Environmental Statement.
- 16.5.8 It should be noted that the long list is subject to ongoing review and update, and thus further developments may be scoped into the assessment and considered as part of the Environmental Statement.

¹ As water effects propagate downstream and flood risk can affect upstream receptors, a wider study area based on professional judgement has also been applied where relevant. The River Trent is considered the final receiving waterbody that could conceivably be affected.



Next Steps

- 16.5.9 The initial long-list will be further refined, aided by consultation with the relevant local planning authorities, to ensure that all developments with the potential to result in potentially significant cumulative effects when considered together with the proposed Scheme are taken into account by each of the environmental topic specialists.
- 16.5.10 At Stage 2, any developments not having potential to result in likely significant cumulative effects will be excluded, following review and consideration by the environmental topic specialists.
- 16.5.11 Stage 3 will involve the collation of information relating to the short-listed schemes, including the design and location, programme for construction, operation and demolition, and any environmental assessments carried out.
- 16.5.12 Stage 4 will involve the assessment and identification of potentially significant cumulative effects in combination with the proposed scheme.
- 16.5.13 The ES will report the results of the assessment with particular consideration given to any significant cumulative effects that are identified, and the need for mitigation. These effects will be reported within individual topic chapters as relevant with full details of Stages 1-4, including the final development schedule, reported within an ES appendix and summarised within a cumulative effects and interactions chapter.



16.6 References

- Ref 16-1 Her Majesty's Stationary Office (HMSO) (2017) The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.
- Ref 16-2 Directive 2011/92/EU of the European Parliament and of the Council (2011) on the assessment of the effects of certain public and private projects on the environment.
- Ref 16-3 The Planning Inspectorate (2015), Advice note seventeen: Cumulative effects assessment relevant to nationally significant infrastructure projects.



17. Summary of Significant Environmental Effects

17.1 Introduction

- 17.1.1 This chapter of this Preliminary Environmental (PEI) Report summarises the significant residual effects of the Scheme. Residual effects are defined as those effects that remain following the implementation of mitigation measures. Residual effects and mitigation measures are discussed in full in the relevant technical chapters in **PEI Report Volume 1: Chapters 6 15**.
- 17.1.2 Each technical chapter contains detailed consideration of both the beneficial and adverse residual effects identified as likely to arise from the Scheme. The criteria applied to define the significance of residual effects are defined within **Chapter 5: EIA Methodology**, with further detail provided within the individual technical chapters. Where technical chapters have deviated from this standard methodology, this is explained in the respective chapters and justification for the reason provided (for example to align with industry-standard guidance for that discipline).
- 17.1.3 The Environmental Impact Assessment (EIA) for the Scheme has been undertaken in parallel with the design process and development of the embedded and additional mitigation identified within **Chapters 6 to 15**. A number of measures have been implemented within the design of the Scheme to reduce adverse environmental effects. These are illustrated on **PEI Report Volume 2**, **Figure 2-4**: **Indicative Site Layout Plan**.
- 17.1.4 The residual effects listed within the technical chapters (**Chapters 6 to 15**) of this PEI Report are described with reference to the scale of effect (i.e. moderate or major) and whether this is significant or not, and the nature of the effect (i.e. adverse, negligible or beneficial).

17.2 Summary of Significant Effects

- 17.2.1 A summary of the identified significant residual effects for each topic are presented in Table 17-1 for the construction phase, Table 17-2 for the operational phase, and Table 17-3 for decommissioning. Negligible and minor (adverse and beneficial) effects (i.e. not considered significant effects) are included within an appendix for each technical chapter (**PEI Report Volume 3: Chapters 6-15**).
- 17.2.2 The conclusions are based on preliminary information and may be revised for the ES for the DCO Application in light of further baseline information or in response to design changes and consultation feedback. In some cases, the assessment is necessarily conservative at this stage and may therefore overestimate the impact and identify significant effects where none may occur. The information presented below reflects a preliminary point in time and thus the assessment findings are subject to change and confirmation.



Table 17-1 Summary of significant residual effects during the construction phase of the Scheme

Description of resource / receptor and effect	Sensitivity (Value)	Description of Impact	Residual Effect
6. Climate Change		•	-
No significant residual effects	on climate change are pi	redicted during the construction of the Scheme.	
7. Cultural Heritage			
Heynings Priory Scheduled Monument (1008685)	High	Change to setting through introduction of panels and infrastructure in the fields surrounding the asset	Major Adverse Significant (temporary)
Gate Burton non-designated parkland (MLI98360)	Medium	Change to setting through introduction of panels and infrastructure in the fields surrounding the asset.	Moderate Adverse Significant (temporary)
Cropmarks of possible prehistoric date (MLI54017, MLI90939 and MLI54018)	Medium	Potential for complete loss	Moderate Adverse Significant (temporary)
Medieval settlement of Gate Burton (MLI50512)	Medium	Potential for loss of a section of the asset.	Moderate Adverse Significant (temporary)
Area of cropmark (MNT4983)	Medium	Potential for loss of a section of the asset.	Moderate Adverse Significant (temporary)
Earthwork mound (MLI52497)	Medium	Potential for complete loss	Moderate Adverse Significant (temporary)



Description of resource / receptor and effect	Sensitivity (Value)	Description of Impact	Residual Effect
Torksey Viking Camp (MLI125067)	High	Potential for loss of part of the asset.	Moderate Adverse Significant (temporary)
8. Ecology and Nature Conservation			
Temporary loss of habitat within Cow Pasture Lane Drains LWS	Medium	Temporary loss of habitat Temporary fragmentation of habitat	Moderate Adverse Significant (temporary)
Running Water	Medium	Temporary loss of habitat Temporary fragmentation of habitat	Moderate Adverse Significant (temporary)
Marshy Grassland	Low	Permanent loss of habitat	Moderate Adverse Significant (permanent)
Hedgerows	Medium	Temporary loss of habitat	Moderate Adverse Significant (temporary)
9. Water Environment			
No significant residual effect	s on water environment ar	e predicted during the construction of the Scheme.	
10. Landscape and Visual	Amenity		
Landscape Receptors (Cor	nstruction)		
LLCA 01 – Gate Burton Estate	Medium	Partial alteration to the Local Landscape Character Area (LLCA)	Moderate Adverse Significant (temporary)



Description of resource / receptor and effect	Sensitivity (Value)	Description of Impact	Residual Effect
LLCA 02 – Ancient Woodland Plateau	Medium	Large alteration to the LLCA	Major Adverse Significant (temporary)
LLCA 03 – Northern Trent Ridge	Low	No direct impact to the LLCA, potential indirect impacts	Moderate Adverse Significant (temporary)
LLCA 04 – Gainsborough Fringe	Medium	No direct impact to the LLCA, potential indirect impacts	Moderate Adverse Significant (temporary)
LLCA 05 – Somerby & Knaith Woodlands	Medium	Partial alteration to the LLCA	Moderate – Major Adverse Significant (temporary)
LLCA 06 – Clay Farmlands	Medium	Large alteration to the LLCA	Major Adverse Significant (temporary)
LLCA 07 – Stow Fringe	Low	No direct impact to the LLCA, potential indirect impacts	Moderate Adverse Significant (temporary)
LLCA 08 – High Wood Plateau	Medium	Partial alteration to the LLCA	Moderate Adverse Significant (temporary)
LLCA 09 – Trent Valley South	Medium	Partial alteration to the LLCA	Moderate Adverse Significant (temporary)
LLCA 10 – Cottam Plateau	Low	Partial alteration to the LLCA	Moderate Adverse Significant (temporary)



Description of resource / receptor and effect	Sensitivity (Value)	Description of Impact	Residual Effect
LLCA 11 – Rampton Fringe & Hawk Hills	Medium	Partial alteration to the LLCA	Moderate Adverse Significant (temporary)
LLCA 12 – West Burton Valley	Low	No direct impact to the LLCA, potential indirect impacts	Moderate Adverse Significant (temporary)
LLCA 13 – Mid-Trent Valley	Low	Partial alteration to the LLCA	Moderate Adverse Significant (temporary)
Visual Receptors (Construc	tion)		
Commercial users of farmland (Viewpoint 1)	Medium	Pronounced change to the composition of the view	Major Adverse Significant (temporary)
Commercial users of farmland (Viewpoint 2)	Medium	Pronounced change to the composition of the view	Major Adverse Significant (temporary)
Vehicle users along Clay Lane (Viewpoint 3)	Medium-High	Pronounced change to the composition of the view	Major Adverse Significant (temporary)
Vehicle users along Willingham Road (Viewpoint 4)	Medium	Pronounced change to the composition of the view	Major Adverse Significant (temporary)
Vehicle users along A1500 / Stow Park Road (Viewpoint 5)	Medium	Noticeable change to the composition of the view	Moderate Adverse Significant (temporary)



Description of resource / receptor and effect	Sensitivity (Value)	Description of Impact	Residual Effect
Residents and vehicle users Manor Farm Stow (Viewpoint 6)	Medium	Noticeable change to the composition of the view	Moderate Adverse Significant (temporary)
Recreational users and vehicle users along Marton Road (Viewpoint 8)	Medium	Noticeable change to the composition of the view	Major Adverse Significant (temporary)
Recreational user, residents and vehicle users along Marton Road, Willingham by Stow (Viewpoint 9)	Medium	Noticeable change to the composition of the view	Moderate Adverse Significant (temporary)
Vehicle users and residents along B1241 / Kexby Lane (Viewpoint 10)	High	Pronounced change to the composition of the view	Major Adverse Significant (temporary)
Vehicle users, residents along B1241 / Kexby Lane at eastern entry to Knaith Park (Viewpoint 11)	Medium	Noticeable change to the composition of the view	Moderate Adverse Significant (temporary)
Vehicle users and recreational users along Station Road west of Knaith Park (Viewpoint 12)	Medium-High	Pronounced change to the composition of the view	Major Adverse Significant (temporary)
Residents of Gate Burton estate (Viewpoint 15)	Medium-High	Pronounced change to the composition of the view	Major Adverse Significant (temporary)
Vehicle users of Clay Lane south of Gate Burton estate (Viewpoint 16)	Low-Medium	Noticeable change to the composition of the view	Moderate Adverse Significant (temporary)



Description of resource / receptor and effect	Sensitivity (Value)	Description of Impact	Residual Effect
Vehicle users and residents along Marton Road (Viewpoint 17)	Low-Medium	Pronounced change to the composition of the view	Major Adverse Significant (temporary)
Vehicle users along Marton Road (Viewpoint 18)	Low-Medium	Pronounced change to the composition of the view	Moderate-Major Adverse Significant (temporary)
Vehicle users and residents along the B1241 / Gainsborough Road (Viewpoint 19)	Medium	Noticeable change to the composition of the view	Moderate Adverse Significant (temporary)
11. Noise and Vibration			
No significant residual effects	on noise and vibration ar	e predicted during the construction of the Scheme.	
12. Socio Economics and L	and Use		
Local economy – GVA generation	Medium	It is estimated that construction will contribute approximately £7.7 million to the national economy, of which £4.4 million would likely be within the study area	Moderate beneficial Significant (temporary)
13. Transport and Access			
No significant residual effects	on transport and access	are predicted during the construction of the Scheme.	
14. Human Health and Welli	being		
No significant residual effects	on human health and we	Ilbeing are predicted during the construction of the Scheme.	

No significant residual effects on air quality; glint and glare; ground conditions, major accidents and disasters; telecommunications, television reception and utilities; and waste are expected during the construction phase.

15. Other Environmental Topics



Table 17-2 Summary of significant residual effects during operation of the Scheme

escription of resource / receptor Sensitivity Descrip		Description of Impact	Residual Effect
6. Climate Change			
No significant residual effects on Clin	nate Change ar	e predicted during the operation of the Scheme.	
7. Cultural Heritage	•		
Heynings Priory Scheduled Monument (1008685)	High	Change to setting through introduction of panels and infrastructure in the fields surrounding the asset.	Major adverse Significant (temporary)
Gate Burton non-designated parkland (MLI98360)	Medium	Change to setting through introduction of panels and infrastructure in the fields surrounding the asset. Severance of historic connection with Burton Wood.	Moderate adverse Significant (temporary)
8. Ecology and Nature Conservation			
No significant residual effects on eco	logy and nature	conservation are predicted during the operation of the Scheme.	
9. Water Environment			
No significant residual effects on wat	er environment	are predicted during the operation of the Scheme.	
10. Landscape and Visual Amenity	,		
Landscape Receptors			
LLCA 01 – Gate Burton Estate	Medium	Partial alteration to the LLCA	Minor – Moderate Adverse – Year 15 Significant
LLCA 02 – Ancient Woodland Plateau	Medium	Large alteration to the LLCA	Major Adverse – Year 15 Significant
LLCA 03 – Northern Trent Ridge	CA 03 – Northern Trent Ridge Low No direct impact to the LLCA, potential indirect impacts Moderate Ad		Moderate Adverse – Year 15

Significant



Description of resource / receptor and effect Sensitivity (Value)		Description of Impact	Residual Effect	
LLCA 04 – Gainsborough Fringe	Medium	No direct impact to the LLCA, potential indirect impacts	Minor – Moderate Adverse – Year 15 Significant	
LLCA 05 – Somerby & Knaith Woodlands	Medium	Partial alteration to the LLCA	Moderate – Major Adverse - Year 15 Significant	
LLCA 06 – Clay Farmlands	Medium	Large alteration to the LLCA	Major Adverse – Year 15 Significant	
LLCA 07 – Stow Fringe	Low	No direct impact to the LLCA, potential indirect impacts	Moderate Adverse – Year 15 Significant	
LLCA 08 – High Wood Plateau	Medium	Partial alteration to the LLCA	Moderate Adverse – Year 15 Significant	
LLCA 09 – Trent Valley South	Medium	Partial alteration to the LLCA	Moderate Adverse – Year 15 Significant	
LLCA 10 – Cottam Plateau	Low	Partial alteration to the LLCA	Minor – Moderate Adverse – Year 15 Significant	
LLCA 11 – Rampton Fringe & Hawk Hills	Medium	Partial alteration to the LLCA	Minor – Moderate Adverse – Year 15 Significant	
LLCA 12 – West Burton Valley	Low	No direct impact to the LLCA, potential indirect impacts	Minor – Moderate Adverse – Year 15 Significant	
LLCA 13 – Mid-Trent Valley	Low	Partial alteration to the LLCA	Minor – Moderate Adverse – Year 15 Significant	



Description of resource / receptor and effect	Sensitivity (Value)	Description of Impact	Residual Effect
Visual Receptors			
Commercial users of farmland (Viewpoint 1)	Medium	Pronounced change to the composition of the view	Moderate-Major Adverse – Year 15 Significant
Commercial users of farmland (Viewpoint 2)	Medium	Pronounced change to the composition of the view	Major Adverse – Year 15 Significant
Vehicle users along Clay Lane (Viewpoint 3)	Medium-High	Pronounced change to the composition of the view	Moderate Adverse – Year 15 Significant
Recreational users and vehicle users along Marton Road (Viewpoint 8)	Medium	Noticeable change to the composition of the view	Moderate Adverse – Year 15 Significant
Residents of Gate Burton estate (Viewpoint 15)	Medium-High	Pronounced change to the composition of the view	Moderate Adverse – Year 15 Significant
Vehicle users and residents along Marton Road (Viewpoint 17)	Low-Medium	Pronounced change to the composition of the view	Moderate Adverse – Year 15 Significant
Vehicle users along Marton Road (Viewpoint 18)	Low-Medium	Pronounced change to the composition of the view	Moderate Adverse – Year 15 Significant
11. Noise and Vibration			

12. Socio-Economics and Land Use

No significant residual effects on socio-economics and land use are predicted during the operation of the Scheme.

13. Transport and Access

No significant residual effects on transport and access are predicted during the operation of the Scheme.



Description of resource / receptor Sensitivity Description of Impact Residual Effect and effect (Value)

14. Human Health and Wellbeing

No significant residual effects on human health and wellbeing are predicted during the operation of the Scheme.

15. Other Environmental Topics

No significant residual effects on air quality; glint and glare; ground conditions, major accidents and disasters; telecommunications; television reception and utilities; and waste are predicted during the operation of the Scheme.



Table 17-3 Summary of significant residual effects during decommissioning of the Scheme

Description of resource / Sensitivity (Value) Description of Impact Residual Effect receptor and effect

6. Climate Change

No significant residual effects on climate change are predicted during the decommissioning of the Scheme.

7. Cultural Heritage

No significant residual effects on cultural heritage are predicted during the decommissioning of the Scheme.

8. Ecology and Nature

Conservation

No significant residual effects on ecology and nature conservation are predicted during the decommissioning of the Scheme.

9. Water Environment

No significant residual effects on water environment are predicted during the decommissioning of the Scheme.

10. Landscape and Visual Amenity

Landscape Receptors (Decommissioning)

LLCA 01 – Gate Burton Estate	Medium	Partial alteration to the LLCA	Moderate Adverse Significant (temporary)
LLCA 02 – Ancient Woodland Plateau	Medium	Large alteration to the LLCA	Major Adverse Significant (temporary)
LLCA 03 – Northern Trent Ridge	Low	No direct impact to the LLCA, potential indirect impacts	Moderate Adverse Significant (temporary)
LLCA 04 – Gainsborough Fringe	Medium	No direct impact to the LLCA, potential indirect impacts	Moderate Adverse



Description of resource / receptor and effect	Sensitivity (Value)	Description of Impact	Residual Effect	
			Significant (temporary)	
LLCA 05 – Somerby & Knaith Woodlands	Medium	Partial alteration to the LLCA	Moderate - Major Adverse Significant (temporary)	
LLCA 06 – Clay Farmlands	Medium	Large alteration to the LLCA	Major Adverse Significant (temporary)	
LLCA 07 – Stow Fringe	Low	No direct impact to the LLCA, potential indirect impacts	Moderate Adverse Significant (temporary)	
LLCA 08 – High Wood Plateau	Medium	Partial alteration to the LLCA	Moderate Adverse Significant (temporary)	
LLCA 09 – Trent Valley South	Medium	Partial alteration to the LLCA	Moderate Adverse Significant (temporary)	
LLCA 10 – Cottam Plateau	Low	Partial alteration to the LLCA	Moderate Adverse Significant (temporary)	
LLCA 11 – Rampton Fringe & Hawk Hills	Medium	Partial alteration to the LLCA	Moderate Adverse Significant (temporary)	
LLCA 12 – West Burton Valley	Low	No direct impact to the LLCA, potential indirect impacts	Moderate Adverse Significant (temporary)	



Description of resource / receptor and effect	Sensitivity (Value)	Description of Impact	Residual Effect
LLCA 13 – Mid-Trent Valley	Low	Partial alteration to the LLCA	Moderate Adverse Significant (temporary)
Visual Receptors - Decommiss	sioning		
Commercial users of farmland (Viewpoint 1)	Medium	Pronounced change to the composition of the view	Moderate-Major Adverse Significant (temporary)
Commercial users of farmland (Viewpoint 2)	Medium	Pronounced change to the composition of the view	Major Adverse Significant (temporary)
Vehicle users along Clay Lane (Viewpoint 3)	Medium-High	Pronounced change to the composition of the view	Major Adverse Significant (temporary)
Vehicle users along A1500 / Stow Park Road (Viewpoint 5)	Medium	Noticeable change to the composition of the view	Moderate Adverse Significant (temporary)
Residents and vehicle users Manor Farm Stow (Viewpoint 6)	Medium	Noticeable change to the composition of the view	Moderate Significant (temporary)
Recreational users and vehicle users along Marton Road (Viewpoint 8)	Medium	Noticeable change to the composition of the view	Moderate-Major Adverse Significant (temporary)



Description of resource / receptor and effect	Sensitivity (Value)	Description of Impact	Residual Effect
Vehicle users and residents along B1241 / Kexby Lane (Viewpoint 10)	High	Pronounced change to the composition of the view	Moderate Adverse Significant (temporary)
Vehicle users, residents along B1241 / Kexby Lane at eastern entry to Knaith Park (Viewpoint 11)	Medium	Noticeable change to the composition of the view	Moderate Adverse Significant (temporary)
Residents of Gate Burton estate (Viewpoint 15)	Medium-High	Pronounced change to the composition of the view	Moderate-Major Adverse Significant (temporary)
Vehicle users and residents along Marton Road (Viewpoint 17)		Pronounced change to the composition of the view	Moderate Adverse Significant (temporary)
Vehicle users along Marton Road (Viewpoint 18)	Low-Medium	Pronounced change to the composition of the view	Moderate Adverse Significant (temporary)
Vehicle users and residents along the B1241 / Gainsborough Road (Viewpoint 19)	Medium	Noticeable change to the composition of the view	Moderate Adverse Significant (temporary)
11. Noise and Vibration			

12. Socio-Economics and Land Use

No significant residual effects on socio-economics and land use are predicted during the decommissioning of the Scheme.

No significant residual effects on noise and vibration are predicted during the decommissioning of the Scheme.



Description of resource / Sensitivity (Value) Description of Impact receptor and effect

Residual Effect

13. Transport and Access

No significant residual effects on transport and access are predicted during the decommissioning of the Scheme.

14. Human Health and Wellbeing

No significant residual effects on human health and wellbeing are predicted during the decommissioning of the Scheme.

15. Other Environmental Topics

No significant residual effects on air quality; glint and glare; ground conditions; major accidents and disasters; telecommunications, television reception and utilities; and waste are predicted during the decommissioning of the Scheme.





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