One Earth Solar Farm

Volume 5 Reports and Statements [EN010159]

Consultation Report

Appendix K-1

February 2025

Document Reference: EN010159/APP/5.1

Revision 01

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 - Reg 5 (2) (q)

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One Earth Solar Farm

Preliminary Environmental Information Report [EN010159]

Chapters 1 to 6

May 2024

One Earth Solar Farm Ltd

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1. Introduction

Purpose of the PEIR

1.1. This Preliminary Environmental Information Report (PEIR) has been prepared to support our proposals for the One Earth Solar Farm Project by One Earth Solar Farm Ltd. Specifically this PEIR has been prepared to enable consultees (both specialist and non-specialist) to gain an understanding of the environmental effects that may arise as a result of the construction, operation and/or decommissioning of our Project, based upon preliminary work undertaken to date. It should be noted that the design is currently being developed and the process of gathering information and identifying how the environment might be affected by our Project is still continuing. The information contained within this document will therefore continue to evolve and will be reported on fully in the Environmental Statement (ES) that will be submitted with the forthcoming development consent order (DCO) application (see Chapter 2: Environmental Statement for further details on the ES).

Background Information

The Applicant

1.2. One Earth Solar Farm is being promoted by One Earth Solar Farm Ltd. This is a joint venture between Padero Solaer Ltd (trading as PS Renewables) and Ørsted Onshore UK Ltd.

1.3. Established in 2012, PS Renewables is one of the UK's largest privately held companies that specialises in the development and asset management of renewable energy projects including solar and BESS. PS Renewables existing solar farm portfolio totals over 300MW of electricity producing potential in the UK.

1.4. In the UK, Ørsted is a leading offshore wind developer; currently operating 12 offshore wind farms, alongside onshore wind farms in Scotland, also owning and operating sites for energy storage. Ørsted is committed to ensuring that its presence contributes to sustainable growth and development, helping to support the UK in meeting its legally binding net zero targets and benefitting the communities in which it operates.

Project Overview

1.5. The One Earth Solar Farm Project will involve the installation and operation of solar photovoltaic panels, Battery Energy Storage Systems (BESS) and associated grid connection infrastructure which will allow for the generation and export of electricity to the High Marnham substation ('our Project'). The Applicant has secured a connection agreement with National Grid which would allow export and import up to 740 megawatts (MW) of electricity to the High Marnham substation.

1.6. Our Project will be sited across approximately 1,500 hectares (ha) of land within Lincolnshire and Nottinghamshire (the 'Site'). Further details of our Project, including details on our Site access, ecological enhancements and cabling are included in **Chapter 4: Our Project**.

1.7. As our Project is an onshore energy generating station the capacity of which will exceed 50MW of electricity, it is classified as a Nationally Significant Infrastructure Project (NSIP), and therefore requires a DCO under Sections 14(1)(a) and 15(2) of the Planning Act 2008 (as amended)[1]. A DCO is required for NSIPs and if granted would authorise the construction, operation and/or decommissioning (where relevant) of the Project. As a result of their national, strategic importance, DCOs are determined at a national level with the decision whether to grant consent or not being made by the relevant Secretary of State (SoS).

This PEIR

1.8. Under the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 as amended[2] (hereafter referred to as the 'EIA Regulations'), NSIPs are generally required to be subject to an Environmental Impact Assessment (EIA). EIA is a formal process that assesses relevant environmental information to identify the likely significant environmental effects of a project and potential mitigation measures for avoiding, preventing, reducing or, if possible, offsetting likely significant environmental effects. It provides decision-makers with the environmental information needed to make informed decisions when determining applications for certain projects. This includes the provision of information on the likely significant environmental effects that will occur as a result of a project to other interested stakeholders, thereby allowing them to provide informed input to the consenting process.

1.9. This PEIR is prepared in advance of the submission of the DCO application to the SoS and is part of the 'pre-application' stage for NSIPs and is required by the EIA Regulations. In respect of the EIA process for our Project, preparation of the PEIR follows submission of the request for an EIA Scoping Opinion but precedes submission of the DCO application and an Environmental Statement (ES). A diagram of the EIA Process is provided in **Figure 2-1** and the EIA Process as it relates to our Project is discussed further in **Chapter 2: Environmental Impact Assessment**. The design of our Project, as presented in this PEIR, has been informed by the ongoing environmental assessment process and consultation and engagement responses. It does not represent the final design.

1.10. To inform our PEIR and the EIA process more generally, we have been undertaking environmental surveys since May 2023 to gather baseline data, and in October 2023 we published our EIA Scoping Report which described the proposed method by which we are making an assessment of the potential effects on the existing environment (see **Volume 3: Scoping Consultation**). The conclusion of our detailed environmental assessment will be presented in an ES that will be submitted with our DCO application. The PEIR presents the findings of the surveys we have undertaken to date as well as details of the *preliminary* impact assessments, as described above, that have been made.

[2] His Majesty's Office (HMSO) (2017) Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.

1.11. This PEIR uses, as far as is possible, non-technical language so as to make it accessible to the widest possible audience. It should however be understood that by its very nature, environmental assessment is a complex discipline and generally technical by nature.

Structure of this PEIR

1.12. This PEIR comprises the following volumes:

- **Volume 1: Main Report** (as presented in this document)
  - Chapter 1: Introduction
  - Chapter 2: Environmental Impact Assessment
  - Chapter 3: Description of our Site and Surrounding Area
  - Chapter 4: Our Project
  - Chapter 5: Legislative and Planning Policy Context
  - Chapter 6: Methodology for the Preliminary Environmental Information Report
  - Chapter 7: Biodiversity
  - Chapter 8: Hydrology and Hydrogeology
  - Chapter 9: Land and Soils
  - Chapter 10: Buried Heritage
  - Chapter 11: Cultural Heritage
  - Chapter 12: Landscape and Visual
  - Chapter 13: Transport and Access
  - Chapter 14: Air Quality
  - Chapter 15: Carbon and Climate Change
  - Chapter 16: Noise and Vibration
  - Chapter 17: Human Health
  - Chapter 18: Socio-Economics
  - Chapter 19: Cumulative Effects
  - Chapter 20: Conclusions of Preliminary Significance
- **Volume 2: Scoping Consultation**
- **Volume 3: Overview of Our Project and Preliminary Likely Significant Effects**

Project Team and Competency

1.13. We have assembled a team (the EIA team) that has significant experience and appropriate competence as required by Regulation 14(4) of the EIA Regulations, including for solar farms and other renewable energy projects. In **Appendix 1-1** we have provided details of our EIA team including providing details of the relevant expertise of all the senior technical specialists who have contributed to the preparation of this PEIR.

PEIR Feedback Process

1.14. We are inviting feedback on our PEIR during our statutory consultation period, which runs between 29th May and 9th July 2024. During this time, you can access our full PEIR and supporting documents on our consultation website (http://oneearthsolarfarm.co.uk/).

1.15. You can submit your written feedback on the PEIR by completing a consultation questionnaire, which is available online at our Project website, as well as in hard copy at consultation events or by request. You can also submit written feedback by email or post through the contact information below:

- Email: info@oneearthsolarfarm.co.uk
- Freepost: One Earth Solar Farm, Freepost SEC NEWGATE UK LOCAL

2. Environmental Impact Assessment

The Need for Environmental Impact Assessment (EIA)

2.1. The aim of EIA is to protect the environment by ensuring that those responsible for making decisions on whether development consent should be granted have information on whether our Project is likely to give rise to likely significant environmental effects. These decision makers can then take into account any possible significant environmental effects when considering whether to grant a consent.

2.2. The EIA Regulations set out a procedure for identifying those projects which should be subject to an EIA. Some types of development must be subject to EIA and these are listed within Schedule 1 of the EIA Regulations. Other developments may be subject to EIA if they are listed in Schedule 2 of the EIA Regulations and it is considered our Project is likely to have significant environmental effects on the environment.

2.3. Our Project does not fall under any of the types of development set out in Schedule 1 of the EIA Regulations. However, it is of a type and scale described in Schedule 2 paragraph 3 (a) of the EIA Regulations, and potentially also falls under (b) of that Schedule:

"Energy industry

a) industrial installations for the production of electricity, steam and hot water (projects not included in Schedule 1 to these Regulations);

b) industrial installations for carrying gas, steam and hot water; transmission of electrical energy by overhead cables (projects not included in Schedule 1 to these Regulations)."

2.4. Based on the above, we have considered that our Project should be subject to EIA and therefore will voluntarily submit an ES in support of the DCO Application, without going through the formal screening process.

The EIA Process

2.5. EIA is a systematic process that comprises a number of key steps. Done well, it should help ensure that the construction, design, operation, maintenance and decommissioning of a project occurs in the most environmentally sustainable way possible. Furthermore, it should be informed by a series of consultations so that a robust and detailed assessment of the likely significant environmental effects of our Project is produced using the most appropriate methods of assessment available.

2.6. **Figure 2-1** shows the steps of the EIA documentation production and also notes the work we have undertaken to date (in green), the work currently being undertaken (in dark blue) and works that will be completed in the future (in white). It also shows how the PEIR fits into the EIA process. **Figure 2-2** presents further details and shows the details to be considered in the ES, which will be submitted as part of the DCO application and which the PEIR will feed into.

Figure 2-1: Stages of the EIA Documentation Production

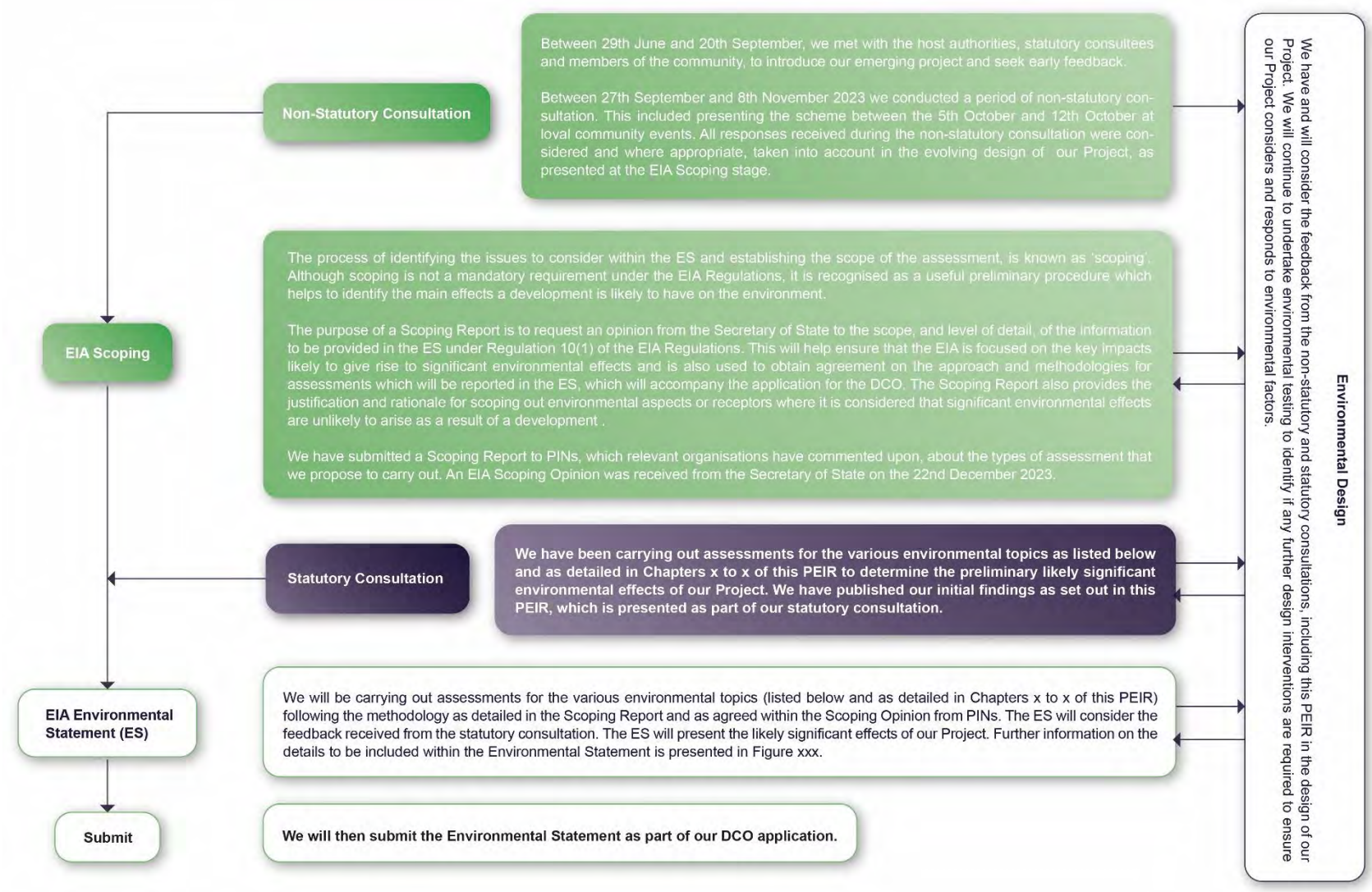
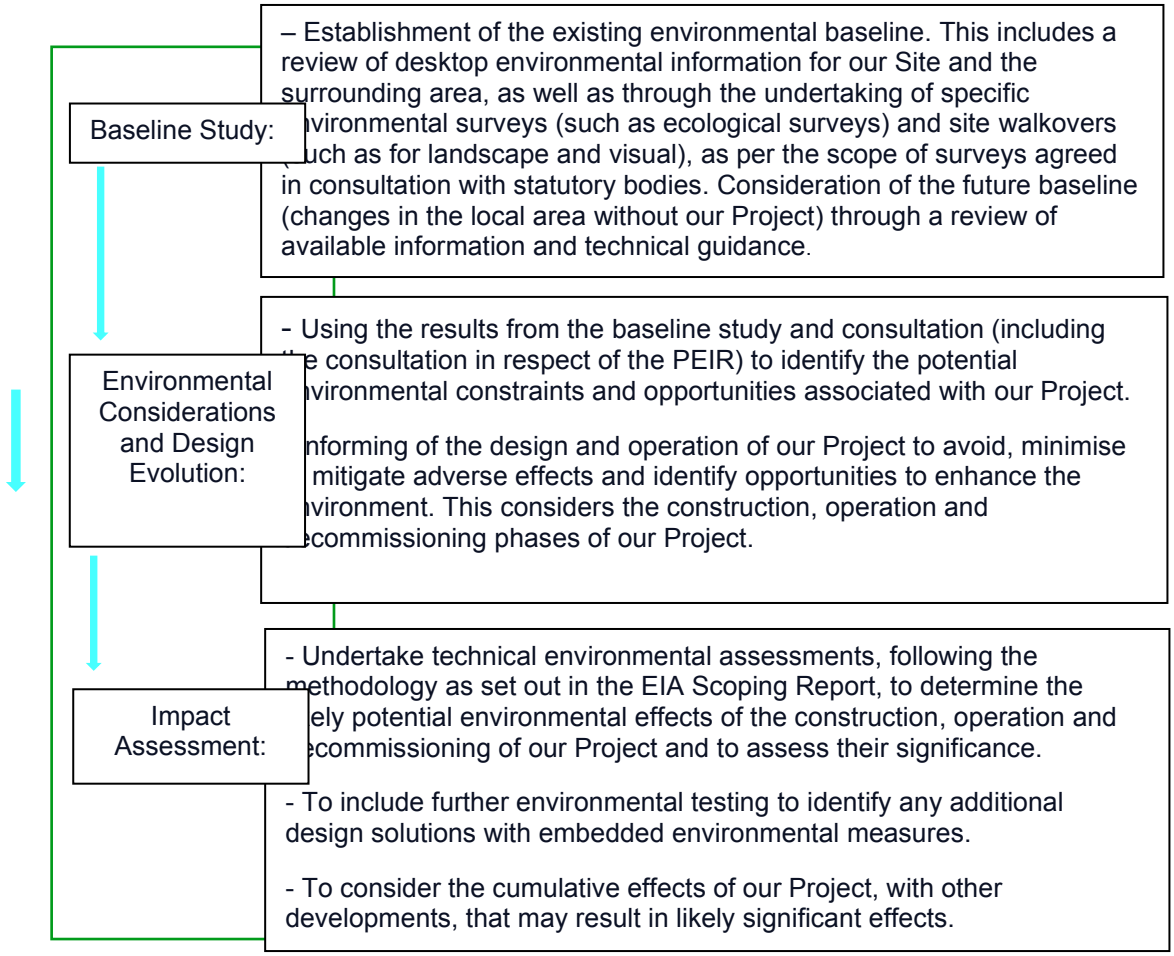


Figure 2-2: Details to be included within the Environmental Statement



2.7. The PEIR presents details on the aspects which have been scoped in and/or out, as agreed by the Planning Inspectorate (PINs) through the EIA Scoping Opinion received (see **Volume 3: Scoping Consultation**). Where relevant, further information is presented.

2.8. Regulation 5(2) of the EIA Regulations sets out the environmental factors which should be considered with the EIA. **Table 2-1** indicates where specifically our PEIR has addressed these requirements.

Table 2-1: Environmental Factors listed under Regulation 5(2) of the EIA Regulations

Schedule 5(2)	PEIR Aspect Chapters
(a) population and human health	Chapter 9: Land and Soils Chapter 12: Landscape and Visual; Chapter 13: Traffic and Transport; Chapter 14: Air Quality; Chapter 16: Noise and Vibration; Chapter 17: Health;

	Chapter 18: Socio-economics.
(b) biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC	Chapter 7: Biodiversity
(c) land, soil, water, air and climate	Chapter 8: Hydrology and Hydrogeology; Chapter 9: Land and Soils; Chapter 12: Landscape and Visual; Chapter 14: Air Quality; and Chapter 15: Carbon and Climate Change.
(d) material assets, cultural heritage and the landscape	Chapter 3: Description of our Site and Surrounding Area; Chapter 10: Buried Heritage; Chapter 11: Cultural Heritage; Chapter 12: Landscape and Visual; Chapter 13: Traffic and Transport; and Chapter 18: Socio-economics
(e) the interaction between the factors referred to in sub-paragraphs (a) to (d)	Chapter 19: Cumulative Effects.

Consultation and Engagement

2.9. Consultation alongside the EIA process is important to the development of a comprehensive and proportionate ES. The views of statutory consultees[3] (including members of the community) and non-statutory consultees are important to ensure that the EIA from the outset focuses on specific environmental issues where there are likely significant environmental effects to occur, and where further investigation is required.

2.10. The consultation, as an ongoing process, enables environmental measures to be incorporated into our Project to avoid, prevent, reduce or, if possible, offset adverse environmental effects and to optimise environmental benefits.

[3] Statutory consultees are described in s.42 of the Planning Act (2008). Details can be found here: Planning Act 2008 (legislation.gov.uk)

2.11. We conducted a period of 'early engagement' between 29th June and 20th September 2023. This included meeting with the host authorities, statutory consultees and members of the community, to introduce the emerging scheme, seek early feedback, and develop the scope and methodology for the non-statutory consultation. On 12th September, we conducted 'door knocking' in the local area to personally introduce our Project and answer any questions in advance of our Project being publicised more widely.

2.12. Following the 'early engagement' we conducted a period of non-statutory consultation between 27th September and 8th November 2023. As part of the consultation, public exhibitions were held in Newton on Trent (5th October), South Clifton (7th October), Dunham-on-Trent (10th October) and Normanton on Trent (12th October), and one online community webinar (11th October).

2.13. All of the written feedback that we received during this period of non-statutory consultation has been recorded and considered, which will be detailed in the Consultation Report submitted with our DCO application.

2.14. All the responses we have received to date during consultation have been carefully considered and where appropriate, have been taken into account in the design of our Project (as presented in **Chapter 4: Our Project**).

Environmental Design

2.15. Our Project has undertaken to respond and understand the impacts upon environmental factors and these impacts have been factored into the design as part of an evolving process. In particular, environmental factors have directly influenced the parameters of the heights of the panels, the landscaping parameters and the location of the solar infrastructure. Details of how our Project has considered the environmental factors is detailed in **Chapter 4: Our Project**.

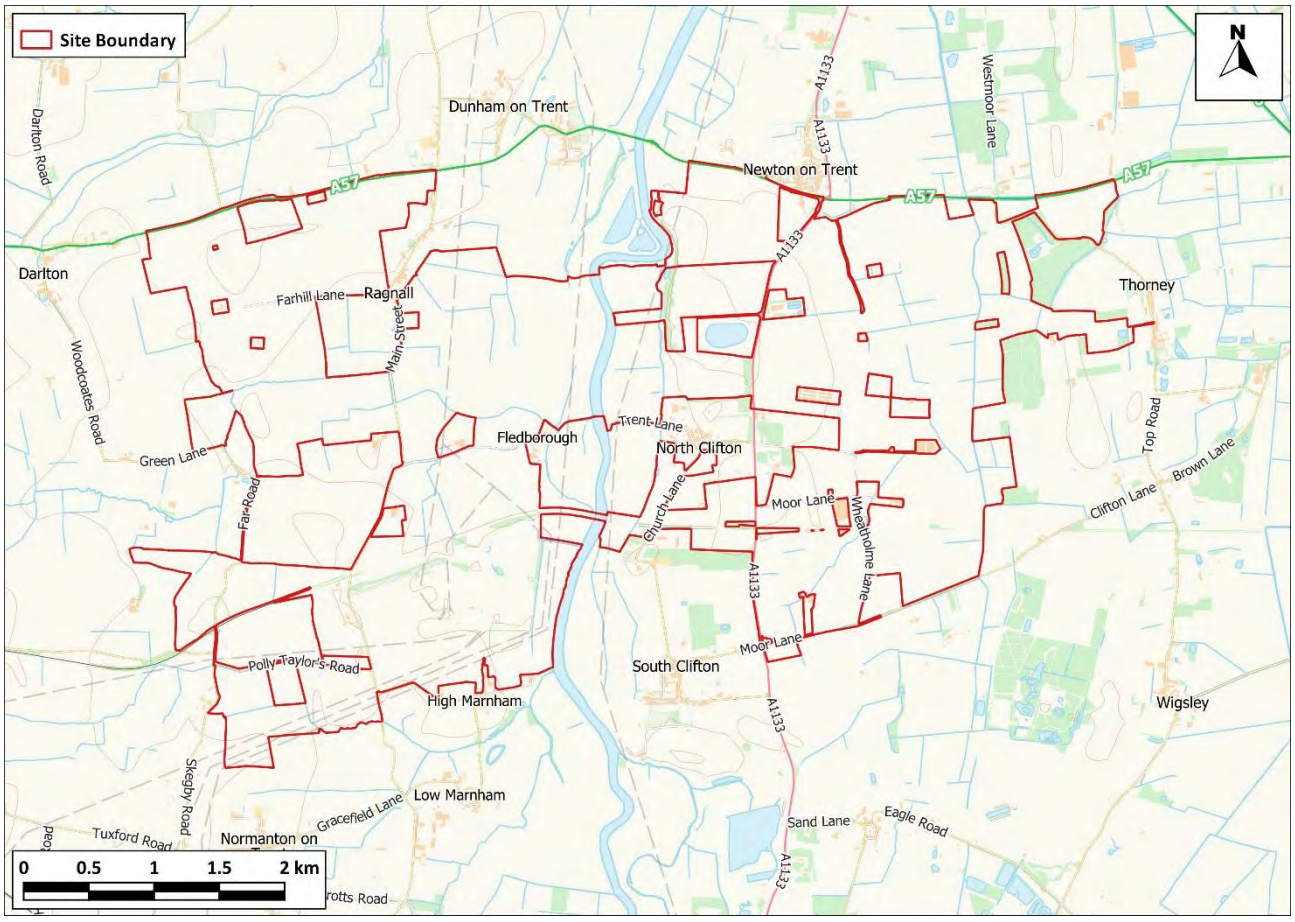
2.16. In addition, the process to get to this point has been driven by environmental testing, albeit always understanding that other factors such as operational, commercial need and safety implications need to be considered. Specific design interventions for each technical aspect can be found in the Environmental Design sections of **Chapters 7 to 18**.

3. Description of our Site and Surrounding Area

Site Location and Surrounding Area

3.1. Our Site boundary is shown in **Figure 3-1** and consists of approximately 1,500 hectares (ha) of land, comprising of agricultural fields located to the east and west of the River Trent which dissects our Site in a roughly north-south alignment. Hedgerows, trees and woodland form the boundaries to many of the fields within our Site. At its maximum, our Site extends approximately 4.5km in a north-south direction and approximately 8km in an east-west direction.

Figure 3-1 Site Boundary



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3.2. Our Site falls across two county boundaries with approximately 1,300ha of our Site falling within Nottinghamshire County Council and the remaining approximately 200ha of our Site within Lincolnshire County Council. Our Site also extends across three administrative boundaries within the County areas, these being Newark and Sherwood District Council, West Lindsey District Council and Bassetlaw District Council.

3.3. The nearest villages to our Site include:

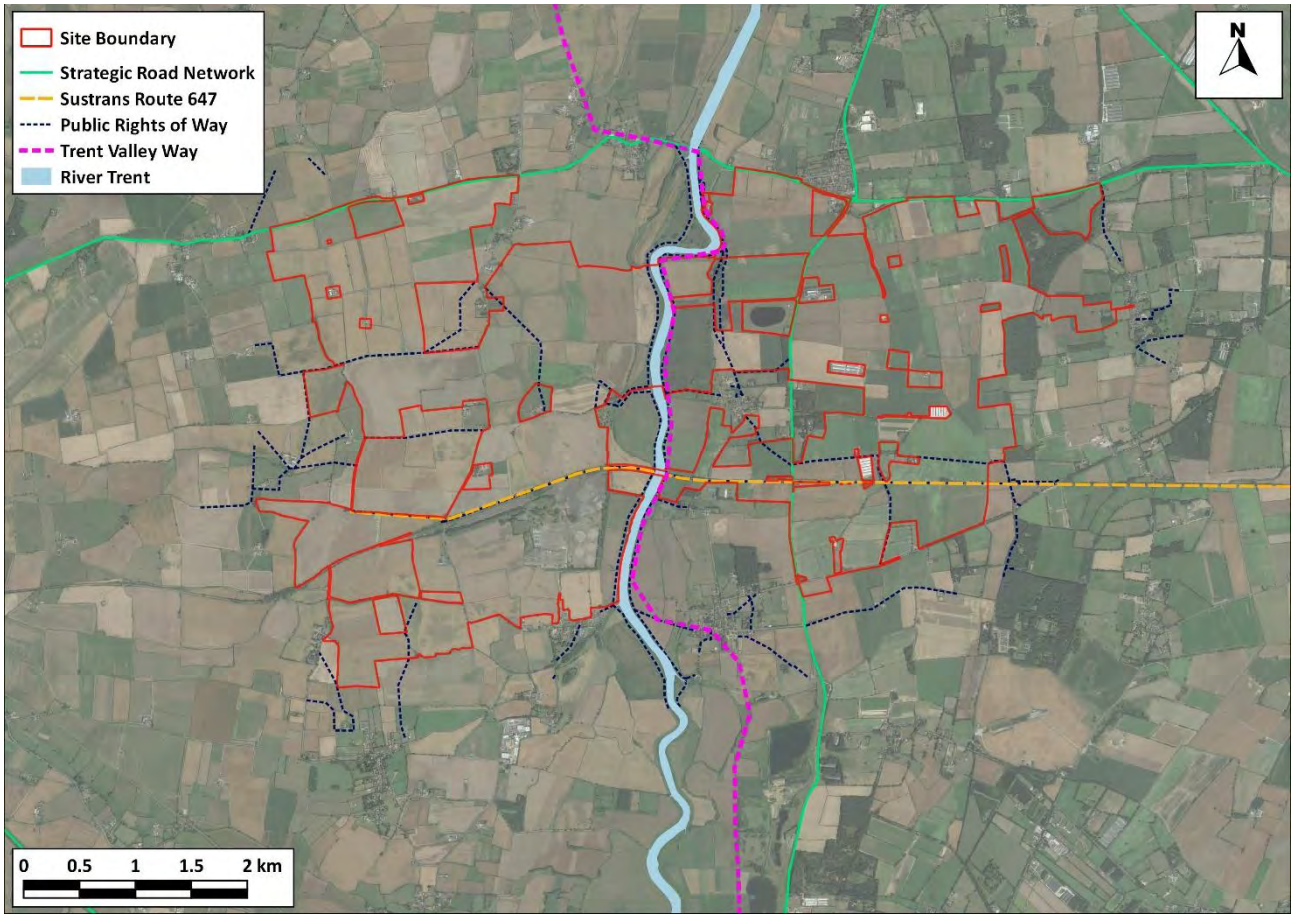
- North Clifton and South Clifton located on the eastern boundaries of our Site;
- Newton on Trent located within 50m of the nearest boundary of our Site to the north;
- Dunham located within 500m to the north of the nearest boundary of our Site;
- Fledborough located on the western boundaries of our Site; and
- Ragnall located on the western boundaries of our Site.

3.4. In addition, there are a number of isolated properties and hamlets, which are dispersed throughout the local area.

Transport and Access

3.5. The key transport features are shown in **Figure 3-2**.

Figure 3-2 Key Transport Features



3.6. Our Site is currently accessible from a number of existing field accesses that allow agricultural machinery to enter and depart its boundaries.

3.7. The A1 which connects Blyth to the north and Stamford to the south, is located approximately 8km to the east of the centre of our Site. The A1 forms a junction with the A57, which connects Markham Moor to Lincoln. The A57 runs along the northern Site boundary, thus being approximately 2.5km from the centre of our Site. The A57 runs eastwards before forming a junction with the A46 to the east of our Site. The A1133 is located within the eastern part of our Site, approximately 1.5km from the centre of our Site, and connects Torksey Lock with Winthorpe, where it then joins the A46.

3.8. The Trent Valley Way extends for 174km from Nottingham in the south, to the Humber Estuary. This long-distance footpath route follows the eastern edge of the River Trent as it runs through our Site. In addition, there are several other footpaths and also bridleways that cross our Site.

3.9. Located within our Site and approximately 500m south of its centre, is the Sustrans Cycle Route 647. This Route is part of the National Cycle Route (NCR) and is a disused railway line associated with the former Lancashire, Derbyshire and East Coast Railway, which ran east-west connecting Lincoln to the east with Tuxford to the west. Crossing over the River Trent, the Sustrans Route utilises the Fledborough Viaduct. This is one of a few river crossing opportunities in the locality.

3.10. The River Trent is classified as a freight waterway, and can accommodate large waterborne craft.

Existing Infrastructure

3.11. Our Site of the former High Marnham coal fuelled Power Station which was decommissioned in 2003, is located on the southwest boundary of our Site. This area of land has been mostly cleared with demolition of the cooling towers occurring in 2012. Remaining infrastructure comprises extensive metalled roadways, including the access road from Fledborough Road to the west, as well as the former pump house that lies adjacent to the River Trent.

3.12. On our Site of the former High Marnham Power Station remains a National Grid 400 kilovolt (kV) and 275kV substation. Our Project will connect into the 400kV and 275kV substations. It is noted that the substation may be modified by National Grid to meet the needs of other projects in the area. Should NGET decide to expand or relocate their substation, our Project has included sufficient flexibility to enable it to connect to this new substation and has been proactively engaging with NGET on this matter. As above, the Applicant has secured a connection agreement with National Grid which would allow export and import up to 740MW of electricity to the High Marnham substation (more details are provided in **Chapter 4: Our Project**).

3.13. Numerous pylons and high voltage overhead power lines occur within the localised landscape (further detail is provided in **Chapter 12: Landscape and Visual**). These include National Grid overhead power lines that are carried by pylons and which are located to the east of the River Trent travelling in a north to south direction, and also throughout land to the west of the River Trent.

3.14. Approximately 6.5km to the north of our Site is the site of the decommissioned coal-fired Cottam Power Station. In August 2023 demolition occurred of the main building, bunker bay, turbine hall and the coal conveyer.

4. Our Project

Overview of Our Project

4.1. Our Project comprises the construction, operation and maintenance, and decommissioning of a solar photovoltaic (PV) array electricity generating facility allowing for the generation and export of electricity to the High Marnham substation. The Applicant has secured a connection agreement with National Grid which would allow export and import up to 740 MW of electricity to the High Marnham substation. Our Project will involve the installation and operation of solar PV modules, BESS and associated grid connection infrastructure, including a cable to cross the River Trent, to connect the solar panels and batteries east of the River Trent to the point of connection at the High Marnham substation on the west. Our Project will be located within the Site as shown in **Figure 3-1**.

4.2. An overview of our Project is presented here in respect of construction, operation and maintenance, and decommissioning, however it should also be noted that on submission of the DCO application and the associated environmental assessment, further details will be presented as the design is refined. On this basis it is therefore necessary to set parameters for the assessment.

The Need

4.3. The compelling need for global action to decarbonise continues to be reinforced. On 20th March 2023, the U.N. Intergovernmental Panel on Climate Change (IPCC) published its 2023 assessment of global climate change. The report concludes that the world is likely to pass a dangerous temperature threshold within the next 10 years, pushing the planet past the point of catastrophic warming — unless nations drastically transform their economies and immediately transition away from fossil fuels [IPCC-2023].

4.4. In the UK alone, there is an urgent and quantifiable need for the deployment of solar farms and other renewable energy generation infrastructure, which is being driven by UK Government policy at both a local and national level. Our Project therefore responds to the UK Government's support for solar energy by providing a renewable energy supply that would reduce carbon emissions and assist in establishing a greater diversity of energy sources in the UK.

4.5. In June 2019 the Government heightened the UK's ambition for tackling climate change by legislating for a net-zero greenhouse gas emission target for the whole economy by 2050. Decarbonising the power sector is integral to achieving this goal and requires major investment in proven technologies, such as solar and battery storage.

4.6. The Net Zero Strategy identifies nuclear power as another option for decarbonising the UK power system. Although nuclear power has historically met circa 20% of UK demand, existing nuclear stations began to close in 2021. Only one existing nuclear plant is scheduled to remain operational beyond 2028 and currently only one new nuclear plant is scheduled to be commissioned in the late 2020s. Any others (although noting that none are currently yet under construction) will not commission before the mid-2030s due to the long construction periods associated with the technology. Only one UK coal station, Ratcliffe Power Station, is still in commercial operation, however it is proposed to close at the end of 2024.

4.7. Carbon Capture Utilisation and Storage (CCUS) is a key plank under development to support Net Zero by facilitating the decarbonisation of the UK's thermal (carbon emitting) fleet, currently circa 40GW, decarbonising industry, producing low-emissions hydrogen 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*".

4.8. Hydrogen is another key plank, but its development is not yet guaranteed. Technological hurdles must be overcome, grid connection, funding and consents must be secured. Blue hydrogen relies on functional CCUS operating at GW-scale; pink hydrogen on abundant electricity from new nuclear facilities; and green hydrogen on abundant low-carbon electricity. Not all enablers to hydrogen production are yet guaranteed, and while the future path to a low-carbon future is incredibly uncertain, much progress has already been made in the delivery of renewable generation facilities.

4.9. The UK has substantial renewable energy resources, including 40% of Europe's wind resource and the Government is targeting 50GW of offshore wind to be operational by 2030. However, wind on its own is not sufficient to meet demand and diversify energy sources.

4.10. The development of large-scale solar in the UK (National Grid estimates up to 42GW of operational solar capacity by 2030 rising to 92GW 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. The Energy Security Plan (March 2023) aims for the UK to achieve up to 70GW of solar by 2035 (a fivefold increase in solar). Solar generation is therefore a critical element of the plan to decarbonise the UK electricity sector with urgency and is already a leading low-cost generation technology in the UK.

4.11. Mission Zero, published in January 2023 by Rt Hon Chris Skidmore MP, Chair of government's Independent Review of Net Zero, finds that "*The benefits of net zero will outweigh the costs*" and believes that "*This is too important to get wrong*". Mission Zero recommends the "*Full-scale deployment of solar including a rooftop revolution to harness one of the cheapest forms of energy, increase our energy independence and deliver up to 70GW of British solar generation by 2035*" [p8].

4.12. The UK Government's Powering Up Britain strategy (updated April 2023) concludes that "We need investment at scale … to rapidly rollout existing technologies … at pace to meet our ambitions for decarbonising power and [lower] wholesale UK electricity prices" [p9] and observes that "a significant proportion of technologies we will need for 2050 are currently at the demonstration or prototype phase" [PUB-p9]. Powering Up Britain therefore concludes that an acceleration of the deployment of renewables is critical to the delivery of Government's plans: "Our goal is to develop up to 50GW of offshore wind by 2030 and to quintuple our solar power by 2035" [p7], noting that 14GW of solar was already installed in the UK at the time of writing the report [p19].

4.13. The national need for solar generation is urgent and the capacity required is significantly greater than the capacity of projects currently understood to be in development.

4.14. Solar energy generation addresses all important aspects of existing and emerging UK Government policy. It will make a critical and timely contribution to decarbonisation and the security of the energy supply in the UK. This will help shield consumer bills from volatile energy prices and fluctuations in international supply markets, and provides the potential to deliver biodiversity net gains through its development.

4.15. National Policy considers solar as being a Critical National Priority (CNP). In particular, the Overarching National Policy Statement for Energy (EN-1) states '*Wind and solar are the lowest cost ways of generating electricity, helping reduce costs and providing a clean and secure source of electricity supply (as they are not reliant on fuel for generation). Our analysis shows that a secure, reliable, affordable, net zero consistent system in 2050 is likely to be composed predominantly of wind and solar*". Our Project responds to this urgent national need, as set out in National policy, for this type of infrastructure.

4.16. It is therefore against the context of a clear and urgent national need for this type of infrastructure that the assessment of alternatives is set.

Alternative Renewable Technologies

4.17. Alternative types of low-carbon forms of electricity generation for utilising the existing National Grid High Marnham Substation connection capacity were not considered by the Applicant as a dedicated solar farm development company.

4.18. It should be noted that tidal power, offshore wind, and hydroelectric storage were not considered possible due to the location of the High Marnham Substation approximately 70km from the coast, and within an area of low, flat topography.

4.19. Our Site is not considered suitable for onshore wind due to the low wind yield relative to other parts of the UK, coupled with the proximity to residential dwellings which would be subject to risks associated with shadow flicker and wind turbine noise. Furthermore, it is noted that the policy context for onshore wind is currently not favourable.

Alternative Locations

4.20. Government policy clearly states solar energy is a CNP and there is an urgent need for solar farms, such as our Project, to meet net-zero by 2050. As above, alternative technologies have not been identified for the Site as for this location, it is considered that solar is the best renewable generating solution for this area.

4.21. The primary driver for the location of our Project has been the availability of significant capacity at the National Grid High Marnham Substation. This available capacity at substations should be utilised (and made the most of) when it occurs.

4.22. Our Project will be able to connect to the High Marnham National Grid Substation without the need for additional capacity improvements, therefore making efficient use of existing infrastructure. This means our Project can be completed quickly responding to the urgent need for renewable energy to address the climate crisis. We have already secured a connection agreement with National Grid which would allow export and import up to 740 MW of electricity to the High Marnham substation.

4.23. From this, a range of technical, environmental and economic factors have been considered when investigating and assessing any alternative site in proximity to the High Marnham Substation.

4.24. A search of potential locations for our Project was undertaken within 10km from the centre of the National Grid High Marnham Substation. An initial distance of 10km was used to avoid the need of a long (distance) cable connection, in order to reduce potential environmental effects during the construction of the cable and to reduce the loss in power associated with a longer cable route.

4.25. The initial search showed that there is suitable land adjacent to the National Grid High Marnham Substation with sufficient willing landowners to deliver a scheme which could deliver the MW output. This means there is no need for a long grid connection cable to connect our Project to the Grid. As above, any alternative site would unnecessarily increase the length of the grid connection cable which would likely result in greater associated environmental impacts and project delay as a result of negotiating more land interests and constructing the cable corridor.

4.26. The topography of land within the 10km study area varies from approximately 105m to 4m above sea level. The lowest topography is around the River Trent. Further to the west, the topography is higher, with the highest land within the 10 km search radius being near Laxton. The topography has been influential to the location of our Project. The land of our Site has the potential to locate a large-scale solar development, due to the existence of large open areas of undeveloped land, which is made of relatively flat topography and generally sparse settlement patterns.

4.27. Our Project is located within National Character Area (NCA) of the Trent and Belvoir Vales, which is defined as "undulating, strongly rural and predominantly arable farmland, centred on the River Trent. A low-lying rural landscape with relatively little woodland cover". This character area includes Newark-on-Trent at the centre with Grantham, Nottingham, Lincoln and Gainsborough on the peripheries. Within this NCA the landscape, compared to other locations within 10 km, our Site has been considered suitable for our Project, as it is already characterised by energy infrastructure. This includes the now decommissioned Marnham Power Station (see **Chapter 3: Description of our Site and Surrounding Area**), which still includes remains of its industrial past within the local landscape including metalled roadways and the former pump house. In addition, there are numerous pylons and high voltage overhead power lines within the localised landscape. These include National Grid overhead power lines that are carried by pylons and which are located to the east of the River Trent travelling in a north to south direction, and also throughout land to the west of the River Trent. It is considered whilst our Site is in the Trent and Belvoir Values NCA, the use of solar is consistent with the historic energy use in the local area.

4.28. Natural England Agricultural Land Classification mapping shows our Site and land within 10 km from the centre of our Site as being Grade 3 land (good to moderate; may be considered Best Most Versatile (BMV) land). Areas of land to the south and west of our Site is classed as Grade 2 land (very good, considered to be BMV land). Natural England's Predictive Agricultural Land Classification Map for the East Midlands also shows the majority of our Site falling within an area with low-moderate likelihood of BMV. Consequently, whilst our Site does include BMV Land this is consistent with the wider area which either has the same or higher mapped BMV land grading.

4.29. The land is not constrained by environmental designations which typically seek to protect often unique or sensitive environmental features. For instance, the land is not located within or close to internationally or nationally designated biodiversity sites. In addition, there are no Areas of Outstanding Natural Beauty or of landscape value, and there is no Green Belt Designation within the 10km study area. The nearest Special Areas of Conservation (SAC) is the Birklands and Bilhaugh SAC located beyond the 10km study area (approximately 16 km to the west of our Site). There are three Sites of Special Scientific Interest (SSSI) to the south of our Site within 10km, the closest being the Spalford Warren SSSI. These areas have therefore been avoided when locating our Project.

4.30. The study area includes a combination of local single carriageway roads and strategic routes including the A1, which bisects the western part of the study area running from south-east to north-west, and the A57 which bisects the northern part of the study area running from east to west. Our Site was identified as a potential location for our Project, as the land is relatively close to part of the Strategic Road Network (SRN) by virtue of the A57 and A1 and has good accessibility via the road network for construction; operational maintenances; and decommissioning. It avoids construction traffic going through settlements further distanced from the SRN.

4.31. Various settlements are located within the study area, including Tuxford, East Markham, Weston, Normanton on Trent, Low Marnham, Darlton, East Drayton, Sutton on Trent, Carlton-on-Trent, High Marnham, North Clifton, South Clifton and North Scarle. Our Site was chosen as there are relatively few residential properties in immediate proximity to our Site and the impact on those that are can be effectively mitigated through measures such as offsets and sensitive landscaping.

4.32. There is no land allocated for future residential development within the relevant Local Plans within the study area. The relevant Local Plans identify existing employment sites to the south east of Tuxford. Our Site was chosen as it has limited land use conflict with respect to local development plan allocations and displacement of existing businesses.

4.33. Within the 10km study area flood risk is high across the middle portion, north to south. This is due to the River Trent, along with the four main tributaries, being tidal and therefore at risk of tidal flooding. To the south west of the study area, there are areas of land outside of high flood risk. Whilst the land of our Project does lie partly within an area at risk of flooding (flood zones 2 and 3), we have followed a sequential approach to site selection which has included a balanced approach to the consideration of the above factors, whilst also ensuring development in flood zones 2 and 3 is minimised as far as possible. The design of our Project has responded our Site being within the flood zones and appropriate measures (in terms of the height of the bottom of the panels that will be installed) have been included within the design, as agreed with the Environment Agency.

4.34. As well as the above environmental considerations, we have taken account of other NSIP-scale solar farms proposed in the local area and have sought to reduce the opportunity for cumulative effects. In particular when choosing our Site we have ensured the majority of land is located within Nottinghamshire County, avoiding other NSIP-scale solar sites within Lincolnshire County (including West Burton Solar Farm, Cottam Solar Project, Steepes Renewable Project and Gate Burton Energy Park). It is noted that a cumulative effects assessment (which does still consider these projects) is detailed in **Chapter 19: Cumulative Effects**.

4.35. Further to the above, a Site Selection Report will be submitted with our DCO application, which will provide further details on how our Site was selected.

Alternative Site Layouts

4.36. Since our last consultation event we have been gathering further environmental information on our Site and in its surrounds. As detailed in **Chapters 7 to 18** further environmental information has been obtained through monitoring, surveys, consultations with relevant statutory bodies, desktop reviews and environmental modelling. The layout and extents of our Project have undergone design evolution in response to feedback from the last consultation event and ongoing survey and engineering works. It is noted that the design may further evolve between statutory consultation and submission of our DCO application, responding to consultation feedback, environmental assessment, and further technical design development.

4.37. The following changes and amendments to our Project layout have been undertaken and are described in the following points:

- All solar panels and associated infrastructure have been removed from land located between North Clifton and South Clifton to protect the setting of the villages and the visual amenity experienced by residents at home or approaching the villages;
- Further offsets have been embedded from Hollow Gate Lane, extending beyond 150m in some locations, to protect the setting of Fledborough and residents' visual amenity;
- Additional offsets and new planting have been incorporated at the southern entrance to Ragnall to protect the sense of arrival into the village along Main Street;
- The field closest to Thorney has been removed from our Project to protect the setting of the village;
- Bespoke offsets have been incorporated from individual residential properties located within, or close to, our Site;
- The use of Best and Most Versatile (BMV) land has been minimised as far as possible;
- New ecological and recreational enhancements have been added across our Project, including the proposed creation of new habitats such as beetle banks and herptile hibernacula, an enhanced green infrastructure network through the planting of new hedgerows and trees, and a new network of permissive paths for public access; and
- The height of the proposed solar PV panels have been discussed with the Environment Agency and a number of design options have been considered. The final option, as presented in our Project, includes the bottom of the flood panels to be raised up to 1.8m above ground level. This includes a 300mm freeboard (i.e. gap between the flood level and base of the panels) to allow for debris in the event of flood to pass beneath the solar panels. The heights of the panels have been staggered across our Site, limiting their height wherever possible to reduce visual impact whilst responding to the potential level of flood water, allowing for the potential impact of climate change.

4.38. At this stage of our Project we are still exploring the options for routing our cables to cross the River Trent, linking land to the east of the river with the National Grid High Marnham substation to the west of our Site. In addition, we are still considering the location of our BESS and substation compound to the west of the River Trent. These options are currently not defined as we are still gathering technical, engineering and environmental information.

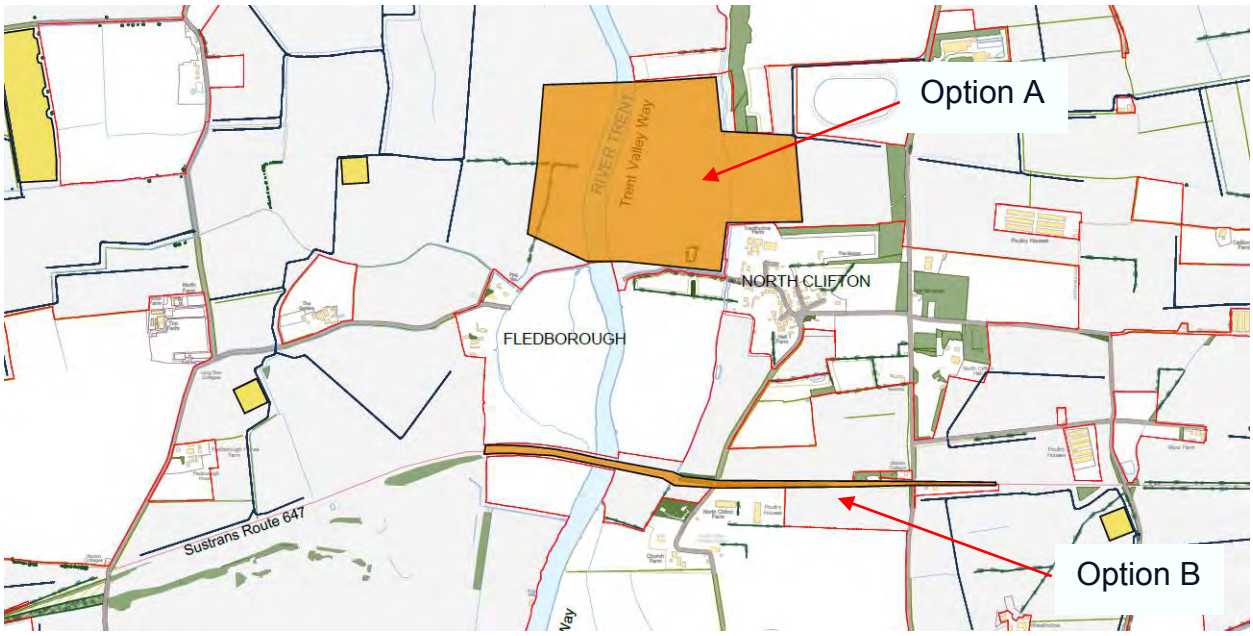
4.39. As detailed in **Chapter 6: Methodology for the Preliminary Environmental Information Report**, within the environmental assessments the options for the river crossing and the BESS and Substation locations have been considered. Each of the options for cable crossing and the locations of the BESS and substations have been assessed in **Chapters 7 to 18**. The highest level of significance from these options (or part of these options) has then been reported and represents the worst case in terms of environmental effects.

River Crossing Options

4.40. At this stage of our Project, we are currently exploring options for how the cables required would cross the River Trent. These options are shown in **Figure 4-1**, which include HDD under the River Trent (Option A) or using the existing Fledborough viaduct (Option B).

4.41. Further options were considered to cross the River Trent which included the use of Dunham Toll Bridge, a bridge or structure, and overhead lines. These options were discounted due to engineering and/or environmental considerations, as well as taking into account consultation from the Canals and River Trust, who advised they would not support a new structure over the River Trent.

Figure 4-1: Options for Cable Crossing over the River Trent



HDD under the River Trent

4.42. This option for crossing the river is to install cables below the River Trent using directional drilling techniques. The cables would be buried in trenches on the approach to the river, then pass beneath the riverbed (more than 5m below the bed of the River) via holes drilled by directional drilling.

4.43. The area identified in Option A of **Figure 4-1** takes into account the uncertainty on where the HDD would be undertaken, as the precise location will be informed by further site investigation and engagement with the Canals and Rivers Trust. **Figure 4-1** also shows the land required for construction compounds to be set up either side of the river.

Fledborough Viaduct

4.44. As described in **Chapter 3: Description of our Site and Surrounding Area**, Fledborough viaduct is approximately 0.5 miles southwest of North Clifton and is used as a public bridleway and footpath. The viaduct formed part of the former Lancashire, Derbyshire and East Coast railway line. The single-track line is now disused and forms part of The National Cycle Network known as Route 647.

4.45. This option for crossing the river is to install cables on the existing Fledborough Viaduct, as shown in **Figure 4-1** as Option B. The cabling would either be installed within the structure of the existing Fledborough Viaduct or on the external support brackets. A structural assessment of the viaduct would be undertaken to determine if this option is possible.

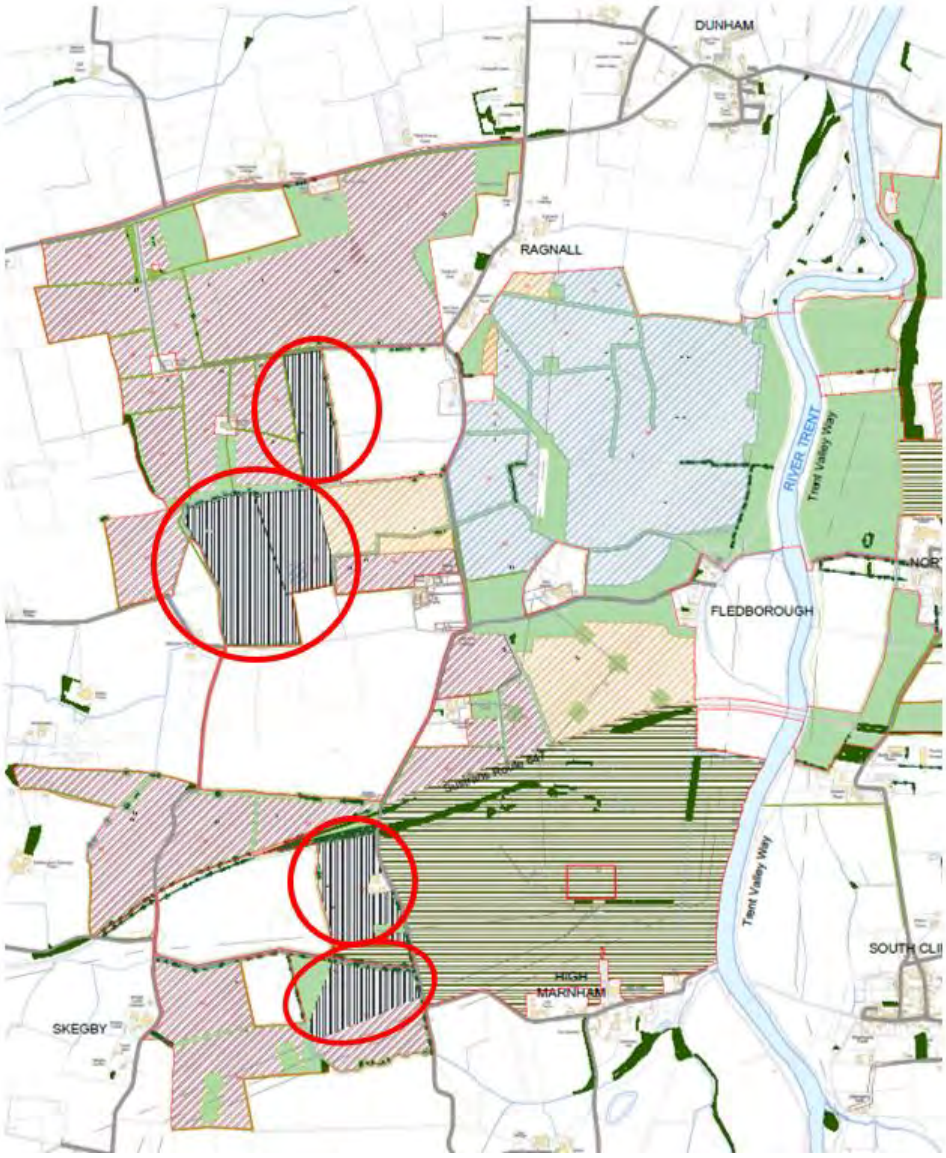
BESS and Substation Locations

4.46. There will be two BESS and substation sites within our Project, one will be located on the east and one located on the west of the River Trent. These sites will occupy up to 20ha each.

4.47. The BESS will allow the storage of energy generated by the solar panels at times of low demand and release to grid at times when demand is high or when solar irradiance is lower (known as load shifting). As a secondary function, the BESS will also have the ability to import power from the grid directly to allow the BESS system to help support the grid through grid balancing mechanisms. The substations will consist of switchgear and transformers and other power quality equipment to transform the electricity generated the PV Solar Modules into electricity for use within the National Grid. Further details on the technical dimension of the BESS and substation (such as the maximum heights) are detailed in **Appendix 4-1**.

4.48. We are considering the location of our BESS and substation compounds on the west of the River Trent. These potential areas have been identified taking into account environmental constraints, in particular ensuring the infrastructure is outside of areas within the flood zones (see **Chapter 8: Hydrology and Hydrogeology**). We will only be taking one of the locations within the west of the River Trent forward as part of our DCO Application. The potential areas are highlighted in **Figure 4-2** and will be subject to further environmental and design works.

Figure 4-2: Options for the Location of our Substation and BESS Compounds



Project Parameters and Rochdale Envelope

4.49. As set out above the development of our Project has been an iterative process, with the design evolution informed by preliminary environmental assessments and consultations to date with statutory and non-statutory consultees.

4.50. As with other projects of this type, the exact design details of our Project cannot be confirmed until the tendering process for the design has been completed and more detailed design has been approved by the relevant local planning authorities in advance of our Project commencing (or phase thereof). This is to allow for flexibility to take advantage of technological advancements. For example, the exact enclosure design or building sizes may vary depending on the contractor selected and their specific configuration and selection of plant. To ensure a robust environmental assessment is made whilst maintaining flexibility in the layout and design within the DCO application, the environmental assessments (as detailed in **Chapters 7 to 18**) are based on the principles of the 'Rochdale Envelope' in accordance with PINS Advice Note 9: Rochdale Envelope. The Rochdale Envelope involves specifying parameter ranges, including details of the maximum, and where relevant the minimum, size (footprint, width, and height relative to above ordnance datum (AOD)), technology, and locations of the different elements of our Project, where flexibility needs to be retained (see **Appendix 4-1** for the parameters of our Project).

4.51. This means that maximum design parameters (an 'envelope' within which our Project will unfold) have been adopted to provide sufficient flexibility for the later detailed design of our Project (detailed design would take place post granting of the DCO and would be subject to a requirement in the DCO for details to be approved by the relevant local planning authority), whilst also allowing for a robust assessment of environmental effects (this assessment being based on maximum 'worst case' parameters) to be made.

4.52. To assist with the interpretation of the Rochdale Envelope, parameter plans have been created, which provide details on the land where development could occur. These are described further in the below.

4.53. Further to the above, to accompany the Rochdale Envelope, a set of Design Principles have been established and will be used in the design evolution of our Project. The Design Principles consider:

- Climate - taking into account climate change as well sensitivity of the local environment;
- People – considering the impact on local communities and looking at opportunities to improve the quality of life for people who live and work nearby;
- Place - supporting the natural and built environment and enriching ecosystems; and
- Value – identifying opportunities to contribute to the local community.

4.54. Further details of the Design Principles which have been established and used for our Project are detailed in **Appendix 4-1**.

Operational Phase of our Project

4.55. Once built, the principal components of our Project comprise the following:

- PV Solar Modules;

- Mounting Structures;
- Power Conversion Stations comprising of inverters, transformers and switchgears;
- Substation and BESS;
- Low Voltage Distribution Cables;
- Grid Connection Cables;
- Fencing, security and ancillary infrastructure;
- Access tracks; and
- Green Infrastructure.

4.56. The detailed information on the components listed above, such as the number of solar PV modules, the maximum and minimum heights of the solar PV modules and the depth of the mounting equipment are set out in **Appendix 4-1**. These details have been used for the environmental assessments as detailed in **Chapters 7 to 18**.

4.57. In accordance with the Rochdale Envelope approach (as described above) a parameter plan for the operational phase of our Project is provided in **Figure 4-3**. This shows the proposed locations of the different elements of our Project, which for some elements include potential alternative site locations, for instance for batteries and substations.

Figure 4-3: Operational Parameter Plan

DUNHAM

NEWTON ON TRENT

RAGNALL

RIVER TRENT

Trent Valley Way

THORNEY

NORTH CLIFTON

FLEDBOROUGH

Sustrans Route 647

Trent Valley Way

SOUTH CLIFTON

HIGH MARNHAM

SKEGBY

LOW

Sustrans Route 647

Key

- Potential location for substation and BESS or solar PV panels
- Solar PV panels, power conversion stations and supporting infrastructure. Lowest point of PV panels is 0.7m AGL. Highest point of PV panels is 3.5m AGL.
- Solar PV panels, power conversion stations and supporting infrastructure. Lowest point of PV panels is 1.3m AGL. Highest point of PV panels is 3.5m AGL.
- Solar PV panels, power conversion units and supporting infrastructure. Lowest point of PV panels is 1.8m AGL. Highest point of PV panels is 3.8m AGL.
- Land for potential cable route
- Land for mitigation and enhancement, including new grassland, wildflower meadow, hedgerow planting and tree planting. Land may also be used for access and cable routes.

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one earth solar farm

PROJECT	**One Earth Solar Farm**
DRAWING TITLE	**Parameter Plan**
CLIENT	**One Earth Solar Ltd.**

DRAWN BY **JG**	DRAWING NO.
CHECKED BY **SG**	**XX**
DATE **24/04/2024**	REV **0**

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4.58. **Figure 4-3** shows the location of:

- PV Solar Modules including the differing heights across our Site;
- The potential locations for substation and BESS (see further details below on optionality);
- The land for the potential cable route (see further details below on optionality); and
- Land for mitigation and enhancement (which may also be used for cable routing).

4.59. Approximately 350 hectares of land is proposed for enhancement and mitigation and is likely to include grassland, wildflower meadows, hedgerow planting and tree planting. It is noted habitats will also be enhanced and created within land shown as having PV Solar Modules. The broad aim will be to improve connectivity, both within our Site and the wider landscape, to create a mosaic of a range of habitat types, benefitting a diverse variety of fauna as a result, and to create a landscape planting to screen the visual impact of our Project.

4.60. During operation our Project will be maintained and operated in accordance with the following management plans. These documents will be submitted as part of our DCO application:

- Outline Battery Safety Management Plan (OBSMP): this will set out the key fire safety provisions for the BESS proposed to be installed in our Project including measures to reduce fire risk and fire protection measures. The OBSMP will take into account good practices for battery fire detection and prevention, in addition to setting an emergency response plan.
- Outline Landscape and Ecology Management Plan (oLEMP): this will set out the short and long-term measures and practices that will be implemented to establish, monitor, and manage landscape and ecology mitigation and enhancement measures embedded in the design. An oLEMP is presented in **Appendix 12-5**.
- Outline Operational Phase Environmental Management Plan (oOEMP): this oOEMP will identify how commitments made in the ES will be translated into actions and includes a process from implementing the actions through to the allocation of key roles and responsibilities for the appointed contractor(s). It will be designed and operated with the objective of compliance with the relevant environmental legislation and mitigation measures set out within the ES.

4.61. Our Project will be operational for 60 years. It is assumed that the Solar PV modules will be replaced once during the operational phase. Where possible, the likely estimates, type and quantities of waste generated during the operational phase of our Project as well as the measures to reduce waste will be presented in the ES.

4.62. Further details on the measures included within our Project to reduce any risks of major accidents and disasters, as well as the inclusion of air quality modelling relating to any unplanned atmospheric emissions from the BESS will be included within the ES.

Construction Phase

4.63. At this stage it is anticipated that the construction phase will commence in 2027 and will be completed in 2029.

4.64. Construction working hours will be 7.00 - 19.00 hours Monday to Saturday with allowance for occasional, overnight working where operations cannot be paused, for example completion of the Horizontal Directional Drilling (HDD).

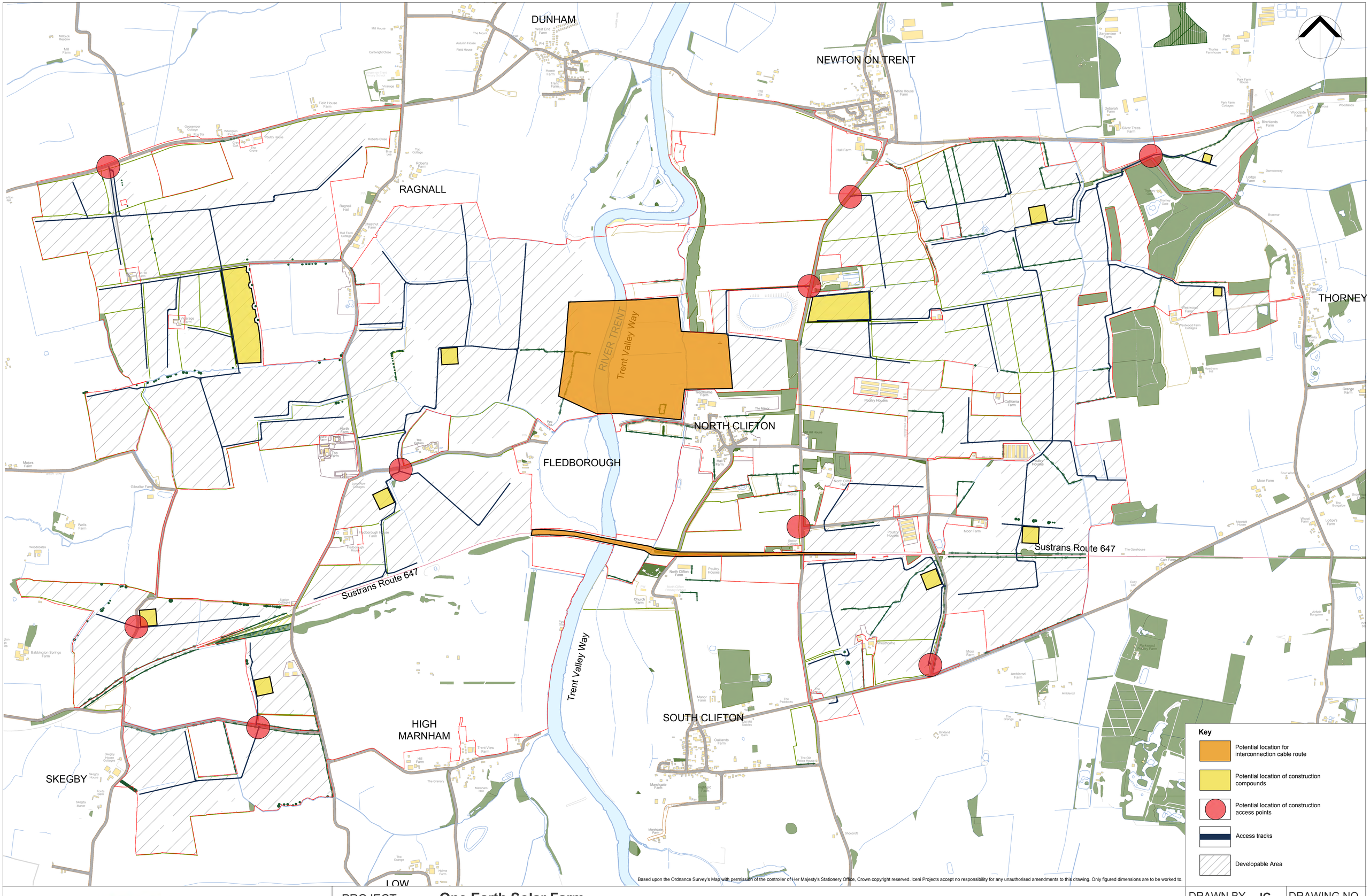
4.65. Construction activities will include:

- Site preparation, such as targeted site clearance and creation of access points:
- Transportation of construction materials, plant and equipment;
- Set up of temporary on-site construction compounds and security fencing;
- Road access upgrade and new road construction including haul roads;
- Construction of cable crossing points over the River Trent;
- Upgrading existing tracks and construction of new access roads within our Site;
- Marking the location of infrastructure components; and installation such as:
  - assembling module mounting structures and then mounting the modules themselves;
  - Installation of electric cabling, substations, inverters, transformer cabins, and battery storage units;
  - Construction of the Substation compounds, BESS compounds, Power Conversion Stations and installation of equipment;
- Landscaping and habitat enhancement; and
- Testing and commissioning.

4.66. Details on the likely duration of the construction activities and the likely construction plant to be used within the construction phase are provided in **Appendix 4.1**.

4.67. As above, in accordance with the Rochdale Envelope approach a parameter plan for the construction phase of our Project is provided in **Figure 4-4**.

Figure 4-4: Construction Parameter Plan



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one earth solar farm

PROJECT	**One Earth Solar Farm**
DRAWING TITLE	**Construction Parameter Plan**
CLIENT	**One Earth Solar Ltd.**

DRAWN BY **JG**	DRAWING NO.
CHECKED BY **SG**	**XX**
DATE **24/04/2024**	REV **0**

4.68. **Figure 4-4** shows the location of:

- the likely areas of construction compounds;
- the preliminary construction routes; and
- the cabling options across the River Trent (see further details below on optionality).

4.69. During construction our Project will be subject to the following management plans:

- Outline Construction Environmental Management Plan (oCEMP): the oCEMP will set out the effective, site-specific procedures and mitigation measures to monitor and control environmental impacts throughout the construction phase of our Project. This will ensure that construction activities so far as is practical do not adversely impact amenity, traffic or the environment in the surrounding area. The oCEMP also sets out the monitoring and auditing activities designed to ensure that such mitigation measures are carried out, and that they are effective. For the purposes of the PEIR, measures that are considered to be included within our Project and which ensure there will not be likely significant effect (for example the use of wheel washing to stop construction dust on the local roads) are set out in a Construction Environmental Measures Register within **Appendix 4-2**. These documents will be submitted as part of our DCO application:
- Construction Traffic Management Plan (CTMP): the purpose of the CTMP is to propose how construction traffic including site personnel movements will be safely controlled at our Site by the developer and its sub-contractors. This will include:
  - routing of construction vehicles;
  - access arrangements to our Site;
  - details of the vehicle holding area(s);
  - details of any diversion, disruption or other abnormal use of the public highway or public right of ways during construction works;

- Outline Soils Management Plan (oSMP): this will manage any potential impacts to the soil (and agricultural land) during and on completion of our Project (considering the construction, decommissioning and operational phases). The oSMP will identify those areas within our Site which may be more susceptible to damage, for example, the temporary access tracks, construction compounds and steep slopes; and will set out details of when soil handling should be avoided (for example when it is wet or after periods of heavy rainfall or high winds) and it will advise on when soils are suitable for being handled or trafficked. The oSMP will also detail measures for soil management and follow the principles of best practice to maintain the physical properties of the soil, with the aim of restoring the land to its pre-construction condition following the temporary construction use and at the end of the lifetime of the Proposed Development, after decommissioning. Further details are provided in **Appendix 9-3**.
- Outline Employment Skills and Supply Chain Management Plan (OESSMP): the OESSCMP sets out measures to maximise opportunities to promote economic benefits in relation with skills, supply chains, and employment in the local region, which is required to deliver the entirety of our Project. For example, how our Project will develop essential skills which would benefit the local population through apprenticeships and workforce training.

4.70. Where possible, details on the potential waste generated during the construction phase of our Project as well as the measures to reduce waste, will be presented in the ES.

Decommissioning

4.71. As above, our Project will be operated up to 60 years after which it will be decommissioned. For the purposes of this PEIR, the technical assessments presented in **Chapters 7 to 18** consider a 60 year lifespan. Decommissioning will include the removal of all above ground infrastructure with the exception of the two project substations. Permissive paths would also be removed. Underground cables may remain in situ. Trees and hedgerows planted as part of our Projectare assumed to remain in situ when the land is returned to the landowners. It is considered all of the solar PV Modules and batteries used in our Project will be recycled. At this stage, it is considered decommissioning will occur over two years.

4.72. During decommissioning our Project will be subject to a Decommissioning Management Plan and a Decommissioning Traffic Management Plan. This will set out the principal decommissioning activities and the measures that will be implemented, so far as is practical, to ensure the works do not adversely impact amenity, traffic or the environment in the surrounding area. It will also set out the monitoring and auditing activities designed to ensure that such mitigation measures are carried out, and that they are effective. An Outline Decommissioning Management Plan will be submitted as part of our DCO Application.

Access

4.73. During construction, operation and decommissioning, access around our Site will be from existing and upgraded strategic points on the public road network, with access achieved via upgraded farm access tracks and new access tracks. **Figure 4-5** shows the location of the indicative access gates.

Figure 4-5: Scheme Access Points / Gates



4.74. A review of the potential for access to our Project using the River Tent has been undertaken and is reported in **Appendix 10.2: Transport Assessment**. As our Project does not feature any suitable river quay facilities to offload materials it is considered that the movement of bulk materials is not feasible. Consideration will be given to the use of the river for the movement of Abnormal Indivisible Loads (AIL) associated with our Project; this will be reported within the ES when further assessment has been undertaken.

4.75. To construct our Project, a variety of vehicles will be required. These will include, but not limited to:

- cars, and Light Goods Vehicles (LGV) and/ Vans;
- articulated Heavy Goods Vehicles (HGV) delivering plant, materials and electrical components;
- rigid HGV delivering bulk materials such as aggregate, ready mix concrete, etc for use on our Site;

- specialist machinery, usually delivered using a low loader style articulated HGV, including loads that may include loads such as directional drilling equipment and excavation plant (for the cable grossing under the River Trent); and
- Abnormal Indivisible Loads (AILs) carrying special oversized loads such as electrical grid transformers.

5. Legislative and Planning Policy Context

Introduction

5.1. As set out within the preceding chapters, the primary legislative requirement applicable to our Project is the Planning Act 2008 (as amended) (the 'Planning Act'). Secondary to this legislation is the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended) (the 'EIA Regulations'). Alongside this legislation is a framework of national and local planning policy against which decisions can be made.

5.2. This chapter presents a summary of the Planning Act 2008 and key national and local planning policy relevant to energy development and our Project. Where planning policy is specific to a particular environmental technical aspect, further information is also presented in an appendix to each technical chapter. Further details of the EIA Regulations are set out within **Chapter 2: Environmental Impact Assessment** and throughout this PEIR.

5.3. A review of policy relevant to each topic chapter will be included within the ES. The weight to be given to certain policies can inform the assessment of effects and will depend on whether the policy is determinative (as a result of being a policy in an NPS which has effect) or an important and relevant consideration (as is the case for local policies). The weight to be given to draft policy will also vary depending on the stage it has reached. Although adherence to planning policy (and the weight given to certain policies) will have often informed the assessment of effects as detailed within the ES, in particular helping to inform whether an environmental effect is significant or not, absolute compliance of our Project with relevant planning policies will not be undertaken within the ES but will be set out in the Planning Statement which will also accompany the DCO application. It is noted that all legislation, national policy and local policy has been considered and accounted for in the environmental assessment.

Planning Act 2008[4]

5.4. Our Project is classified as a National Significant Infrastructure Project (NSIP), in accordance with the Planning Act 2008, as it comprises:

- The construction or extension of a generating station (Part 3, Section 14(1)(a)); and
- Its capacity will be more than 50MW (Part 3, Section 15(2)).

[4] His Majesty's Office (HMSO) (2008) Planning Act 2008 (as amended)- https://www.legislation.gov.uk/ukpga/2008/29/contents

5.5. Therefore, a Development Consent Order (DCO) application under the Planning Act 2008 is required to be made to the Planning Inspectorate (PINS) as the Examining Authority, for determination by the Secretary of State (SoS for Energy Security and Net Zero (DESNZ)).

5.6. Section 104 of the Planning Act 2008 applies where a relevant NPS has effect[5]. NPS EN-3 (Renewable Energy Infrastructure) applies to solar photovoltaic (PV) greater than 50 MW in England and greater than 350 MW in Wales and therefore Section 104 applies. Under Section 104 the SoS must decide the Project in accordance with the relevant NPS, unless the adverse impacts outweigh the benefits.

5.7. An overview of the NPSs that have been considered from a planning policy perspective as part of undertaking this PEIR are listed below with a summary of their content set out within **Chapters 7 to 18**.

National Policy

5.8. In accordance with Section 104(2) of the Planning Act 2008, the SoS must determine our Project in accordance with the relevant NPS, when deciding whether or not to grant a DCO.

5.9. There are three NPS relevant to our Project:

- Overarching National Policy Statement for Energy (EN-1)[6];
- National Policy Statement for Renewable Energy Infrastructure (EN-3)[7]; and
- National Policy Statement for Electricity Networks Infrastructure (EN- 5)[8].

5.10. Further details of these NPSs are set out in **Chapters 7 to 18**.

[5] Section 104 is where national policy statements have an effect in the decision making (i.e. considering the National Planning Statements when making a decision).

[6] Department for Energy Security & Net Zero (2023) Overarching National Policy Statement for Energy (EN-1).

[7] Department for Energy Security & Net Zero (2023) Policy Statement for Renewable Energy Infrastructure (EN-3).

[8] Department for Energy Security & Net Zero (2023) Policy Statement for Electricity Networks Infrastructure (EN-5).

5.11. At a national level the National Planning Policy Framework (NPPF)[9] sets out the government's planning policies for England and how these are expected to be applied. The NPPF does not contain specific policies for NSIPs as these are determined in accordance with the decision-making framework in the Planning Act 2008 and any relevant NPSs, but it still can be an important and relevant matter for the purposes of the Secretary of State's decision making when determining the DCO application. The NPPF also provides relevant context for individual assessment topics. Further details of the NPPF are set out in **Chapters 7 to 18**.

Local Planning Policy

5.12. The NPSs are the primary consideration for DCO applications. Nevertheless, Local Plans and policies are still considered an important and relevant matter in deciding an application for a DCO, although in the event of any conflict, the relevant NPS(s) prevails.

5.13. The relevant local planning policies of the adopted development plans for each of the 'host' planning authorities have been considered as part of this preliminary assessment, these are listed below with further summary details set out in **Chapters 7 to 18**.

- Newark and Sherwood District Council, Local Development Framework, Amended Allocations and Development Management, Development Plan Document (2023)[10]
- Newark and Sherwood District Council, Amended Core Strategy Development Plan (2019)[11];
- Central Lincolnshire Local Plan (2023)[12];
- Bassetlaw District Council Local Development Framework, Publication Core Strategy and Development Management Policies (2010)[13]; and
- Draft Bassetlaw Local Plan 2020-2038: Main Modifications Version, August 2023[14].

[9] Available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2

[10] Newark and Sherwood District Council (2023) Local Development Framework, Amended Allocations and Development Management, Development Plan Document

[11] Newark and Sherwood District Council (2019) Amended Core Strategy Development Plan

[12] Central Lincolnshire Local Plan (2023)

[13] Bassetlaw District Council (2010) Local Development Framework, Publication Core Strategy and Development Management Policies

[14] Bassetlaw District Council (2023) Draft Bassetlaw Local Plan 2020-2038: Main Modifications Version, August 2023

6. Methodology for the Preliminary Environmental Information Report

6.1. This PEIR has been produced in accordance with the requirements of Regulation 12(2) of the EIA Regulations, which state:

"In this regulation, "preliminary environmental information" means 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)."

In addition to the EIA Regulations, the PEIR has been produced in accordance with PINs Advice Note Seven15 taking note of paragraph 8.4 which states:

"*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*".

Approach to the Preliminary Environmental Information Report

6.2. Within our PEIR, each technical aspect as presented in **Chapters 7 to 18** documents the bespoke elements of the methodology used to undertake a preliminary assessment of potentially significant environmental effects. The assessments do, however, take a broadly similar overarching approach that includes:

- Defining the Study Area: the study area is a geographical area within which it is considered there may be environmental effects as set out in technical guidance. So, if considering changes in air quality, it is the area within which it is considered there could be changes in the quality of air as a result of our Project based on the likely distances as detailed in the guidance from the Institute of Air Quality Management. Study areas are not necessarily consistent between technical aspects, so (for example) the study area for air quality may be different to the study area for noise.

[15] Available at: https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-seven-environmental-impact-assessment-process-preliminary-environmental-information-and-environmental-statements/

- Current Environmental Conditions: this is also described as the 'baseline' and sets out how data on the existing environment conditions within our Site and surrounding area have been collected such as through project specific monitoring (for example ecological surveys) and the collection of data from reputable sources (such as the local records centres). The results are reported and where possible visualised. The details of any future surveys we will be undertaking is also set out.
- Future Environmental Conditions: within our preliminary assessment we have considered the likely environmental changes of our Site and surrounding area, without the implementation of our Project. This can also be described as the 'future baseline'. This draws on details contained within policy and technical guidance. For example, data from the Department for Environment, Agriculture and Rural Affairs (Defra) shows air quality is expected to improve overtime with the projected increase in cleaner vehicles (either newer vehicles with cleaner emissions or electric cars with no emissions).
- Environmental Measures: as described in **Chapter 2: Environmental Impact Assessment**, our PEIR describes the environmental measures that have been incorporated into our Project which will help to ensure that any likely significant environmental effects can be avoided or where such is not possible, to ensure that they are minimised. Environmental measures also include the measures which will benefit the local environment, such as the ecological enhancements which will improve local biodiversity. These are listed in the technical chapters as they are specific to the particular technical aspect and not repetitious of more general scheme description as detailed in **Chapter 4: Our Project**.
- Potential Likely Significant Effects Scoped Out: through the EIA Scoping Opinion received from PINs (see **Volume 3: Scoping Consultation**), we have agreed the effects which are scoped out of the environmental assessment as they are not considered likely to be significant. This includes the evidence that justifies this approach. They will not be considered further within the EIA.
- Preliminary Environmental Assessment: this section sets out our approach to the preliminary assessment of each technical topic, to determine the preliminary likely significant environmental effects of our Project. This considers the methodology used to determine the likely effects from the construction, operation and decommissioning phases. The methodology makes reference to published guidance where appropriate. The effects in this PEIR are described as either:

Significance	Definition of Significance
Not Significant	No significant effect to an environmental resource or receptor.

Significant Beneficial	Advantageous or positive effect to an environmental resource or receptor.
Significant Adverse	Detrimental or negative effect to an environmental resource or receptor.

As described in **Chapter 4: Our Project**, we are currently exploring options for our cables to cross the River Trent. The options include either directional drilling under the River Trent or using the existing Fledborough viaduct. We are also looking at options for the location of our compounds which will contain our substation and BESS. The options relate to the potential locations on the western side of the River Trent within our Site. Within the environmental assessments the likely significance of effects from each of the options for cable crossing and the locations of the BESS and substations have been considered within the technical assessments as presented in **Chapters 7 to 18**. The highest level of significance from these options has then been reported and represents the worst case in terms of environmental effects.

- Conclusions: a summary of the preliminary likely significant effects, with further information is presented. It also includes the next steps to be undertaken as part of the EIA.

Appendices

Appendix 1-1: Environmental Consultant Technical Team

Appendix 4-1: Project Description

Appendix 4-2: Environmental Register

Appendix 1-1: Environmental Consultant Technical Team

Table 1-1: EIA Consultant Team

Name	Company	Aspect Covered	Qualifications	Description of Competence
Toby Gibbs	Logika Consultants Ltd	EIA	CEnv, CMIEEM	A Chartered Environmentalist and a specialist in EIA having worked on many infrastructure projects, and with experience in the UK, Europe, Africa and the Middle East. Projects include being engaged to provide environmental support to the development of Heathrow Airport's expansion proposals, a major NSIP development. He was also the Director responsible for the EIA that formed part of the DCO documentation for reopening Manston Airport in Kent and had a leadership role in the EIA for Hinkley Point C new Nuclear Power Station DCO application.
Guido Pellizzaro	Logika Consultants Ltd	EIA	BSc (Hons) MIAQM AMIEnvSc PIEMA	Environmental consultant with more than 15 years' experience overseeing the production of EIA reports and ES' for a range of developments, including solar, throughout the UK. Expert in the management of ES' including liaising with clients, external organisations and project team members. Working as part of the team in providing technical advice on a wide range of environmental issues.

Alan Kirby	Logika Consultants Ltd	Ecology and Biodiversity	BSC(HONS), MSC, PHD	Alan is an ecologist with 19 years of consulting experience. Alan has led the biodiversity inputs on a number of large infrastructure projects including input into the ES's as part of the DCO applications for Rampion 2 Offshore Wind Farm (ongoing), the Heathrow Expansion Project, Navitus Bay Offshore Windfarm (NBOWF) and the North London (Electricity Line) Reinforcement Project. He has also provided input to DCO Examination hearing sessions (e.g. Hinkley Point C NNB, NBOWF and Triton Knoll Electrical System), Public Inquiries and Examinations in Public including the provision of written representations, the negotiation of Statements of Common Ground and the giving of oral evidence as an expert witness.
Craig Thwaites	Logika Consultants Ltd	Hydrology and Hydrogeology	MEng	Craig has worked on a variety of complex solar projects across the UK including Tregonning Solar Farm and Inkersall Road Solar Farm. Within all these projects Craig uses his experience to impact design and inform the design team on the requirements and benefits that are provided by implementing sustainable flood and drainage solutions.
Simon McMillan	ADAS	Land and Soils	BASIS, BSSS	Simon is a senior soils consultant for ADAS (an RSK company). He has expertise in the management and delivery of soils consultancy and agricultural and environmental research. In recent years he has delivered soil surveys and provided reports for hundreds of projects, including large scale solar, rail, housing and cross-country pipeline projects. These typically comprise agricultural land classification (ALC), soil resources plans and soils aftercare management plans. Simon was a lead surveyor Welsh Government project that undertook the largest scale soil survey for over 30 years, covering around 3,000 ha of Wales to

				help develop the Welsh Government's predictive ALC tool.
Claire Cogar	Iceni	Buried Heritage	MCIfA	Claire is the director of archaeology at Iceni. She has extensive experience of development-led archaeology. She has managed works on the Thames Tideway and HS2 Infrastructure schemes and has carved out a niche in undertaking the archaeological and heritage components of large-scale public sector health projects.
Georgia Foy	Iceni	Cultural Heritage	BA (hons)	Georgia specialises in large scale development schemes affecting the historic environment and townscape character, where a careful but pragmatic approach is needed to balance the need for development with the heritage and townscape sensitivities of a place. Her particular expertise is in detailed policy appraisals, design and feasibility advice and inputting into Environmental Impact Assessments
Sam Griffiths	Iceni	Landscape and Visual	CMLI	Sam is an Associate Landscape Architect at Iceni working on complex projects as part of multidisciplinary teams, including preparation of landscape planning and design deliverables for Nationally Significant Infrastructure. Sam was part of the landscape team for the DCO consented Longfield Solar Farm.
Gordon Buchan	Pell Frischmann	Transport and Access	BEng (Hons), MSc, CMILT, FCIHT	Gordon Buchan is a highly experienced Transport Planner, having worked on wide range of projects across the UK, Ireland and Scandinavia. Gordon specialises in private sector development and renewable energy projects. He has supported several EDF projects in the UK and have acted as Expert Witness on a number of Public Inquiries and NSIP hearings. He has given presentations at the ICE Infrastructure Show at the NEC and at the All Energy conference in Aberdeen on two occasions. Gordon was a finalist in the 2018 NCE 100 Alternative Energy Award category.

Chris Whall	Air Quality Consultants Ltd	Air Quality	CEnv, MiEnvSci, MIAQM	Chris is a Chartered Environmentalist with over 20 years' experience in environmental consulting. He has a background in air quality, climate change and emissions quantification, impact assessment and management. Chris has particular expertise in the management and delivery of complex air quality and carbon assessments for major infrastructure projects, most notably in the power and transport sectors including Development Consent Order applications and highly contentious public consultation exercises.
Laurence Caird	Air Quality Consultants Ltd	Climate Change	Csci, MIEA, IAQM	Laurence is a Chartered Scientist with 15 years' experience in the field of environmental consultancy with extensive experience in air quality and climate change assessments. He helped shape the methodology for the assessment of greenhouse gas emissions within EIA to satisfy the requirements of the EIA Regulations 2017. He has produced carbon footprints and greenhouse gas assessments for a number of projects including major infrastructure projects including transportation, as well as EIA residential, commercial and mixed-use developments and industrial facilities

Jon Sims	Noise Consultants Ltd	Noise and Vibration	BEng (hons), BSc (hons), MIO	Jon has over 15 years experience in acoustic consultants, this includes many large infrastructure projects including onshore and offshore wind farms, energy transmission systems, rail, road and large industrial projects. Jon provided consultancy advice on noise to HS2 Ltd for several years, particularly in relation to the construction and operation of Phase 1 of HS2, the DCO application for Triton Knoll Offshore Wind Farm Onshore Electrical system, including giving evidence on noise at the planning hearing and environmental permitting for several power stations.
Jon Wright	Iceni	Health	Full Member RTPI, AIEMA	Jon has significant solar experience in the completion on heath assessments; he held a role within the in-house planning team of Lightsource BP, a global leader in the development and management of solar projects and smart energy solutions. He was responsible for large-scale solar farm planning applications throughout the UK and Republic of Ireland.
David Tyrer	Logika Consultants Ltd	Socio-Economics	Msc BA (Hons)	David is an environmental policy and economics expert with nearly 20 years professional experience. He specialises in socio-economic impact assessment, cost benefit analysis, impact assessment and valuation, in the context of government policy as well as development plans and projects. He has led studies for the then Department for Communities and Local Government on the UK costs and benefits of the EU proposals for a revised EIA Directive and a further analysis of the adopted proposals (now the 2017 EIA Regs). He has long experience of preparing and reviewing socio-economic assessment as part of the EIA and DCO processes (including airports, nuclear power stations, wind farms, urban extensions, and various mixed-use developments in the UK and overseas).

Appendix 4-1: Project Description

Good Design

Good design, as required by NPS EN-1 (section 4.7)[1], has been a fundamental consideration from the outset of our Project, influencing the siting, sustainability, and appearance of our Project, as well as the functionality of each individual element.

Design is an iterative process, and as such our Project masterplan has evolved between non-statutory consultation and statutory consultation and will continue to develop through until submission of the DCO. Design Principles, prepared with reference to the National Infrastructure Commission Guidance on Design Principles for National Infrastructure[2] were adopted by our Project from the outset and continue to guide decision making throughout design development. The Design Principles are categorised under the headings of climate, people, places and value. As well as developing the design in line with the Design Principles, our Project committed to appreciate the wider context in which the Potential Order limits are located, engage meaningfully with local and technical stakeholders, and seek to continually measure and improve the proposed design.

The Project Design Principles are set out in Table 1 with a description of how they have been embedded in our Project layout.

Table 1: Project Design Principles

Category	Design Principle	How this has been embedded in our Project to date.
Climate	Maximise the volume of clean energy that can be provided to the national electricity grid.	The Project has sought to allocate sufficient land to the solar PV area to generate an output of approximately 740MWac.
	Seek to reduce embodied carbon throughout the project lifecycle.	The amount of concrete used across our Project continues to be minimised, for example via the preference for pile driven frames rather than concrete footings.
	Craft a scheme that is resilient to the effects of climate change.	All land subject to the greatest level of flood risk has been excluded from the developable area. The height of infrastructure within areas of potential low flooding has been staggered, allowing for a 300mm freeboard.

[1] Available at: https://assets.publishing.service.gov.uk/media/65a7864e96a5ec0013731a93/overarching-nps-for-energy-en1.pdf

[2] Available at: https://nic.org.uk/app/uploads/NIC-Design-Principles.pdf

	Protect and improve the local environment.	Offsets have been incorporated from environmental features, including the following minimum measurements: > Trees: 10m > Woodlands: 15m > Hedgerows: 10m > Waterbodies: 10m > Drains: 8m > Rivers: 16m > Public Rights of Way: 15m > Badger Sets: 30m Our Project includes improvements to existing hedgerows and the planting of new hedgerows. 100ha. of land has been designed to accommodate ground nesting birds The use of Best and Most Versatile (BMV) land has been minimised as far as practical.
People	Protect features that are important to the local community.	Larger infrastructure, such as the project substations and BESS, have been sited at least 300m from residential properties and 100m from PRoW. Bespoke offsets have been incorporated from isolated properties, including: > Top Farm > Long Row Cottages > Fledborough House > Station Cottages > The Old Police House > The Old Station House > Clifton Hall > 1 Collingham Road

		> Westwood Farm Cottages
Place	Protect and enhance places of value.	The developable area close to Fledborough has been reduced to protect the continuity of the village from east to west.
	Create new places of amenity and ecological value.	A series of beetle banks, bug hotels and herptile hibernaculas is proposed across the site
Value	Enhance local recreational assets.	A permissive path network is proposed, connecting to existing PRoW.
	Create jobs and contribute to the local economy and education provision.	750 peak jobs during construction 15 – 20 full time jobs during operation
	Provide resource for research and development.	An area of the Site has been set aside for research and development, focussing on management techniques and landscape enhancement.

Components of the Project

This section lists the key components and activities associated with our Project during construction, operation and maintenance, and decommissioning.

Construction

Construction is anticipated to start in 2027 and be completed in 2029. It is estimated that a maximum of approximately 750 workers will be working on Site at any one time. This represents the peak of construction activity. It is assumed that construction would be undertaken across the entire Site, simultaneously. This is considered to be the worst case scenario for environmental impacts and is therefore the scenario assessed in the PEIR.

Construction will be undertaken in line with the following management plans

- Outline Construction Environmental Management Plan;
- Outline Construction Traffic Management Plan;
- Outline Soils Management Plan; and
- Outline Employment Skills and Supply Chain Management Plan.

The management plans listed above will accompany the ES at upon submission of the DCO application. An overview of the management plans is provided in the relevant chapter.

Construction working hours will be 7.00 - 19.00 hours Monday to Saturday with allowance for occasional overnight working where operations cannot be paused, for example completion of the HDD.

Mobile lighting towers, fitted with directional hoods/cowls, will be used for all activities during hours of darkness (within permitted working hours) or within sheltered areas where natural light is not sufficient.

All public rights of way will remain open during construction, but temporary minor diversions may be required and managed in line with the Outline Construction Traffic Management Plan.

At this stage it has been estimated that during the peak of the construction phases our Project will generate 60 car/ light duty vehicles per day on the east and on the west of the River Trent (a total of 120 vehicles) and 272 heavy goods vehicles per day on the east and on the west of the River Trent (a total of 544 vehicles) This represents the peak number of construction traffic journeys based on the preliminary information.

A review of the potential for access to our Project using the River Tent has been undertaken and is reported in **Appendix 10.2: Transport Assessment**. As our Project does not feature any suitable river quay facilities to offload materials it is considered that the movement of bulk materials is not feasible. Consideration will be given to the use of the river for the movement of large infrastructure (such as the transformers) knows as Abnormal Indivisible Loads (AIL) associated with our Project; this will be reported within the ES and submitted in the DCO Application when further assessment has been undertaken.

We have retained flexibility to allow for two methods of connecting the eastern and western sides of our Project across the River Trent. The first option is to install electrical cables beneath the river using horizontal directional drilling (HDD). The second option is to attach electrical cables to the Fledborough viaduct. The location of both options is shown on the Construction Parameter Plan (see **Figure 4-4**). Whilst only one option will be required, implementation of both options has been considered and assessed in this PEIR. It is noted that for the HDD option, during construction the preliminary assessments have considered the use of an HDD rig to allow for direction drilling.

Table 2 identifies the key activities and the associated indicative durations that will be undertaken throughout the construction period.

Table 2: Construction Activity and Durations

Construction Activity	**Indicative Duration**
Site Establishment including: > Construction of site access points > Setting out	3 months
General Deliveries: > Import and export of materials from site.	Ongoing throughout 25 months

Establishment and decommissioning of site compounds including: > Installation of surfacing for material storage and parking > Installation of welfare buildings and site offices > Establishment of secondary compounds which will be used to store materials and welfare to limit movement of internal traffic.	4 months
Site Tracks: > To comprise crushed aggregate	6 months
Installation of geotextiles	14 months
Preparation of substation platform	6 months
Cabling Works	6 months
Pouring of substation concrete	2 months
Substation HV Deliveries	3 months
Internal HV Works & Buildings	3 months
Solar Array Works > Piling of mounting structures to 1.5 – 3m below ground. > Mounting of 1,445,130 modules to be completed using lifting machinery but fixed using hand held power tools.	16 months
Installation of cabling & cabling sand	16 months
Battery Platform	6 months
Battery Foundations	4 months
Battery Cabling	4 months
Site Restoration & Fencing	Ongoing throughout 25 months
Commissioning	5 months
Final Connection	1 month

Staff Movements	Ongoing throughout the anticipated 25 month programme

Table 3 below shows the indicative construction plant required for our Project.

Table 3: Anticipated Construction Plant

Plant	Description	Indicative Dimensions	Number of Items During Construction Period
Excavator	Used for site preparation, grading, and trenching for cable laying.	Crawler Excavators → 22.5 tons (9.53x 3.17x 2.96, Lx Wx H) Smaller Excavators → 1.7 tons (dig depth: 2.57m, dump height 2.63m)	40-50 units
Mobile Cranes	Lifting heavy equipment and panels into place.	Varies widely depending on the capacity, but could range from 20 to 500+ tons. Height when fully extended could range from 20 to 100+ meters.	10 units
Compact track loaders	Moving smaller loads and materials across rough terrain.	Length around 3 to 4 meters, width around 1.5 to 2 meters, height around 2 meters.	10 units
Compact track loaders	Moving smaller loads and materials across rough terrain.	Length around 3 to 4 meters, width around 1.5 to 2 meters, height around 2 meters.	10 units
Telehandlers (Telescopic Handlers)	Used for lifting and transporting materials and equipment around the site	Height reach could vary from 6 to 20 meters, with a lifting capacity of 2 to 4 tons.	40 units

Bulldozers	Used for grading and levelling the site.	Length around 5 to 8 meters, width around 3 to 4 meters, height around 3 meters.	10 units
Aerial Work Platforms (AWPs) or Cherry Pickers	Used for accessing elevated areas during installation	Height reach could vary from 10 to 30 meters.	30 units
Flatbed trucks	Transporting solar panels, mounting structures, and other large materials.	Length could vary from 6 to 18 meters, width around 2.5 to 3 meters.	Flatbed trucks
Dump trucks	Hauling earth, gravel, and other construction materials	Varies widely, but typical dimensions could be around 8 meters in length, 3 meters in width, and 3 meters in height.	10 units
Water trucks	Used for dust suppression and site watering during construction	Could be similar to flatbed trucks or smaller.	10 units
Generators	To provide temporary power during installation	Relatively small in size	25 units
Concrete Mixers and Pump Trucks	Used for pouring concrete foundations for mounting structures and equipment pads.	Up to 8m	10 units
Pile driver	Driving piles into the ground	Can be around 3m in height and can provide around 50HP of power.	15-20 Units
Trencher	Cable trenching	As an indication only: > Weight: 1,800kg	20 units

		> Length: 3.7m > Width: 1.9m > Height: 1.8m	
Compactors	Compacting soil and gravel for roads and foundations.	As an indication only: > Weight: 12.6 tons > Length: 5.87 > Width: 2.27 > Height: 2.9m	15 units

Operation

The following management plans will accompany the DCO application:

> Outline Operational Environmental Management Plan;

> Outline Landscape and Ecological Management Plan; and

> Outline Battery Safety Management Plan.

Our Project will be operational for 60 years. It is assumed that the Solar PV modules will be replaced once during the operational phase.

An overview of the approach taken to each management plan, recording the proposed mitigation, is provided in the relevant chapter.

Our Project will comprise the following key elements during operation:

> • Solar array, occupying approximately 965ha. which will comprise:

– Solar panels that convert sunlight into electrical current (as direct current (DC)). Individual modules are typically up to 2.4m in height by 1.3m in width and consist of a series of PV cells beneath a layer of toughened glass with anti-reflective coating. Other PV technologies are developing rapidly and may be available at the time of construction, therefore, to allow flexibility for future module technology to be larger, the maximum height parameter considered within this PEI Report is 3.8m. This maximum height is limited to areas of flood risk. The maximum solar panel height across the rest of the site is 3.5m. The areas of 3.8m and 3.5m high solar panels are shown on the Parameter Plan (see **Figure 4-3**). The module frame is typically built from anodised aluminium. 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 modules are fixed to a mounting structure in groups known as ‘strings’. The number of PV Panels that will make up each PV Table (group of PV Panels within a string) is not yet known. We are seeking flexibility in this arrangement to accommodate future technology developments.

- Mounting frames for the solar panels will likely be the frames which are usually supported by galvanised steel poles. We have assumed that the poles will be driven to a depth of 3m. This is the most common solution on existing UK solar farms. The modules across the Project would be mounted on structures with a minimum clearance above ground level of 0.7m, increasing to 1.5m and 1.8m in areas where there is elevated risk of flooding. These dimensions are maximum parameters and have been assessed in this PEIR. The area covered by each parameter is shown on the Parameter Plan (see **Figure 4-3**).The final elevations of the frames, within the parameters assessed, will be influenced by various design factors such as local topography, drainage design and configuration. The separation distance (interrow distance) between each row of frames would be a minimum 3m for a south facing fixed configuration, dependent upon angle and length of slope, to allow for appropriate maintenance and to minimise inter-row shading.
- Power Conversion Stations (PCS) typically comprise the inverter, transformer, and switchgear (although the inverters can alternatively be located at the panels rather than in this centralised configuration, as described further below). These components may be located next to one another individually or enclosed together in a single container. A single container would occupy the greatest area and therefore has been assessed in this PEIR. The containers are typically externally finished in keeping with the prevailing surrounding environment, often utilising a green painted finish. The containers would be mounted on adjustable legs on an area of hardstanding. This PEIR assumes that the containers will measure 13m (l) x 3m (w) and 6m (h). There is potential for the containers to be lower; however 6m has been assessed to allow for the containers to be elevated in areas of flood risk. There would be up to 170 Power Conversion Stations located within the Solar PV Array area. A Power Conversion Station will comprise two inverters, a transformer, and switchgear which can be grouped together or distributed throughout the Site. It is anticipated that PCSs would be installed on compacted gravel and concrete bases.

> BESS, occupying up to 20ha split over two sites; will allow the storage of energy generated by the solar panels at times of low demand and release to grid at times when demand is high or when solar irradiance is lower, known as load shifting. The BESS will also have the ability to import power from the grid directly to allow the BESS system to help support the grid through grid balancing mechanisms. The BESS will be located in up to two BESS sites next to the substation locations. The BESS sites will consist of a series of battery units with dimensions of around 9.5m x 1.8m x 2.6m (LxWxH) with BESS inverters with dimensions of around 12.5m x 2.5m x 3.5m. There will be a ratio of 8 battery units to every BESS inverter. The BESS compound will also have water tanks for fire suppression, a control building with footprint 15m x 20m, a storage building with footprint 15m x 10m and drainage ponds in the region of 2500m^3 at each BESS location. Given the flexibility currently required with regard to the layout of the BESS, this PEIR has assumed that all areas shown on the Parameter Plan (**see Figure 4-3**) as potential locations for the substations and BESS, totalling 86ha., would 13.5m high such that potential impacts arising from the tallest element has been assessed. It is assumed that areas not required for substations or BESS in the final Project layout will be occupied by solar PV panels.

- Substations: There will be two substations, one on either side of the River Trent. However, the location of the substation on each side of the river is not yet fixed. The potential areas within which the substation could be located are shown on the Parameter Plan (**see Figure 4-3**). These areas are the same as shown as potential areas of the BESS and total 86ha. This PEIR assumes that the substation would occupy the entire extent of the potential 86ha, measuring up to 13.5m in height. In reality, the maximum area of the substation on the eastern side will be 170m x 140m x 13.5m (l x w x h) , occupying a footprint of 23,800m2. The maximum area of the west substation will be 250m x 190m x 13.5m (l x w x h) with a footprint of 47,500m2. Our assessment in this PEIR includes for lightning rods of up to 25m tall within each of the substations. The substations will consist of 33kV switchgear and 2 33/400kV transformers and other power quality equipment such a reactive compensation equipment. The exact design of the substations will be determined later in our Project.
- Grid connection route: This connection route will connect the east and west substations prior to combining into a single cable route to the National Grid substation which is assumed to be located near the existing High Marnham 275kV substation south of the red line boundary on the west side of the Trent.
- Electrical cables, fencing and CCTV: A fence will enclose the operational area of our Project. The fence is likely to be a 'deer fence' (wooden with wire mesh) and 2.2m in height. Pole mounted internal facing closed circuit television (CCTV) systems installed at a height of up to 4.5m are also likely to be deployed around the perimeter of the operational areas, typically these CCTV cameras will be infrared triggered and would not record unless triggered.
- To comply with British Standard (BS) EN 62271-1:2017, if outdoor transformers are used, they will be surrounded by a secure wire mesh fence or metal palisade fence. These will only be located in inverter stations. This fence is likely to be 1.8 to 2.5m in height, and so a height of 2.5m has been assumed for the purpose of this PEIR. In addition, the Onsite Substation would be surrounded by a secure metal palisade fence and would also be up to 3m in height
- Low voltage cabling between PV modules and the inverters (typically via 1.5/1.8kV cables) will typically be located above ground level (along a row of racks), fixed to the mounting structure, and then underground (between racks and in the central inverter's and or transformer input). Medium voltage cables (around 33kV) are required between the transformers, switch gear and the onsite primary substations. The dimensions of trenching will vary subject to the underground cabling which will be based on the number of cables they contain. The trench will typically be up to 1m wide per cable with a maximum depth of 1.2m and will be dependent on the method of installation, ground conditions and number of cables laid in parallel. Subject to engagement with utility providers there may be a requirement for horizontal directional drilling (HDD) within our Project to cross beneath existing buried utilities.
- Landscape enhancement areas will be included across our Project, totalling an area of approximately 250ha, including a network of permissive paths, new species rich grassland, wildflower meadows, tree and hedgerow planting and habitat creation areas.
- Part of the solar PV area will be identified for research and development to monitor and trial landscape enhancements and management techniques.

Decommissioning

Decommissioning is anticipated to last two years and will take place 60 years after our Project becomes operational. A Decommissioning Environmental Management Plan will be prepared prior to decommissioning.

Table 4 presents the plant likely to be used throughout decommissioning.

Table 4: Anticipated Decommissioning Plant

Plant	Description	Indicative Dimensions	Number of Items During Construction Period
Excavator	Used for site restoration, grading, removal of piles	Crawler Excavators → 22.5 tons (9.53x 3.17x 2.96, Lx Wx H) Smaller Excavators → 1.7 tons (dig depth: 2.57m, dump height 2.63m)	40-50 units
Mobile Cranes	Lifting heavy equipment and panels removing panels from site	Varies widely depending on the capacity, but could range from 20 to 500+ tons. Height when fully extended could range from 20 to 100+ meters.	5 units
Compact track loaders	Moving smaller loads and materials across rough terrain.	Length around 3 to 4 meters, width around 1.5 to 2 meters, height around 2 meters.	10 units
Compact track loaders	Moving smaller loads and materials across rough terrain.	Length around 3 to 4 meters, width around 1.5 to 2 meters, height around 2 meters.	10 units
Telehandlers (Telescopic Handlers)	Used for lifting and transporting materials and equipment around the site	Height reach could vary from 6 to 20 meters, with a lifting capacity of 2 to 4 tons.	40 units

Bulldozers	Used for grading and levelling the site.	Length around 5 to 8 meters, width around 3 to 4 meters, height around 3 meters.	10 units
Aerial Work Platforms (AWPs) or Cherry Pickers	Used for accessing elevated areas during installation	Height reach could vary from 10 to 30 meters.	30 units
Flatbed trucks	Transporting solar panels, mounting structures, and other large materials.	Length could vary from 6 to 18 meters, width around 2.5 to 3 meters.	15-20
Dump trucks	Hauling earth, gravel, and other construction materials	Varies widely, but typical dimensions could be around 8 meters in length, 3 meters in width, and 3 meters in height.	10 units
Water trucks	Used for dust suppression and site watering during construction	Could be similar to flatbed trucks or smaller.	10 units
Generators	To provide temporary power during installation	Relatively small in size	25 units

Decommissioning will include the removal of all above ground infrastructure with the exception of the two project substations. Permissive paths would also be removed. Underground cables may remain in situ. Trees and hedgerows planted as part of our Project are assumed to remain in situ when the land is handed back to landowners.

100% of the solar PV panels and batteries used in our Project will be recycled.

Design Parameters

The use of design parameters has been adopted to present a likely worst-case assessment of potential environmental effects of our Project. Wherever an element of flexibility is maintained, the likely worst-case scenario is assumed and impacts reported accordingly. As such, the PEIR has been undertaken adopting the principles of the ‘Rochdale Envelope’, as described in the Planning Inspectorate Advice Note 9. This involves assessing the maximum (and where relevant, minimum) parameters for our Project.

Table 5 sets out the construction and operational parameters that have been assessed within this PEIR.

Table 5: Project Parameters

Component	Parameter Type	Proposed Parameter
Solar PV fields	Location	Solar PVs will occupy land shown for solar panels on the parameter plan (see **Figure 4-3**)
Solar PV Modules and Mounting Structure	Design	The maximum width of the solar arrays will be 9.5m
Solar PV Modules and Mounting Structure	Design	Minimum pile depth will be 1.5m deep. Maximum pile depth will be 3m.
Solar PV Modules and Mounting Structure	Scale	The maximum height of the highest part of the solar array module will be 3.8m above ground level (AGL)
Solar PV Modules and Mounting Structure	Scale	The minimum height of the lowest part of the PV module will be 0.7m AGL
Solar PV Modules and Mounting Structure	Scale	The solar arrays will be south facing
Solar PV Modules and Mounting Structure	Design	The solar modules will face south at 10 - 25 degree pitch
Solar PV Modules and Mounting Structure	Design	Minimum spacing between rows of 3m
Solar PV Modules and Mounting Structure	Design	The solar PV module will be dark blue, grey, or black in colour
Solar PV Modules and Mounting Structure	Design	All DC cables within the solar arrays will be secured to the PV mounting structure or buried underground up to 1m deep.
Solar PV Modules and Mounting Structure	Design	33kV distribution cables to be buried in trenches alongside access tracks or between arrays up to 1.2m deep.

Power conversion station (PCS)	Scale	Power conversion station to be mounted on skid with dimensions 13m x 3m
Power conversion station (PCS)	Scale	PCS within the arrays will not exceed height 6m AGL
Power conversion station (PCS)	Number	There will be up to 170 PCS across the Site.
Access tracks	Design	Internal access tracks will be between 4 and 10m wide with passing places where required.
Access tracks	Design	Internal access tracks will comprise unbound gravel or similar
Substations	Location	Two substation locations will be implemented, one on the west side of the River Trent and one on the east side. The location of the substations is shown on the parameter plan (Appendix 4.2)
Substation	Size	Substation located on the west of the River Trent - dimensions as 250m x 190m (area as 47,500m^2) x height of 13.5m. Lightning rods up to 25m in height may be required. This will be located adjacent or near to the west BESS compound. Substation located on the east of the River Trent - dimensions as 170m x 140m (area as 23,800m^2) x height of 13.5m. Lightning rods up to 25m in height may be required. This will be located adjacent or near to the east BESS compound.
Welfare and storage building(s) for operation and maintenance of PV and BESS	Size	Up to 2No. buildings each measuring up to 40x15x8m

River Crossing	Option 1	Electrical cables will be installed beneath the River Trent using horizontal directional drilling (HDD). The location of the HDD is shown on the Construction Parameter Plan (see **Figure 4-4**).
River Crossing	Option 2	The cable(s) will be attached externally to Fledborough Viaduct crossing the River Trent.
BESS	Number and location	There will be up to two BESS sites, one on the east and one on the west of the River Trent. The locations are shown on the Parameter Plan (see **Figure 4.3**).
BESS	Location	Each BESS compound will be located adjacent to an on-site Substation Location
BESS	Scale	The west BESS will occupy up to 11.2 hectares and measure up to 3.5m tall. This will be located adjacent or near to the west substation compound. The east BESS will occupy up to 8.5 hectares and measure up to 3.5m tall. This will be located adjacent or near to the east substation compound. Buildings within the BESS compound will be up to 8m tall.
Construction	Design	Access points are shown on the Construction Parameter Plan
Construction	Design	There will be two principal construction compounds. One of the west and one of the east

Construction	Design	There will be up to 10 satellite constriction compounds. Five on the east and five on the west.
Lighting	Design	No external lighting will be permanently operated.
Lighting	Design	Operational lighting will be directional, orientated internally, away from the surrounding environment, and will be fitted with features to minimise light spillage.
CCTV	Scale	The camera height will be up to 4.5m tall.
Fencing	Design	The fence around the solar PV area will comprise a deer fence (wooden posts and metal wire mesh) and will be up to 2m in height. The fence posts will measure up to 2.2m above ground level.
Fencing	Design	The fence around the substations, BESS and PCS will be palisade fencing, up to 3m in height.

Appendix 4-2: Environmental Register

Indicative Measures to be included During Construction

Tables 1 to 9 below sets out the indicative measures that will be used during the construction phase of our Project to ensure that construction activities, so far as is practical, do not adversely impact amenity or the environment in the surrounding area. These measures are only in outline at this stage, a final list of environmental measures will be included within the Construction Environmental Management Plan, which will be implemented (as agreed with the host authorities) prior to commencement of the construction works.

For the purposes of the PEIR, the measures set out in Tables 1 to 9 set out our assumption on how environmental impacts during construction will be controlled to ensure likely significant effects do not occur. Measures specific to the management of soils, in particular how Best Most Versatile soils will be protected are detailed in **Appendix 9-3** of the PEIR. These measures are considered to be embedded within the environmental measures included within our Project.

Table 1: Biodiversity

Environmental Issue	Environmental Protection Measure

Ecological receptors including protected/ notable species.	• Appointment of a licenced Ecological Clerk of Works (ECoW) for the duration of the construction works. They will oversee the management of the construction works in terms of managing and protecting (where required) biodiversity. They will ensure compliance with environmental legislation and planning conditions as they relate to nature conservation on site. Duties will include carrying out surveys to identify ecological constraints to site operations, and to help guard against ecological risks from design and construction activity, for example to flora, fauna and water courses. The will ensure compliance with relevant management plans, including the Outline Landscape and Ecology Management Plan (oLEMP).
	• All construction works of our Project will be undertaken with the relevant management plans, this includes:
	  ○ oLEMP that sets out measures to mitigate the potential impacts of construction on biodiversity and landscape features.
	  ○ A Species Protection Plan (SPP).
	  ○ An Invasive Species Management Plan (ISMP).

	These plans will include specific measures such as: ○ Protection and enhancement measures include avoiding areas of high-quality habitat, protection and maintenance of retained vegetation, implementation of a timetable for maintenance and management to protect, manage and enhance habitats. ○ Undertaking vegetation clearance in advance of construction at the appropriate time of year, outside of the bird breeding season and the reptile/ amphibian hibernation period. Should it not be possible to avoid this season, vegetation will be inspected/surveyed by the ECoW immediately before clearance (within 24 hours). ○ Maintaining short vegetation post clearance to displace present amphibians away from the Site. ○ Maintaining disturbed cleared ground in the run-up to construction to minimise the risks of nesting birds attempting to nest. ○ Protecting hedgerows, tree lines, ditches and trees including the tree RPA during construction with suitable buffers and fencing. ○ Application for species licences from Natural England for translocation of animals away from construction areas sufficiently in advance of the works. ○ Implementation of measures to avoid trapping, injuring, or killing wildlife within construction areas. ○ Employing reasonable measures to avoid impacts on bats including maintenance of trees with potential bat roost trees with potential roost features (PRF), which will be protected during development, in line with British Standard BS 5837: Trees in relation to design, demolition and construction by establishing a Construction Exclusion Zone (CEZ) around their Root Protection Areas (RPA). ○ No works will be undertaken within 30m of a badger sett. Where there are badger setts, employing reasonable measures to avoid impacts on badgers including conducting pre-construction surveys, covering exposed trenches and implementing fencing early in the construction phase. ○ All works in proximity to waterbodies/watercourses should follow standard protection measures to ensure their complete protection against pollution, silting and erosion. ○ Undertaking of pre-construction surveys to provide am update on the presence and location of invasive species.

	○ Creating an Invasive non-native plant species (INNPS) method statement. ○ Controlling lighting to minimise visual intrusion and potential adverse effects on sensitive ecology such as bats, as far as reasonably possible. ○ Restricting lighting to working hours (unless in the case of emergency or occasional overnight quiet working), and directing light away from retained habitats, including hoods or cowls to direct light forwards into the construction areas where possible. ○ Avoidance of construction traffic through designated sites. ○ Securing the perimeter of the Site with appropriate fencing, including mammal gates where required to secure Site boundary, including gaps for mammals. ○ Aeration of compacted soils from heavy machinery prior to landscape planting. • Implementing measures to minimise/ prevent dust creation, pollution incidents and noise and vibration impacts on ecology. Please refer to Table 2: Hydrology and Hydrogeology, Table 5 Air Quality and Table 7 Noise and Vibration for the measured employed to minimise effects on air quality, water quality and noise and vibration effects.

Table 2: Hydrology and Hydrogeology

Environmental Issues	Environmental Protection Measures
Surface and Groundwater	• Compliance with Guidance for Pollution Prevention (GPP) 2 (Above ground oil storage tanks), 4 (Treatment and disposal of wastewater). 5 (works and maintenance in or near water), 8 (Safe storage and disposal or used oils), 21 (Pollution incident response planning). • Adherence to Construction Industry Research and Information Association (CIRIA) report C532: Control of water pollution from constriction sites and CIRIA report C649: Control of water pollution from linear sites. • Adherence to BS 6032: Code of Practice for Earthworks. • Implementing a temporary sustainable drainage system to prevent runoff contaminated with fine particles / construction waste / debris / wash water from entering surface drains. This will include protection of land drains and waterbodies using drain covers, earth bunds, geotextile silt fences, straw bales or proprietary treatment. • Undertaking of earthworks in dry months of the year where possible.

	• Storage of topsoil 20m or more from watercourses on flat land where possible. Where this is not practical the material should be covered with geotextile mats, seeded to promote vegetation growth or runoff prevented from draining to a watercourse without prior treatment. • Providing appropriately sized runoff storage areas for the settlement of excessive fine particulates in runoff to be treated on site or discharged under a water discharge activity permit from the Environment Agency to controlled waters. • Washing and cleaning of designated runoff areas within the site, and vehicle wheels at entry and exit points to the Site. • Maintenance of a secure, clean and tidy site, clearly labelled waste receptacles, and the maintenance of site fencing to prevent the entrance of debris into watercourses. • Storing fuel in accordance with the Control of Substances Hazardous Regulations 2002 and the Control of Pollution (Oil Storage) (England) Regulations 2001. Fuel should be stored in leak proof containers and in a secure bunded area. • Regular inspection of plant, machinery and vehicles off Site. • All vehicles carrying hazardous loads must regulations set out in the Health and Safety Executive's (HSE) Carriage of Dangerous Goods. • Drivers of vehicles carrying hazardous loads must be properly trained and carry a transport document with a description of the load. • Washing, refuelling, oiling and greasing vehicles take place in designated areas protected from underground strata and watercourses. • Keeping spill kits at high-risk locations. • Undertaking water quality monitoring of potentially impacted watercourses. • Management of site welfare facilities, appropriate waste disposal by an appropriate contractor to a suitably licenced facility. • Developing strategy to detail monitoring of cable route construction if required.
Flood risk	• Application and implementation of a Flood Risk Activity Permits (FRAP) to document the measures to be implemented when working in the flood zone. The FRAP will be submitted to the Environment Agency for approval and to obtain the licence to undertake works during the construction phase. • Restricting storage of machinery or spoil/materials within the identified flood extent, to ensure no impact on contractors, or deviation in flow routes due to the proposed works.

	• Maintaining connectivity between the floodplain and the adjacent watercourses. • Designing drainage systems to ensure surface runoff is adequately attenuated and treated and there is no significant increases in flood risk downstream during storms (up to and including the 1% annual probability design flood – with allowance of 40% for climate change). • Monitoring of weather forecasted, and planning works according. • Appointment of an Emergency Response Plan. This would include appointment of a contractor with 24hr availability and ability to mobilise staff in the event of a flood, details of evacuation procedures and safe exits. Plan for the removal of plant, machinery, and hazardous material and the implementation of de-watering methods (in line with the requirements of the Environment Agency under the 1991 Water Resources Act and the 2016 Environmental Permitting Regulations) if water is encountered below ground construction.

Table 3: Cultural Heritage

Environmental Issue	Environmental Protection Measures
Cultural Heritage Resources	• Ensuring main site access are set away from heritage assets to manage potential impact of increased traffic and delivery of components. • Adopting mitigation measures to mitigate the temporary impacts of increased visual and noise intrusion on heritage assets are described in Table 4 and Table 7.
Archaeological deposits	• Undertaking all archaeological work in line with a Detailed Archaeological Mitigation Strategy (DAMS), which will be submitted to the host authorities prior to the commencement of works. • Where there are archaeological remains are identified to be of significance and works may result in damage to the asset, a site-specific Written Scheme of Investigation (WSI) will be submitted. • Implementing suitable buffer zones (minimum 5m) around the sensitive archaeological areas prior to construction. • If remains of sufficient archaeological significance are identified, provision will be made to apply mitigation by design through the use of above ground foundations to remove an intrusive groundwork which would otherwise be required. Where mitigation by design is not possible, or not warranted due to the significance of the identified or likely remains, mitigation through preservation by record will be applied via a watching brief.

	• Developing strategy to detail monitoring of cable route construction if required.

Table 4: Landscape and Visual

Potential Impact	Environmental Protection Measures
Loss of landscape features	• Implementing an oLEMP that sets out measures to mitigate the potential impacts of construction on biodiversity and landscape features, including an implementation timetable for maintenance and management. • Undertaking a pre-construction tree survey to establish the extent to which any vegetation removal may be needed and identify required protection zones. • Securing the perimeter and protecting and maintaining retained vegetation during construction. • Implementing replacement tree and hedgerow planting.
Visibility of construction activities	• Maintaining a clean and tidy Site and the use of appropriate hoarding to manage visual presence of construction activity. • Managing existing vegetation to aid the screening of views of the construction Site. • Lighting used in construction will be used only during working hours (unless in the case of emergency or occasional overnight quiet working), and fitted with directional cowls orientated into the Site, away from residential areas and roads.

Table 5: Air Quality

Environmental Issue	Environmental Protection Measures
Dust	• Implementing a Dust Management Plan (DMP). The DMP will include monitoring of dust deposition, dust flux, suspended dust and/or visual inspections. The DMP will also include measure such as: ○ A method for stakeholder communications and a recording for dust/air quality complaints / exceptional incidents.

	○ Undertaking daily on-Site and off-Site inspections where receptors are nearby, especially when activities with a high potential to produce dust are being carried and during prolonged dry or windy conditions. ○ Wetting of dust generating activities and locating of dust generating activities far from receptors, ensuring adequate water supply. ○ Removing dust producing materials as soon as possible or cover, seed, fence or water to prevent wind whipping. ○ Ensuring aggregates do not dry out and cement and other fine particles are delivered in sealed bags / enclosed tankers and stored in silos with appropriate emission control systems. ○ Avoid scabbing (roughening of concrete surfaces) where possible. ○ Sheeting vehicles carrying dust and impose a 15mph speed limit on surfaced and 10mph speed limited on un-surfaced roads. ○ Where appropriate re-vegetate earthworks and exposed areas to stabilise surfaces as soon as possible. If not possible to re-vegetate, use Hessian, mulches or track fires. Only remove the cover in small areas during work and not at once. ○ Implementing Trackout measures such as the use of water-assisted dust sweepers on the access and local roads, avoiding dry-sweeping of large areas, covering and wheel washing vehicles entering and leaving the Site, inspecting hall routes or installing hard surfaced hall routes and ensuring adequate hard surfaces are available between wheel washing and the exit.
Nitrogen dioxide (NO_2) and particulate matter (PM_{10}) Emissions	• Switching off vehicles when stationary. • Avoiding diesel/ petrol powered generators and use mains electricity or battery powered equipment where practicable. • Ensuring proper maintenance of machinery. • Imposing a 15mph speed limit on surfaced and 10mph speed limited on un-surfaced roads. • Implementation of a Construction Traffic Management Plan to manage the sustainable delivery of goods and materials. • Avoiding bonfires and burning of waste.

Table 6: Carbon and Climate Change

Potential Impact	Environmental Protection Measures
Greenhouse Gas (GHG) emissions	• Adopting the Considerate Constructors Scheme (CCS) to assist in reducing GHGs, from the Proposed Development by employing good industry practice measures. • Encouraging the use of lower carbon modes of transport and implementing a Construction Traffic Management Plan, which includes details a construction travel plan to reduce the volume of trips taken by construction staff and employees. • Requiring reporting of fuel consumption and carbon footprint following construction. • Switching vehicles and plant off when not in use and ensuring regular maintenance to optimise efficiency. • Ensuring vehicles conform to current EU Emissions standards.
Natural resource use	• Recycling of construction waste and local disposal of waste where possible. • Maximising the use of alternative materials with lower embodied carbon, such as locally sourced products and materials with a higher recycled content where feasible.
Climate Change	• Monitoring of weather forecasts the news for Environmental Agency warnings and plan works accordingly, protecting workers and resources from any extreme weather conditions. • Adhere to health and safety plans that account for potential climate change impacts. • Using equipment's cooling systems where necessary/adapting working practices and equipment used based on current weather conditions. • Storing construction materials outside of Flood Zone 3 where possible. • Designing drainage systems to ensure no significant increases in flood risk downstream during storms (up to and including the 1% annual probability design flood – with allowance for climate change). • More details on flood risk mitigation measures are found in Table 2.

Table 7: Noise and Vibration

Potential Impact	Environmental Protection Measures
Construction noise and vibration	• Apply Best Practicable Means (BMP) where reasonably practicable to minimise noise and vibration at sensitive receptors. • Contractors should be familiar with BS 5228 guidance, which gives recommendations for basic methods of noise control relating to construction works. • Control of noise and vibration at the source, encouragement of quieter methods and consideration of local Site equipment. • Using and properly maintaining modern plant and equipment. • Restriction of construction to working hours. • Minimising drop heights of materials, engine revving, loading and unloading of materials and dismantling or moving of equipment of materials where possible. • Encouraging sequential engine starting up and switching off equipment where possible. • Offsite prefabrication where practicable. • Screening around possible producing plant and activities. • Identification of potential construction traffic routes that, where possible, avoid the main areas of existing residential development. Implementation of a Framework Construction Traffic Management Plan (CTMP). • Provision of information to Local councils and residents to advise of noisy works and monitoring of noise complaints.

Table 8: Human Health

Potential Impact	Environmental Protection Measures
Human Health Risks	• Measures to mitigate human health risks are covered in the following tables: Table 2 for Hydrology and Hydrogeology, Table 5 for Air Quality, Table 6 for Carbon and Climate Change, Table 7 for Noise and Vibration and Table 9 for Socio-Economic impacts.

Table 9: Socio- Economics

Potential Impact	Environmental Protection Measures
Local residents, businesses and community facilities	• Implementation of an Outline Skills, Supply Chain and Employment Plan (OSSCEP). • Explore employment and supply chain opportunities throughout the construction period. • Prepare Construction Management Plan and Construction Transport Management Plan to temporarily re-route existing Public Rights of Way. Provision of clearly signed alternative routes to minimise disruption. • Measures to mitigate the effects of visual impacts, air quality and noise are outlined in Table 4 of Landscape and Visual, Table 5 for Air Quality and Table 7 for Noise and Vibration respectively.



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Preliminary Environmental Information Report [EN010159]

Chapter 7: Biodiversity

May 2024

One Earth Solar Farm Ltd

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Appendix 7-8: List of Species with Scientific names

7. Biodiversity

Summary of Preliminary Likely Significant Effects

7.1. This Chapter concludes that there are no likely significant environmental effects arising from our Project on the Ecological Features scoped into the assessment. The majority of negative effects identified arise from the construction phase and will be mitigated by environmental measures set out in the outline Construction and Environmental Management Plan (oCEMP) and detailed in the construction environmental register in **Appendix 4-2.**

7.2. Overall, our Project will result in likely significant positive effects during the operational phase, resulting from habitat creation and enhancement delivered through embedded measures and Biodiversity Net Gain (BNG).

Introduction

7.3. This Chapter of the PEIR has been prepared by Logika. It presents preliminary findings and identifies the likely significant environmental effects of our Project upon biodiversity, including habitats and legally protected or notable[1] species on, and adjacent to the Site. It is based on the environmental information collected to date (which is detailed in this Chapter), as well as the current description of our Project, as set out in **Chapter 4: Our Project**.

7.4. Specifically the PEIR presented herein has been undertaken with reference to applicable wildlife and countryside legislation, national and local planning policy (see **Appendix 7-1**) and the Chartered Institute of Ecology and Environmental Management (CIEEM, 2018)[2]. The assessment methodology also reflects the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the 'EIA Regulations') and focuses on those activities that could potentially generate significant effects on ecological features.

7.5. This Chapter is supported by further detailed information in the appendices:

- Appendix 7-1: Key Policy and Legislation
- Appendix 7-2: Phase 1 Habitat Survey
- Appendix 7-3: Bat Baseline
- Appendix 7-4: Breeding Bird Baseline

[1] Notable species are those with conservation designations but no specific legal protection e.g. birds that appear on the red or amber list of the Birds of Conservation Concern (BoCC) or invertebrates listed in relevant Red Data Books.

[2] CIEEM (2018, version 1.2 updated 2022) Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester.

- Appendix 7-5: Great-Crested Newt Baseline
- Appendix 7-6: Badger and Riparian Mammal Baseline
- Appendix 7-7: Wintering Bird Baseline
- Appendix 7-8: Scientific Names of Species Referred to in the Main Document

Current Biodiversity Conditions

Study Area

7.6. The study area varied for different ecological receptors, depending on their sensitivity to environmental change. Study areas adopted are defined in **Table 7-1** (presented in **Figure 7-1**) below and were determined using best practice guidance (issued by the CIEEM, professional judgement and a high-level assessment of the types of ecological features present, or potentially present.

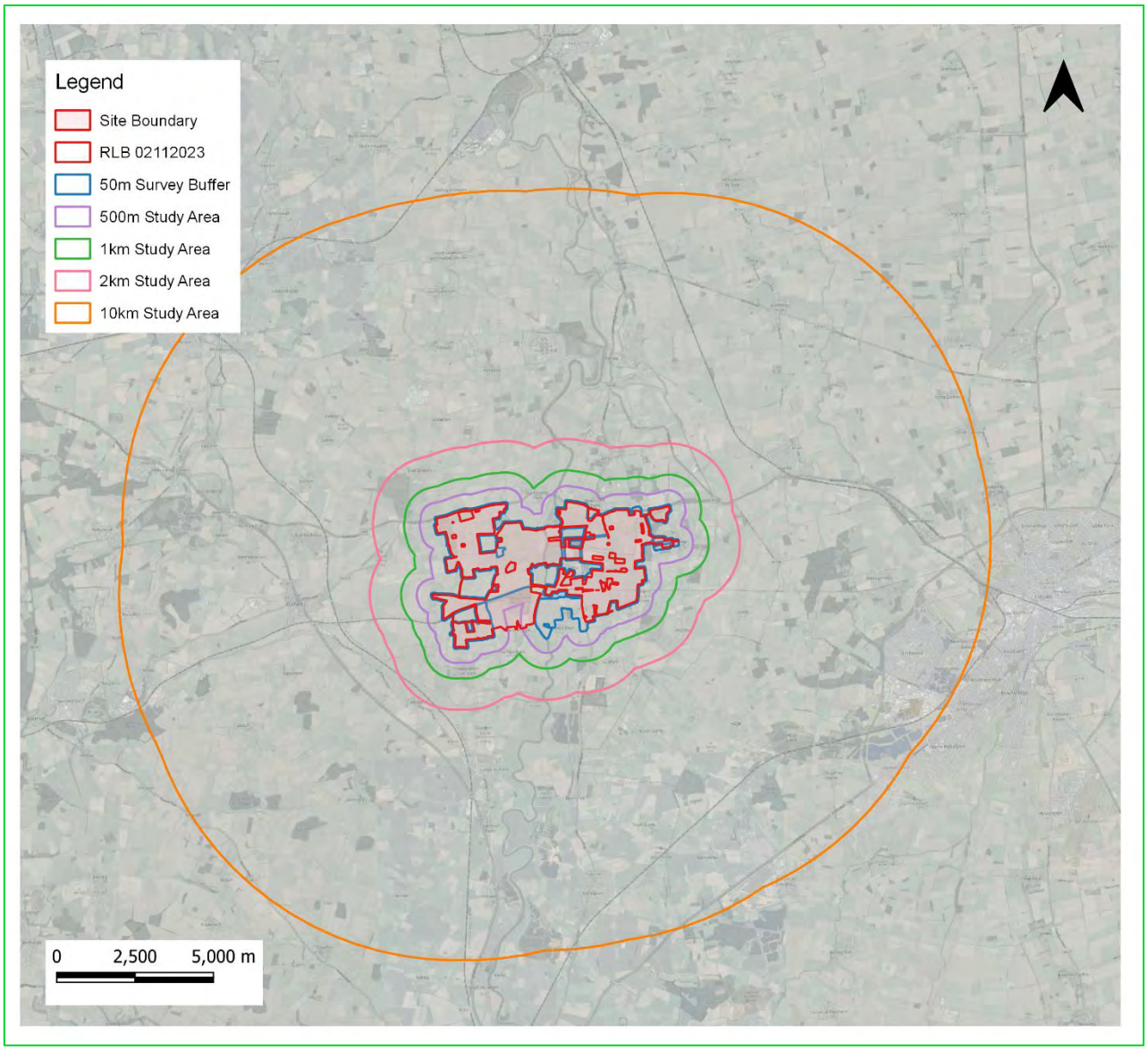
Table 7-1: Extent of Data Search (ZoI) for Ecological Features

Ecological feature*	Study area
European Designated Sites	Site, plus a 10km buffer
Statutory Designated Sites	Site, plus a 2km buffer
Non-Statutory Designated Sites	Site, plus a 2km buffer
Priority Habitats and Veteran Trees	Site, plus a 1km buffer
Legally protected and notable species	Site, plus a 2km buffer
Habitats	Site, plus a 50m buffer
Waterbodies and water courses	Site, plus a 500m buffer

Refer to **Appendix 7-1** for the legislation and policy under which sites, habitats and species are designated and/or protected.

7.7. The study area is continuously reviewed and amended in response to design refinement and consultation feedback, ensuring that there is sufficient data available to conduct the assessment.

Figure 7-1: Study Area



Collection of Biodiversity Data

7.8. Establishment of the biodiversity baseline within the study area involves reference to existing data sources (biodiversity records centres), consultation with stakeholders, including statutory bodies, and field survey data.

Desk Study

7.9. The following sources have been used to inform the assessment:

- Magic website[3]

[3] Multi-Agency Geographic Information Centre (MAGIC) website: https://magic.defra.gov.uk/magicmap.aspx

- Joint Nature Conservation Committee (JNCC) website[4]
- Natural England's (NE) website[5]
- Greater Lincolnshire Nature Partnership (GLNP)
- Nottinghamshire Biological and Geological Records Centre (NBGRC)
- Ordnance Survey (OS) online mapping[6]
- Woodland Trust's Ancient Tree Inventory (ATI) for veteran trees[7]

Field Survey

7.10. This chapter has been informed by a series of field surveys for habitats and protected, notable and controlled species which are included in detail within **Appendices 1.2 to 1.8**. A summary of surveys undertaken, dates and methodologies adopted is provided in below in **Table 7-2**.

Table 7-2: Field Survey Methodologies

Ecological feature*	Main guidance document	Method
Habitats and vegetation	JNCC '*Handbook for Phase 1 habitat survey: A technique for environmental audit*' UK Habitat Classification methodology (2020)	This comprised a walkover of land within our Site and recording of habitat types and boundary features. Hedgerow habitat was considered with reference to the Hedgerows Regulations thereby allowing Important Hedgerows within our Site to be identified. Protected, notable and controlled species scoping was carried out during the Phase 1 habitat survey. This identified the potential for there to be animal and plant species for which there was the requirement for further species-specific field surveys. Survey was undertaken in May and June 2023. Full methodologies are provided in **Appendix 7-3**.

[4] Found at https://jncc.gov.uk/

[5] Found at https://designatedsites.naturalengland.org.uk/

[6] Found at https://explore.osmaps.com/

[7] Found at https://ati.woodlandtrust.org.uk/

Ecological feature*	Main guidance document	Method
Bats	Bat Conservation Trust's '*Bat Surveys for Professional Ecologists*' (Collins, 2016) British Standard: (BS 8596:2015) '*Bat Roosts in Trees'* (Andrews 2018)	Surveys followed a sampling approach due to the extent of generally poor-quality habitat within the Site with only isolated parcels of moderate and high-quality habitat. Ground-level roost assessment for trees within our Site was undertaken alongside habitat assessment. Three transect routes were designed to incorporate a range of habitat types present within our Site and were visited once per season (spring, summer, autumn) with six associated static locations monitored for five full nights in each survey season. Survey visits were conducted from April to October 2023. Full methodologies are provided in **Appendix 7-3**.
Badger	'*Surveying for Badgers: Good Practice Guidelines'* (Scottish Badgers, 2018)	Formal badger surveys were undertaken concurrently with habitat assessment, and during all other ecological surveys conducted in 2023. Full methodologies are provided in **Appendix 7-6**.
Breeding Birds	British Trust for Ornithology's (BTO) *Common Birds Census* (CBC) *methodology* (Gilbert *et al*., 1998)	Due to the extent of generally poor-quality habitat that occurs across our Site, a sampling approach was used. This focused on hedge and ditch networks within the River Trent Corridor that were considered to provide the best breeding bird habitat. All bird species observed or heard were recorded and mapped in each of six survey visits. Survey visits were undertaken between May and late-July 2023. Full methodologies are provided in **Appendix 7-4**.

Ecological feature*	Main guidance document	Method
Great-crested newt	*'Evaluating the suitability of habitat for the great-crested newt (Triturus cristatus)'* (Oldham *et al*, 2000) *Using eDNA to develop a national citizen science-based monitoring programme for the great crested newt (Triturus cristatus)* (Biggs *et al*, 2015)	Where access allowed, waterbodies within and adjacent to our Site were assessed to calculate a habitat suitability index (HSI) for great-crested newt. All waterbodies within our Site (access permitting) were sampled for environmental DNA (eDNA) analysis. Surveys were conducted between May and June 2023. Full methodologies are provided in **Appendix 7-5**.
Otter	'*Monitoring the Otter*' (Chanin, 2003a)	An assessment was made of riparian and connected scrub and woodland habitats within our Site for their potential to support otter. Surveys were conducted in May and June 2023. Full methodologies are provided in **Appendix 7-6**.
Water vole	'*Water Vole Mitigation Handbook*' (Dean *et al*., 2016)	An assessment was made of riparian and agricultural ditch habitats for their potential to support water vole. Surveys were conducted in May and June 2023. Full methodologies are provided in **Appendix 7-6**.
Wintering birds	British Trust for Ornithology's (BTO) Common Birds Census (CBC) methodology (Gilbert *et al*, 1998)	Ten transect routes were designed to incorporate the range of habitats identified across our Site. Each route was surveyed once per month. Survey visits occurred from October to March 2023 to 2024. Full methodologies are provided in **Appendix 7-7**.
Priority species	N/A	Priority Species such as hedgehog and brown hare were recorded during other ecological surveys undertaken in 2023.

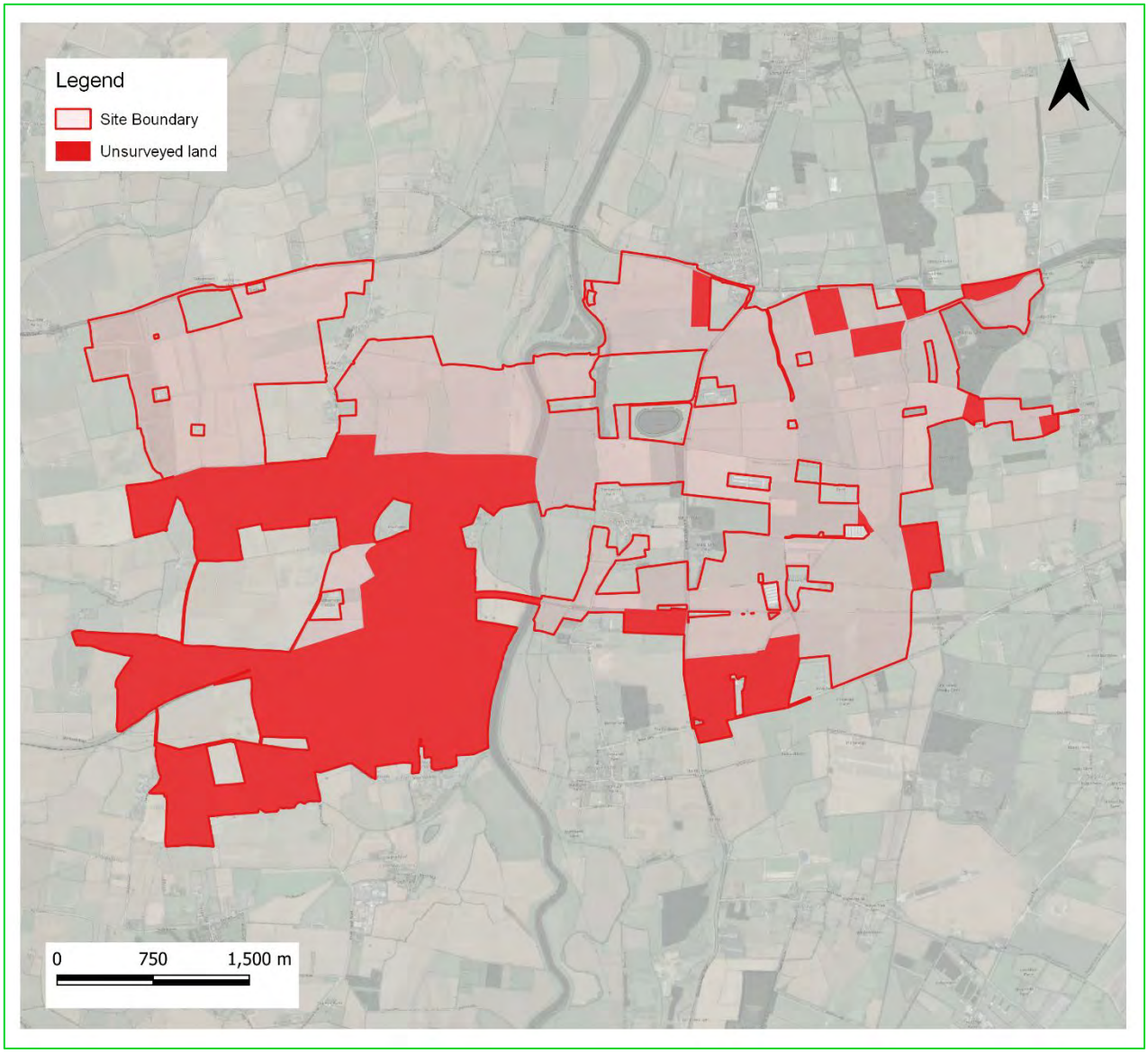
Biodiversity Net Gain

7.11. It is now mandatory for Town and Country Planning Act (TCPA) applications to demonstrate a quantifiable biodiversity net gain ('BNG') of at least 10% under the Environment Act 2021 (see **Appendix 7-1**), with nationally significant infrastructure projects (DCOs) becoming mandatory in November 2025. The submitted ES will demonstrate BNG using the DEFRA Biodiversity Metric Calculator to provide evidence of achievable on-Site BNG associated with our Project and will be presented as an Appendix to the ES Chapter.

Limitations and Assumptions

7.12. Our Site boundary changed a number of times over the duration of survey visits, incorporating new areas which were not included in the initial walkover survey, as new landowners joined our Project. These areas were incorporated into surveys where possible, otherwise they were assessed using aerial images and 'on the ground' knowledge of the area. **Figure 7-2** shows the extent of Phase 1 survey coverage within our Site.

Figure 7-2: Survey Coverage



7.13. The static acoustic monitoring surveys aimed to record for a minimum of 5 nights per season at each monitoring location, however, technical failures occurred, impacting recording at static detector locations along transect 2 (in summer and autumn) and transect 3 (in spring, summer and autumn).

7.14. Extensive flooding along the River Trent in December and January limited access to certain areas within the winter bird survey. These areas were viewed from vantage points and from the other side of the river so the areas were still partially surveyed and bird records were taken, but it may have impacted records of smaller bird species not visible or audible from a distance. As a result, three of 60 transects over the season were altered, the locations of which are presented in **Appendix 7-7**.

7.15. The sampling of waterbodies for great-crested newts is typically conducted for all waterbodies within our Site and a 500m buffer (the study area). However, due to access restrictions (located within private land, presence of dense vegetation surrounding ponds) this was not possible. As a result, two of the six ponds within our Site were sampled, and eight of 34 ponds outside of our Site, within the 500m Study Area. Additional detail is provided in **Appendix 7-5**.

Current Results

Desk Study

7.16. There are no sites designated as being of international nature conservation value within the 10km study area.

7.17. There is one site of national nature conservation value within the 2km study area: Spalford Warren SSSI lies 1.92km south and comprises the best remaining example of grass heath dominated by wavy hair-grass and sand sedge in Nottinghamshire and one of the last to be found in the Midlands. Its location is shown in **Figure 7-3**.

7.18. SSSI Impact Risk Zones (IRZ) extend across our Site. These relate to specific developments likely to impact SSSIs and require consultation with Natural England. The types of developments described do not include solar farms.

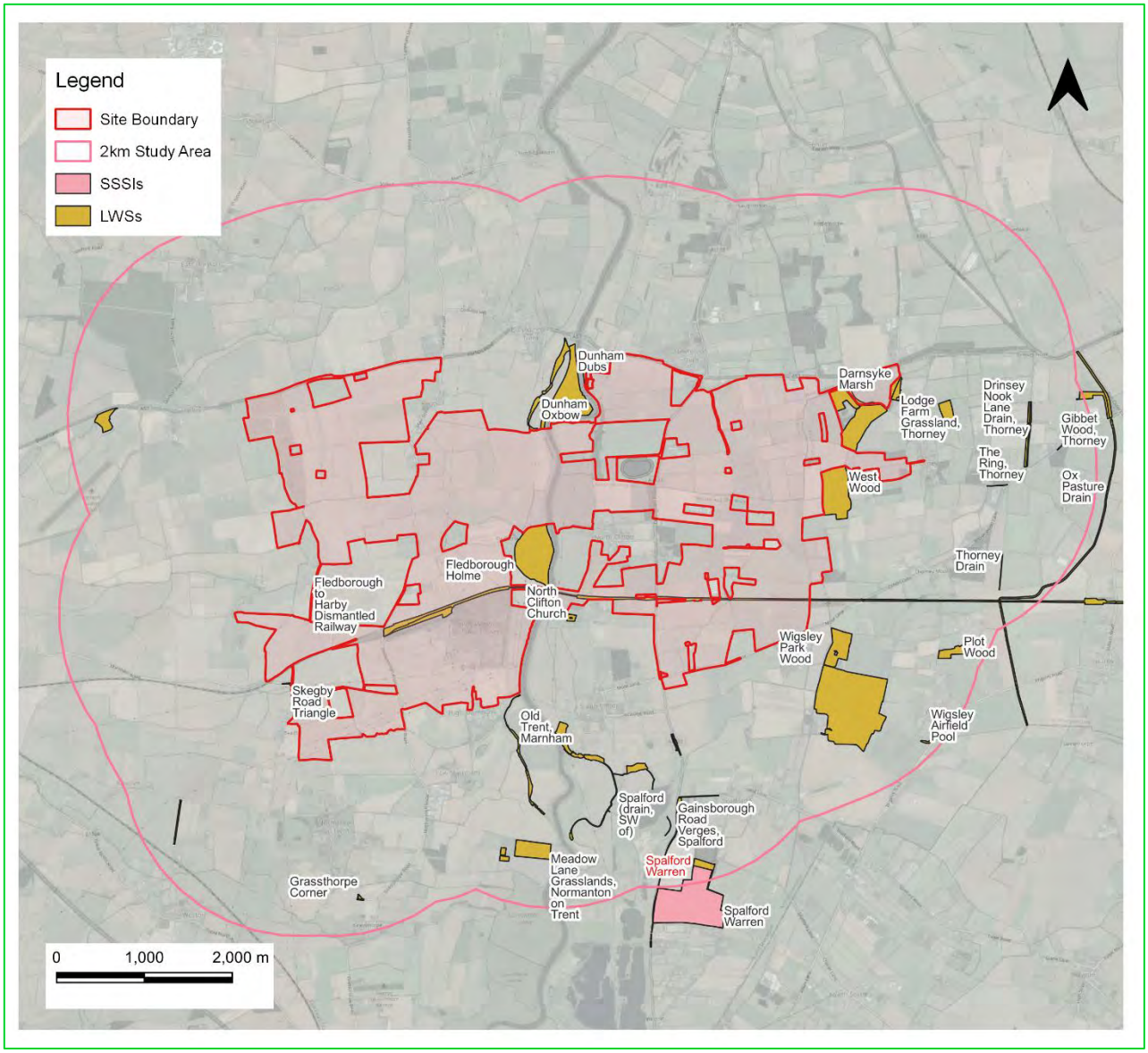
7.19. There are 34 LWSs within the 2km study area, one of which occurs within our Site itself, with a further seven immediately adjacent to our Site. Details of those sites that occur either within or adjacent to our Site and therefore have the potential to be impacted by our Project are summarised in **Table 7-3**, the 26 LWSs that lie further afield are here scoped out. The locations of all LWSs considered within the study area are shown in **Figure 7-3**.

Table 7-3: Summary of LWSs within or adjacent to our Site

LWS name	Area (ha)	Location	Qualifying features
Fledborough to Harby Dismantled Railway	20.88	Within Site	Grassland and scrub on disused railway line.
Dunham Dubs	19.52	Adjacent to northern Site	Two lakes with improved grassland, planted broad-leaved trees and associated marginal flora and marsh.
Dunham Oxbow	4.45	Adjacent to northern Site	Marsh and wet woodland habitat supporting an interesting variety of characteristic plant species.
Fledborough Holme	22.20	Adjacent to central Site	Trees, shrubs, tall herb and semi-improved grassland.

LWS name	Area (ha)	Location	Qualifying features
South Clifton Grassland	2.78	Adjacent to southern Site	Neutral pasture on floodplain.
West Wood	16.28	Adjacent to eastern Site	Deciduous woodland, plantation woodland and acid grassland With ancient woodland indicators (wood anemone and bluebell).
Road Wood	18.44	Adjacent to eastern Site	Broadleaved woodland.
Darnsyke Marsh	1.05	Adjacent to eastern Site	Deciduous woodland, marshy grassland and emergent plant species associated with the Darnsyke drain.

Figure 7-3: Sites of National and Local Nature Conservation Value



7.20. Priority Habitats identified within our Site are:

- Coastal and Floodplain Grazing Marsh, associated with the River Trent.
- Deciduous Woodland at a single location west of Hall Water Reservoir.

7.21. Priority Habitats which lie outside of our Site but adjacent, are:

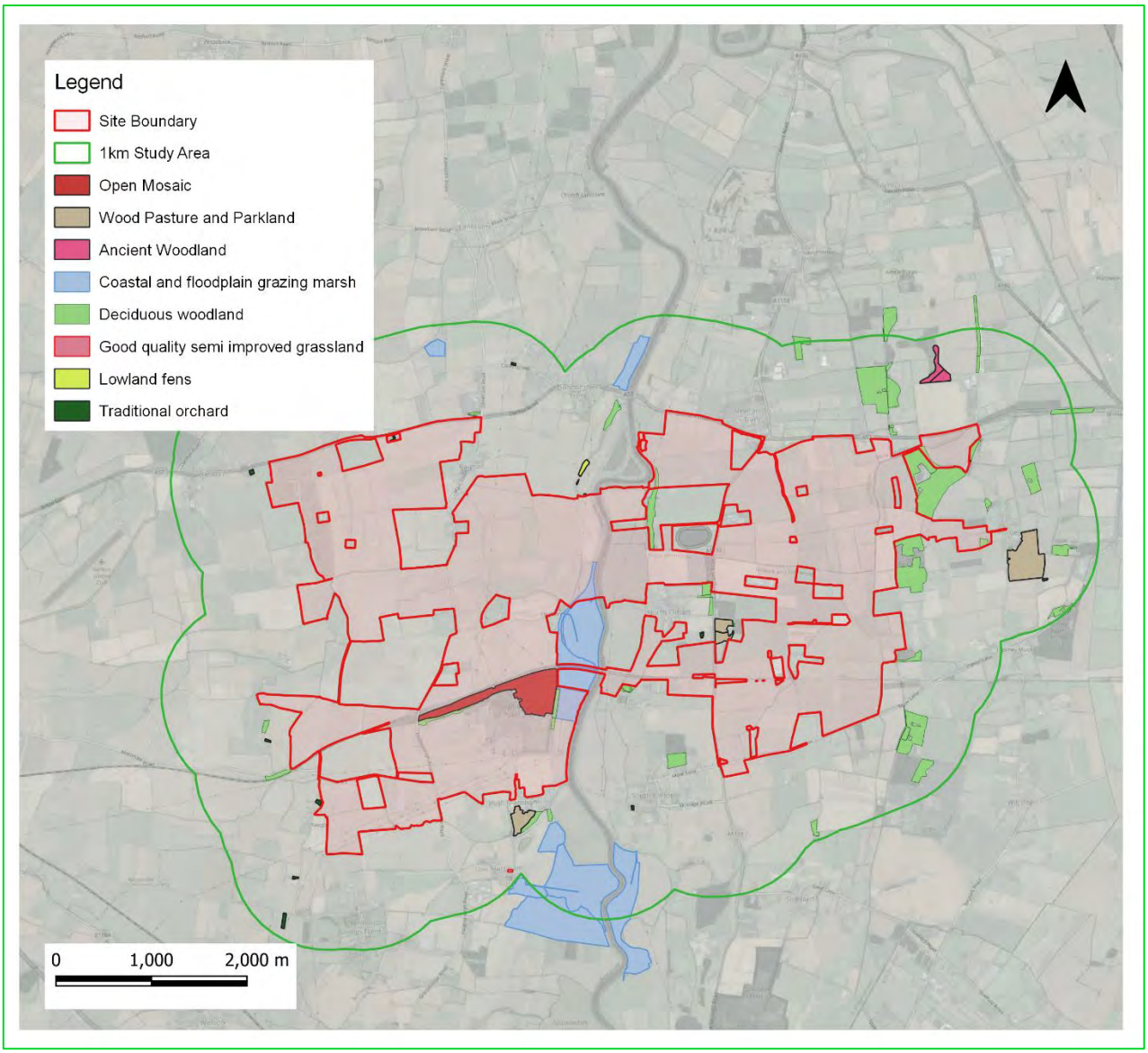
- Traditional Orchard in the northwest of our Site.
- Lowland Fens, to the north and associated with the River Trent.

- Open Mosaic Habitat, associated with the dismantled railway LWS.
- Wood Pasture and Parkland in North Clifton.

7.22. There were no trees assigned veteran status within our Site. However, two veteran crack willow lie adjacent to our Site in North Clifton and three more are located north of the A57 in Dunham.

7.23. In addition, Good Quality (in HPI terms) Semi-Improved Grassland was recorded 865m south of our Site and Ancient Woodland was recorded at Blackthorn Wood, 514m north of our Site. The location and extent of Priority Habitat and Ancient Woodland is presented in **Figure 7-4**.

Figure 7-4: Priority Habitats and Ancient Woodland

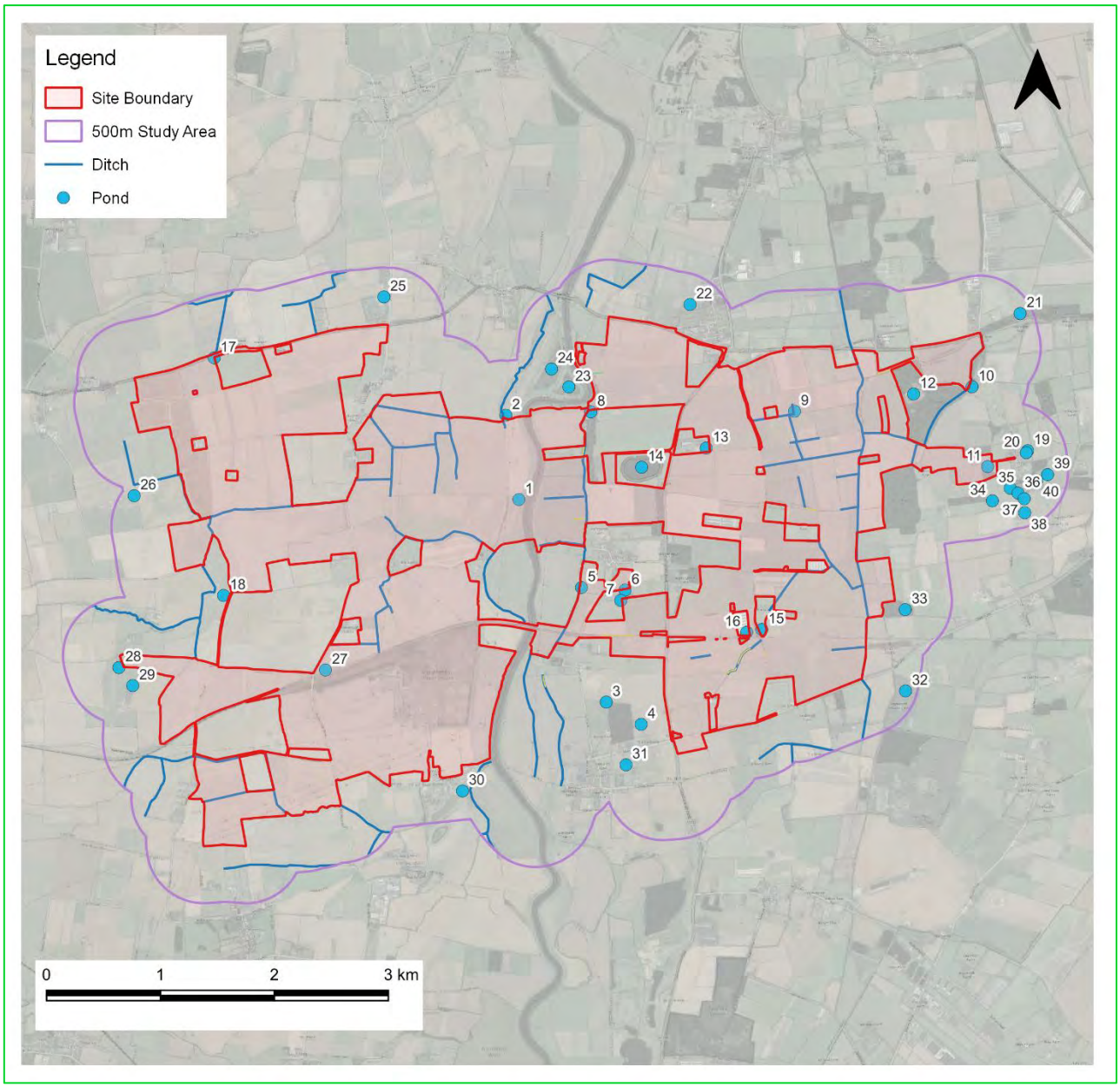


7.24. In addition to the habitats recorded on the Priority Habitat Inventory, several other habitat types recorded during the field survey qualify as HPI in England. These include rivers, ponds and hedgerows.

7.25. There are 40 waterbodies within the Study Area, of which three are located within the Site: 1, 5 and 9. Waterbodies and ditches holding water within our Site and the 500m Study Area are presented in **Figure 7-5**.

7.26. Agricultural ditches holding water are found throughout the Study Area, running parallel to and east of the River Trent, Fledborough Beck in the west of our Site and a ditch extending the full length from north to south in the east.

Figure 7-5: Waterbodies and Watercourses

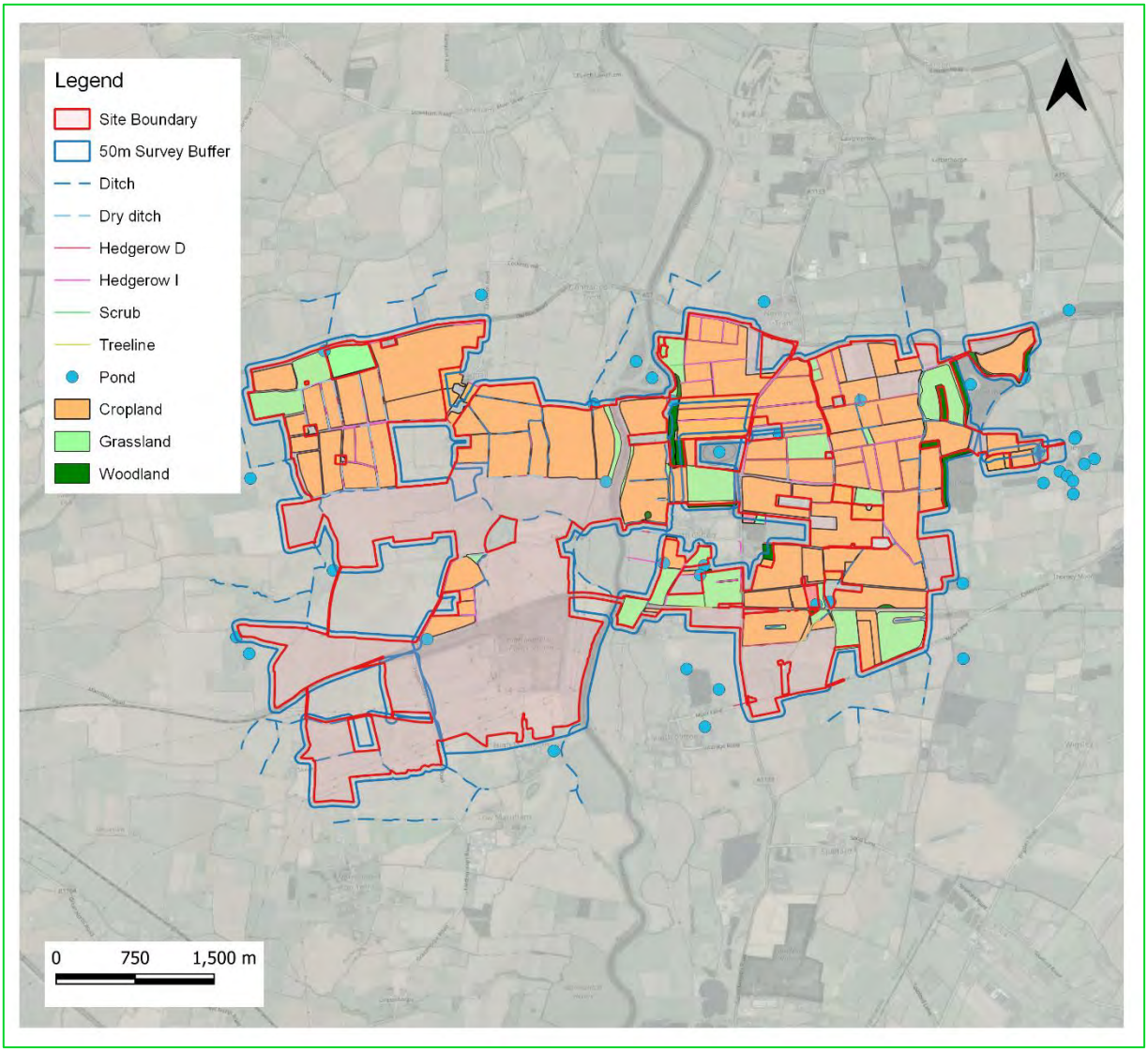


Field Survey

7.27. The current Site cover approximately 1,591ha of which approximately 60 percent (957ha) has been incorporated into Phase 1 habitat survey, UK Habitats Classification and condition assessment. Areas not subject to this level of survey at this stage, in particular because of access issues, have received a high-level assessment based on satellite imagery. All mapped habitats (UK Habs) are presented in **Figure 7-6**.

7.28. The River Trent bisects our Site from north to south with approximately half of the area of our Site lying to the west and the remaining to the east. Arable fields account for approximately 87 percent of our Site. They include cereal and non-cereal crops and substantial grass-leys used for turf production. Additional grassland occurs within narrow field margins (~1m) and as grazing pasture or hay crop. There is floodplain grazing marsh adjacent to the River Trent on both its sides, with water levels managed within the area via a matrix of water-filled ditches with associated sluice gates. Hedgerows and treelines bound the majority of the agricultural fields with species assemblages occurring typical of such features within the region.

Figure 7-6: Habitat Assessment (UK Habitat Classification)



Full details on habitats recorded as a result of field survey are presented within Technical **Appendix 7-2**. In summary habitats recorded are presented in **Table 7-4** below.

Table 7-4: Summary of Habitats Recorded in the Study Area

Phase 1	UKHabs	Area	Condition
Arable	Cropland - Cereal and Non-Cereal Crops	1278ha	N/A

Phase 1	UKHabs	Area	Condition
Improved and Semi-improved grassland	Modified and Other Neutral Grassland	197ha	Poor to Moderate, with the majority of modified grassland, namely grass-leys, assessed as Poor.
Broad-leaved woodland (semi-natural and plantation	Woodland and Forest - Other	7.6ha	Poor or Moderate for plantation woodlands, with the HPI woodland parcel and any other semi-natural woodland qualifying as Moderate.
Dense continuous scrub	Heathland and Shrub – Hawthorn scrub	5.7ha	Areas were assessed as being Moderate or Good condition.
Tall Ruderal	Grassland – Secondary Code 16: Tall forbs	1ha	N/A
Standing Water	Lakes – Ponds (priority and non-priority habitats)	0.3ha	The condition of the ponds varied between Poor and Good.
Open Mosaic Habitat (OMH)	Open Mosaic Habitat on Previously developed land	30.4ha	The condition of OMH (if present) will be varied between Poor and Good.
Intact and Defunct Hedgerows	Hedgerows and Lines of Trees – Native with and without trees, banks and/or ditches	58.2km	Species-poor and defunct hedgerows qualify as Poor. Those with increased species diversity and improved structure qualify as Moderate or Good.
Treelines	Hedgerows and Lines of Trees	9.2km	Range from Poor to Good.
Running water	Watercourse – ditches (wet and dry)	25.9km	Dry ditches are not assessed, wet ditches ranges from Poor to Good.

Bats

7.29. The desk study identified 577 records of a minimum of seven bat species within the study area. Species recorded within our Site were common pipistrelle and Leisler's bat and the genera Nyctalus, Pipistrellus and Myotis, where acoustic records could not be identified to species level. Brown long-eared bat and soprano pipistrelle were recorded within 120m of our Site, and barbastelle and noctule more than 1km from our Site. In addition, whiskered bat was recorded 1.77km from our Site, this is a species of the genus Myotis.

7.30. A single bat European Protected Species Licence (EPSL) was granted for a location 80m from our Site, near South Clifton, allowing the destruction of a resting place for both common pipistrelle and brown long-eared bats.

7.31. During the field survey sixty-six trees within our Site were found to support features potentially suitable for roosting bats, with the majority of these being located to the east of the River Trent in species including oak, ash, beech, willow and poplar.

7.32. Habitats within our Site are generally considered to be of low and moderate quality for foraging and commuting bats due to the extensive cover of arable fields with species poor and defunct hedgerow boundaries. More valuable commuting and foraging habitat is present to the east of the River Trent, associated with woodland habitat, treelines and species-rich, intact hedgerows and the River Trent corridor.

7.33. Activity surveys identified a minimum of seven bat species within our Site, consistent with those identified in the desk study and confirming noctule, brown long-eared bat, barbastelle and Nathusius' pipistrelle within our Site. Common pipistrelle was the most frequently recorded species being found to be foraging and commuting on all transect routes and monitoring locations within our Site and in all seasons the surveys occurred. Soprano pipistrelle was the second most frequently recorded and bats of the genus Myotis the third most frequent. Nathusius' pipistrelle and barbastelle were the least frequently recorded species. Monitoring locations in the north of our Site recorded the highest levels of activity, with the most active period being during the spring monitoring surveys.

Badger

7.34. [redacted].

7.35. [redacted]

Birds

7.36. The desk study returned 59,491 records of legally protected or notable bird species within the study area including within the Site themselves. However, the majority of record locations provided were of a low accuracy, being within a 100km square or a 10km square. Only barn owl and house sparrow allowed accurate identification of a specific record location being outside of our Site.

7.37. During the breeding bird surveys undertaken during 2023, 78 species were recorded in total within the study area. Of those, 39 were considered to show territorial behaviour associated with potential breeding attempts, such as singing males or displaying on two or more occasions, nest building or active nests being found, carrying food or faecal sacks to/from an area.

7.38. Of species potentially breeding within the sampling area:

- Three are listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended): quail, barn owl, and hobby.
- Nine are Red-listed on the Birds of Conservation Concern (BoCC) 5: skylark, yellowhammer, house sparrow, yellow wagtail, linnet, greenfinch, grey partridge, house martin, and turtle dove.
- Eleven are Amber-listed on BoCC5: wren, whitethroat, reed bunting, woodpigeon, sedge warbler, dunnock, song thrush, mallard, oystercatcher, quail, and kestrel.

7.39. Wintering bird surveys identified a flooded area in the north of our Site, adjacent to the River Trent, which supported large flocks of greylag goose, lapwing, black headed gull, wigeon and common gull. They were recorded foraging or resting in this area in December and January.

7.40. A temporary scrape in a grass-ley in the southeast of our Site supported large flocks of lapwing, starling, woodpigeon and common gulls. They were recorded throughout the winter, foraging and resting in the area. In addition, a large flock of golden plover (approximately 400 individuals) was recorded foraging in an arable field in the southwest of our Site, to the south of Crabtree Lane in November. Smaller flocks of this species were recorded at various locations within our Site throughout the winter period.

Great-crested newt

7.41. The majority of records identified by the desk study were historic, with the only recent positive record located 250m east of our Site in 2017. Additional records were provided for negative eDNA results at ponds to the south of our Site.

7.42. Arable habitats are sub-optimal for great-crested newt in their terrestrial life phase. Therefore, although ponds within and adjacent to our Site provide some suitable breeding habitat, these locations are not well-connected to the wider landscape, with limited opportunities for the terrestrial phase, including refuge and hibernation opportunities found in scrub, woodland edge and hedgerow habitat.

7.43. Regardless of their habitat suitability for great-crested newt, all ponds within and adjacent to our Site, where access was available, were sampled for eDNA. Ten samples (for ponds 1 to 10) were analysed and returned negative results for great-crested newt.

Otter

7.44. Only historic records of otter within the study area were returned by the data search, the most recent being submitted in 2005, north of our Site along the River Trent.

7.45. The River Trent was considered to provide suitable habitat for commuting and foraging, with branching ditches providing access to woodland habitat suitable for holts and resting. No evidence of otter was however, observed during habitat surveys.

Reptiles

7.46. Two records of grass snake were located to the northeast of the study area, the closest being 950m from our Site, recorded in 2015.

7.47. Rough grassland with open areas and close to scattered scrub and woodland edge habitat and riparian habitats are suitable to support the common and widespread reptile species. These were located either side of the River Trent and alongside agricultural ditches, including Sewer Dyke, the Old Trent and Fledborough Beck. Reptiles were not observed during habitat surveys.

Water vole

7.48. The data search revealed 39 records of water vole within the past decade. Several of which occurred within our Site, with the most recent having been submitted in 2017. Most of the records were from the west of the River Trent, associated with the Fledborough Beck and the Old Trent ditches.

7.49. Wet agricultural ditches with marginal, emergent vegetation, 45-50 degree earth banks with a variety of vegetation providing forage and cover from predators, are suitable for water vole. These occurred within our Site to the east and west of the River Trent, namely Fledborough Beck, the Old Trent, Sewer Dyke and a large drain running south to north in the east of our Site and the smaller agricultural drainage network associated with these watercourses. No evidence of water vole presence was identified during habitat surveys.

Notable species

7.50. The desk study identified two mammals listed as priority species (SPI), both of which were recorded within our Site. West European hedgehog was recorded east of the River Trent and south of the A57, with the most recent record being in 2021. Brown hare was recorded to the west of North Clifton in 2017. Brown hare were also recorded frequently in all areas of our Site throughout the ecology surveys that were undertaken.

7.51. Thirty-eight records within the last 10 years of European eel were identified by the desk study. Several were located within watercourses that occur within our Site: south of Dunham Road, southeast and southwest of Ragnall, south of Woodcoates Lane, and south of Polly Taylor's Road, with the latest record in 2022.

7.52. All notable invertebrate records identified in the desk study were for butterfly or moth species which occurred outside of our Site. The closest was for wall brown, a priority (SPI) species of butterfly approximately 1km north of the of our Site, most recently recorded in 2020.

7.53. The data search returned 124 records of legally protected and/or priority flora within the study area in the past 10 years. Some of the records had low accuracy grid references and could not be mapped, others are confirmed to occur within our Site, such as rye brome, common cudweed (*vulgaris* and *germanica*), the aquatic plant frogbit, hoary cinquefoil, and the tree species bird cherry. A high density of records outside of our Site are located at the High Marnham Power Station and along the disused railway LWS.

Legally controlled species

7.54. Several legally controlled plant species were identified by the desk study, mostly those which have an association with aquatic or riparian habitats. Water fern was recorded at two locations within our Site, west of the River Trent, while parrot's feather, Himalayan balsam, floating pennywort and New Zealand pygmyweed were recorded outside of our Site. In addition, a single record of wall cotoneaster and another of Japanese knotweed were identified outside of our Site.

7.55. Several records of Chinese mitten crab were located along the River Trent, within and to the north of our Site, and American mink were recorded at a similar location. American mink was recorded incidentally during the ecology surveys undertaken occurring at the same location as was identified by the desk study.

Future Biodiversity Conditions

7.56. This section considers the likely changes to the current baseline that may occur over the duration of our Project. It also considers the changes that may occur in the absence of our Project.

7.57. The study area within our Site and up to 50m is dominated by arable fields, with occasional sheep grazed improved grassland fields, bounded by ditches and hedgerows with occasional standard trees. Woodland copses fall adjacent to our Site, with woodland ponds occasionally present. The River Trent bisects our Site from north to south at Dunham.

7.58. In the absence of our Project, these habitats will be managed in the same way, continuing to provide habitat for those (limited) legally protected, notable and controlled species identified in the current baseline. Some of these species have adapted to live successfully in agricultural habitats, such as badger, hare and ground nesting birds.

7.59. In the short, medium, and long term, species populations and distributions will continue to fluctuate in response to standard agricultural management, such as crop rotations and grazing. As a result of intensive farming practices, the majority of UK species populations are in decline. Therefore, in the absence of our Project, it is likely that this trend would continue, with more common, widespread and adaptable species populations continuing to decrease.

7.60. In the longer term, changing climatic conditions resulting from climate change may impact the resilience of certain habitats and species, for example water levels in the ditch systems may change over time. Generally though, because of the intensive nature of management that already exists in the areas of agricultural land, climate change is unlikely to significantly impact the vast majority of land that occurs within our Site.

Environmental Measures

7.61. Our Project seeks to minimise adverse ecological effects and to maximise the opportunities for biodiversity benefit by following the 'mitigation hierarchy' as referred to in the revised NPPF 2023 (paragraph 181) and EIA Regulations 2017 (paragraph 18 (3)(c)), including measures to avoid, prevent, reduce and if possible, offset any identified significant adverse effects with an overall objective of delivering biodiversity net gain.

7.62. Avoidance and mitigation measures are being achieved as a result of the careful planning and design that has occurred, and will continue to occur until our Project design is fixed, and through the adoption of good construction and operation principles as described below. Specifically:

- Higher value habitats, such as woodland, hedgerow, trees and ponds, will be avoided and retained where they occur, and will be subject to biodiversity enhancement where appropriate.
- Appropriate buffers (minimum 5m) will be maintained or created around habitats which are of value, including watercourses, woodland, hedgerows, trees and ponds (see **Chapter 4: Our Project**, which includes the design principles on setback distances and buffers adopted for our Project).
- Existing trees and hedgerows will be retained as far as possible and protected in accordance with best practice (BS 5837). Where the removal of such features is unavoidable, lower value features will be selected over higher value.

- Existing tracks and field access locations across our Site will be utilised and where new access is unavoidable, it will be in the footprint of lower value habitats and to a maximum width of up to only 6m.
- The crossing of ditches will be avoided wherever possible so that the current design incorporates the crossing of a single ditch only. The crossing itself will be designed in such a way as to ensure the maintenance of connectivity for aquatic fauna (fish) and semi-aquatic fauna (water vole and otter).

Embedded Measures

7.63. Measures which will be managed throughout the life of our Project will primarily be associated with habitat creation and enhancement. These measures are designed to result in positive effects on biodiversity and to establish an overall Biodiversity Net Gain to deliver in excess of the minimum ten percent required uplift in habitat units, hedgerow units and river units.

7.64. Habitats will be enhanced and created both within land which will be developed, as well as land outside of development areas (set aside for biodiversity and green infrastructure enhancement). The broad aim will be to improve connectivity, both within our Site and the wider landscape, and to create a connected mosaic of a range of habitat types, benefitting a diverse variety of fauna as a result. They will be managed appropriately so that they attain their highest value for biodiversity with a flexible approach, responsive to conditions recorded, attained through regular monitoring.

7.65. This will achieved through:

- Hedgerow planting and enhancement – planting will include a range of native species typical of the region, such as hawthorn, blackthorn, hazel, privet and guelder-rose, with supplementary planting of species-poor and defunct hedgerows. A range of species results in availability of berries, nuts and flowers over the year, provisioning for a range of animal species.
- Species-rich grassland – created under and around solar panels and other infrastructure, utilising a range of seed mixes for specific locations to ensure successful establishment, for example, the use of shade tolerant species underneath solar panels.
- Coastal and floodplain grazing marsh – created along the River Trent corridor, specifically in locations where this habitat type has been mapped as HPI but has lost its qualifying features.

- Ditches – these are likely to improve in terms of water quality providing associated ecological benefits due to the absence of adjacent agricultural activities, such as the spraying of chemicals and resulting runoff. Where ditches have become overgrown with successional vegetation such as willow scrub and bramble, management will be carried out to remove this vegetation allowing sunlight to penetrate and improve the growth of ground flora. Seeding or planting of common reed and other emergent species can be carried out at strategic locations, providing habitat for breeding birds and forage and cover for small mammals. Bankside habitats will be managed to create a 'riparian zone', increasing the habitat availability for associated riparian species. This may include seeding with a species-rich, tussocky meadow mix.
- Scrub – there will be scrub creation which will include a range of native species typical of the region, planted to create marginal habitat between woodland and tall grassland. This would create in extension for woodland fauna and cover for grassland fauna. Consideration will also be paid to planting to improve connectivity between habitats of value, such as along the disused railway track running east to west, and between woodland parcels in the east of our Site.
- Ponds and temporary scrapes and pools – created to improve heterogeneity of habitats, benefiting a range of species. They will be situated in strategic locations where water logging/pooling has been recorded and in close proximity to hedgerow and scrub habitats.
- Badger gates and wildlife-friendly fencing will be permeable to small animals (hedgehogs, reptiles etc.)

7.66. **Appendix 4-1** also sets out the minimum off-sets which have been incorporated from environmental features to protect and improve the local environment.

7.67. Habitat enhancement and creation will provide opportunities for a range of protected and notable species. Additional measures will be incorporated into the design to benefit species identified as local targets, including:

- Barn owl – through improvement of grassland thereby providing better quality habitat for small mammal prey.
- Bats – creation of habitats to improve connectivity and provision of bat roost boxes fixed to trees within suitable habitat.
- Farmland birds including turtle dove – through enhancement and creation of hedgerows, provision of cover crops seeded as narrow strips along field edges, with species such as millet to provide forage and cover.
- Hairstreak butterflies – scrub and hedgerow enhancement and creation.
- Harvest mouse – creation of species-rich grassland, tall, tussocky grassland and provision of cereal cover crops.

- Pollinators – through species-rich grassland creation and the selection of seed mixes for a range of pollinators at strategic locations.
- Skylark – via creation of species-rich grassland.
- Turtle dove – creation of species-rich grassland alongside hedgerow habitat, seeding with a specialised mix for this species.
- Water vole – through enhancement of ditches and bankside habitat.

7.68. In addition, habitat enhancement will include the provision of log piles to create hibernacula for reptiles and amphibians, and bee and beetle banks running east to west between rows of panels.

7.69. Our Project will collaborate with the Local Wildlife Trusts to implement an invasive species management plan. This would focus on the removal and prevention of spreading of Himalayan balsam and Japanese knotweed, and the control of American mink.

Construction Phase

7.70. To ensure that impacts arising from construction are avoided and minimised, our Project will follow an agreed oCEMP (see **Appendix 4.2** of the likely environmental measures to be included) and a 'Decommissioning Management Plan' which will outline the working methods and details of restoration once the construction phase is complete (see **Chapter 4: Our Project** for further details on these plans).

7.71. The oCEMP will include avoidance measures to ensure legal compliance for protected species, including badgers, bats, breeding and wintering birds, otter, reptiles and water voles.

7.72. In addition, an appropriately qualified Ecological Clerk of Works will be appointed for the duration of the construction phase to provide toolbox talks to workers, providing information about protected habitat and species and the legislation relating to them, and to be a point of contact for issues which arise over the duration.

Stakeholder Consultation

7.73. Consultation to date has included meetings with Natural England (NE), Lincolnshire Wildlife Trust and all the host authorities. A summary for which is present in **Table 7-5** below.

Table 7-5: Consultation to Date

Consultee	Date	Stage	Issue raised	Response/ Action taken
Lincolnshire Wildlife Trust	16/10/2023	Pre-EIA Scoping	Workshop run by Lincolnshire Wildlife Trust with multiple solar developers and other stakeholders	N/A
Natural England	05/02/2024	Post EIA scoping	Project overview, baseline, approach to assessment and scoping of the Discretionary Advice Service (DAS) inputs	DAS set up and agreed between parties
Lincolnshire Wildlife Trust	29/02/2024	Post EIA scoping	Project overview, baseline, identifying local conservation priorities, biodiversity enhancement and Biodiversity Net Gain (BNG)	Agreement reached on extent of baseline data collection requirements and need to ensure habitat creation is focused on local conservation priorities as well as delivery of BNG
Solar developers in Lincolnshire and Nottinghamshire	07/03/2024	Post EIA scoping	Coordination of biodiversity enhancements, designing habitat enhancements in light of local nature conservation priorities, approaches to mitigation	Agreement on further coordination and desire to ensure solar development can provide a positive benefit to biodiversity

Consultee	Date	Stage	Issue raised	Response/ Action taken
Lincolnshire County Council, Nottinghamshire County Council, Bassetlaw District Council, Newark and Sherwood District Council, West Lindsay District Council	11/03/2024	Post EIA scoping	Project overview, baseline, identifying local conservation priorities, biodiversity enhancement and Biodiversity Net Gain (BNG)	Agreement reached on extent of baseline data collection (with one outstanding consideration) requirements and need to ensure habitat creation is focused on local conservation priorities as well as delivery of BNG

Potential Likely Significant Effects Scoped Out

7.74. **Table 7-6** presents the elements which have been scoped out from the detailed assessment for all ecological features, as it is considered no likely significant effects will occur.

Table 7-6: Likely Significant Effect Scoped Out of the Assessment

Effects scoped out	Justification
Construction and decommissioning emissions (traffic and construction plant)	Emissions from plant and delivery traffic during the construction and decommissioning phases can lead to habitat change through nutrient deposition, acidification and direct toxicity. However, they are scoped out of the assessment because there are no European sites within 200m of roads on which a detectable rise in traffic would be predicted during the construction phase. There are two SSSI within 200m of the A1133 (Spalford Warren SSSI and Besthorpe Warren SSSI), however these are south of our Site on a stretch of road that is unlikely to be a major construction traffic route, given access from the A57 is proposed. Further, construction and decommissioning traffic can anyway be discounted as the increase in traffic will be temporary and limited, ensuring that the extent of the effect will be low, temporary and reversible. This justification equally applies to LWSs present within the area.
Electro-magnetic fields (EMF)	The effects of electro-magnetic fields (EMF) from buried cables can result in environmental changes in close proximity to cables through soil heating (altering habitat composition) and magnetic fields discouraging certain species from moving through the area. However, cabling for solar farms is no different to those already in position across the country (e.g. connections for on and offshore wind farms, parts of the national grid and district network distribution system and other solar farms) and there is no evidence to suggest they have an effect on ecological features. Heating of the soil would occur over a small area only with typical estimates of measurable changes in temperature being at most between 1 and 1.5m from the cable, thus making any potential effect highly localised. Cabling may be required to pass underneath the River Trent (if the alternative cable crossing of using the Fledborough Viaduct is not possible), this would be installed using directional drilling, at a depth of at least 5m, therefore, EMF effects such as heating will not extend to the water.

7.75. The scope of the biodiversity assessment was to use the baseline data collected through desk study and field survey to-date to determine which of the identified ecological features are 'important'. Following CIEEM (2018, updated 2019) guidance, the importance of each ecological feature was determined using a geographic scale[8] (see **Table 7-7**). The importance of the ecological features has been described in relation to UK legislation and policy, and with regard to the extent of habitat or size of population that may be significantly affected by our Project.

7.76. The importance of ecological features can therefore differ from that which would be conferred solely by legislative protection or identification as a conservation notable species. For example, house sparrow is important at a national level (in policy terms) because it is a priority species (SPI) and features on BoCC red list[9]. However, a small population that could be affected by a development might be assessed as only being of local importance due to the large, albeit declining, UK population (in excess of five million pairs). Similarly, a small length of hedgerow (a HPI), even if deemed to be 'important[10]' with regard to the Hedgerow Regulations, is unlikely to be considered to have greater than 'local' importance due to the extent of this habitat type across a given county.

7.77. Wherever possible, information regarding the extent and population size, population trends and distribution of the ecological features was used to inform their categorisation, and determine their importance at the project level. Where detailed criteria or contextual data were not available at this stage of our Project, professional judgement was used to determine importance.

Table 7-7: Defining Importance of Ecological Features

[8] Where this was not possible due to the level of baseline information currently available the highest relevant level of importance is assumed to ensure no ecological features are scoped out of future assessment when not appropriate.

[9] The IUCN red list provides taxonomic, conservation status and distribution information on taxa that have been globally evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those taxa that are facing a higher risk of global extinction - those listed as Critically Endangered, Endangered and Vulnerable. [Online] Available from: [redacted]

[10] This refers to the legal definition of 'important' within the Hedgerow Regulations 1997 – this is different from how the same term is used within the CIEEM guidelines.

Geographic context of importance	Description
International or European	National site network constituents including SPAs, SACs and candidate SACs. pSPAs, pSACs, Ramsar sites (designated under international convention) and proposed Ramsar sites are also considered in the same manner, in accordance with national planning policy. Areas of habitat or populations of species which meet the published selection criteria based on discussions with Natural England and field data collected to inform the EcIA for designation as a constituent of the national site network, but which are not currently designated at this level.
National	A nationally designated site including SSSIs and NNRs. Areas (and the populations of species which inhabit them) which meet the published selection criteria guidelines for selection of biological SSSIs but which are not themselves designated based on field data collected to inform the EcIA, and in agreement with Natural England. SPIs and HPIs, Red listed and legally protected species that are not addressed directly in Part 2 of the 'Guidelines for Selection of Biological SSSIs' but can be determined to be of national importance using the principles described in Part 1 of the guidance. Areas of ancient woodland, for example woodland listed within the Ancient Woodland Inventory and ancient and veteran trees.
Regional (East Midlands)	*A Biodiversity Strategy for the East Midlands* (2006) provides information on habitats at a regional scale. In respect of our Project, habitats of regional importance will be determined based on the targets set in this chapter. Regularly occurring HPI or populations of SPI, Red listed and legally protected species may be of regional importance in the context of published information on population size and distribution.
County (Lincolnshire and Nottinghamshire)	LNRs and Non-Statutory Designated sites including: LWSs and notable roadside verges.

Geographic context of importance	Description
	Areas which, based on field data collected to inform the EcIA, meet the published selection criteria for those sites listed above (for habitats or species, including those listed in relevant Local Biodiversity Action Plans) but which are not themselves designated.
Local	HPI and SPI, Red listed and legally protected species that based on their extent, population size, quality etc are determined to be at a lesser level of importance than the geographic contexts above. Common and widespread semi-natural habitats occurring within the study area in proportions greater than may be expected in the local context. Common and widespread native species occurring within the study area in numbers greater than may be expected in the local context.
Negligible	Common and widespread semi-natural habitats and species that do not occur in levels elevated above those surrounding the study area. Areas of heavily modified or managed land uses (for example, hard standing used for car parking, as roads etc.)

7.78. Where protected species are present and there is the potential for a breach of legislation due to our Project, those species are considered to be 'important' features regardless of extent of occurrence. With the exception of such species receiving specific legal protection, or those subject to legal control (for example, invasive species), all ecological features determined to be of 'negligible' importance are scoped out of the assessment. This approach is consistent with that described in CIEEM (2018, updated 2019).

7.79. Through an understanding of the activities associated with our Project and the resulting environmental changes, it is possible to identify ecological features that may be subject to potentially significant effects. Ecological features including legally protected species that are of sufficient importance that effects upon them arising from our Project could be significant, were then taken through to the next stage of the scoping assessment.

7.80. To identify such ecological features, all the activities and consequent environmental changes associated with the construction, operation and decommissioning of our Project have been considered. Given the ongoing design process, at this stage of our Project, the environmental changes have been considered in broad categories only. Wherever there is uncertainty as to the potential level of effect or the occurrence of a particular ecological feature, a precautionary approach has been taken.

Spatial Scope

7.81. Key to establishing a potentially significant effect is the determination of a Zone of Influence (ZoI) for each ecological feature (in other words the area within which a significant effect on an ecological feature may occur as a result of our Project). ZoIs differ depending on the type of environmental change (in other words the change from the existing baseline) as a result of our Project, and the ecological feature being considered.

7.82. The construction, operation and maintenance, and decommissioning phases of our Project may result in the following broad environmental changes:

- Temporary land take and habitat degradation during construction.
- Permanent land take, and habitat loss and degradation associated with presence of permanent infrastructure.
- Fragmentation of semi-natural habitats due to habitat loss or degradation and reduction in landscape permeability due to the presence of infrastructure.
- Increases in noise, vibration and human presence during the construction and decommissioning phases resulting in disturbance of fauna.
- Increases in temporary and permanent lighting through all phases of our Project resulting in disturbance of fauna.
- Changes in ground water levels and surface water movement patterns due to imposition of temporary and permanent drainage resulting in habitat degradation.
- Accidental spread of invasive non-native species due to construction activity.
- Pollution of terrestrial and freshwater habitats through loss of chemicals and fines or dust from work areas during construction and decommissioning.
- Changes in hydrology (ground water levels and surface water run-off rates) resulting in habitat change.

7.83. The most straightforward ZoI to define is the area affected by land-take and direct land-cover changes associated with our Project. This ZoI is the same for all affected ecological features. By contrast, for each environmental change that can extend beyond the area affected by land-take and land-cover change (for example noise created by construction), the ZoI may vary between ecological features, dependent upon their sensitivity to the change and the precise nature of the change. For example, a dormouse might only be disturbed by noise generated very close to its nest, whilst nesting lapwing might be disturbed by noise generated at a much greater distance; other species (for example many invertebrates) may be unaffected by changes in noise at all.

7.84. In view of these complexities, the definition of the ZoI that extends beyond the land-take area was based upon professional judgement informed, as far as possible, by a review of published evidence (for example disturbance criteria for various species). The ZoIs for each broad environmental change are specified below. Due to the level of information currently available for this preliminary assessment, the ZoIs have been applied broadly to be precautionary:

- Temporary or permanent land take and habitat degradation - ZoI within our Site for habitats and sedentary species; mobile species may be affected beyond that if the land within our Site lies within their typical home-ranges.
- Fragmentation of semi-natural habitats due to habitat loss or degradation and reduction in landscape permeability due to the presence of infrastructure - ZoI within our Site for habitats and sedentary species; mobile species may be affected beyond that if land within our Site forms part of their typical home-ranges.
- Increases in noise, vibration and human presence during the construction and decommissioning phases resulting in disturbance of fauna - ZoI for sensitive species is up to 500m from construction works, noting that for mobile features of designated sites this is related to the species land use, as opposed to designation boundary.
- Increases in temporary and permanent lighting through all phases of our Project resulting in disturbance of fauna - ZoI for sensitive species up to 450m from areas which require lighting, noting that for mobile features of designated sites this is related to the species land use, as opposed to designation boundary.
- Changes in ground water levels and surface water movement patterns due to imposition of temporary and permanent drainage resulting in habitat degradation - ZoI within the Site for habitats and sedentary species; mobile species may be affected beyond that if land within our Site forms part of their typical home-ranges.
- Accidental spread of invasive non-native species (INNS) due to construction activity - ZoI for habitats and species is up to 500m from our Site, or further if the source and the ecological feature are directly linked via the river system.

- Pollution of terrestrial and freshwater habitats through loss of chemicals and fines or dust from areas of construction and decommissioning - ZoI for habitats and species is up to 500m from our Site, or further if the source and the ecological feature are directly linked via the river system.
- Changes in hydrology (ground water levels and surface water run-off rates) resulting in habitat change - ZoI for sensitive species is within the surface and ground water features described in **Chapter 8: Hydrology and Hydrogeology**, noting that for mobile species that occur on designated sites, this is related to the species range, as opposed to designation boundary.

7.85. It should be noted that the avoidance of potential effects through design are implicitly taken into account through the consideration of each ZoI. Furthermore, when scoping in or out ecological features from further assessment, embedded environmental measures associated with good practice have been taken into account (for example dust suppression, appropriately scheduled vegetation removal etc.).

7.86. **Table 7-8** presents the biodiversity scoping assessment.

Table 7-8: Defining Importance of Ecological Features

Ecological feature	Importance (legislation and policy)	Importance (project level)	Scoped in or out of detailed assessment
Spalford Warren SSSI	National	National	Scoped out – this SSSI lies outside of the ZoI and has been designated for its floral composition rather than for any mobile species. Pollution and runoff from our Project will be controlled through the oCEMP.
Fledborough to Harby Dismantled Railway LWS	County	County	Scoped in – parts of this site occur within our Site, embedded measures will prevent negative effects with enhancement measures resulting in positive effects.
Dunham Dubs, Dunham Oxbow, Darnsyke Marsh, and Fledborough Holme LWS	County	County	Scoped in – these sites support waterbodies within the ZoI for groundwater, pollution and INNS, the environmental measures (best practice construction methods, use of spill kits and detailed drainage design) will prevent negative effects, with habitat enhancement resulting in positive effects, e.g. control/removal of INNS, reduction of polluted runoff from arable fields.
Road Wood, West Wood and South Clifton Grassland	County	County	Scoped out – these lie outside of ZoI for relevant environmental changes in relation to the habitats they support.
Coastal and floodplain grazing marsh	National	National	Scoped in – this habitat lies within our Site it will be retained and enhancement measures will result in positive effects.

Ecological feature	Importance (legislation and policy)	Importance (project level)	Scoped in or out of detailed assessment
Deciduous Woodland	National	County	Scoped out – although this habitat lies within our Site, the embedded measures will result in retention and protection, specifically incorporating a buffer during construction works and as a standoff for solar panel installation.
Other HPIs (hedgerows, ponds, ditches)	National	County	Scoped in – these habitats occur within the ZoI for all environmental changes, however, environmental measures will result in the retention of these habitats. An overall biodiversity gain will be achieved in the enhancement and creation of these habitat types through green infrastructure provision and BNG.
Higher value habitats (plantation woodland and neutral grassland)	National	County and Local	Scoped in – these habitats occur within the ZoI for all environmental changes, however, environmental measures will result in positive effects through the retention and enhancement of these habitats.
The River Trent	National	National	Scoped in – occurs within the ZoI for all environmental changes.
Common and widespread habitats	Local	Local	Scoped out – local losses of common and widespread habitats are not a material consideration. Delivery of the green infrastructure strategy and commitment to BNG ensures overall benefit to the biodiversity of the area.

Ecological feature	Importance (legislation and policy)	Importance (project level)	Scoped in or out of detailed assessment
(cropland, modified grassland, scrub, tall ruderal and dry ditches)			
Badger	Local	Local	Scoped in – occur within the ZoI for all environmental changes. Badger are a highly mobile species and it is possible that new sett excavation may occur within areas of proposed land take prior to the construction phase.
Bats	International	County	Scoped in – bat species occur within the ZoI for all environmental changes.
Birds	International to Local	International to Local	Scoped in – bird species occur within the ZoI for all environmental changes.
Great-crested newt	International	County	Scoped out – it is unlikely that this species occurs within the ZoI for all environmental changes. Pond habitats will not be directly impacted and the creation of ponds, scrapes, scrub and hibernacula will be beneficial for this species, should dispersal occur from the wider landscape.

Ecological feature	Importance (legislation and policy)	Importance (project level)	Scoped in or out of detailed assessment
Otter	International	Local	Scoped in – this species was confirmed to occur within the ZoI as a result of the desk study. Consultation feedback has identified the requirement for further survey to establish presence or likely absence within our Site.
Reptiles (common species)	National	Local	Scoped in – grass snake was confirmed to occur within the ZoI as a result of the desk study. Consultation feedback has identified the requirement for further survey to establish presence or likely absence of grass snake within our Site.
Water vole	National	County	Scoped in – this species was confirmed to occur within the ZoI as a result of the desk study. Consultation feedback has identified the requirement for further survey to establish presence or likely absence within our Site.
Fish	International to Local	International to Local	Scoped out – European eel and river lamprey are confirmed to occur within the ZoI. Consultation feedback identified river lamprey as being a species to consider, however, the only environmental change with potential to impact this species is EMF emitted by cables. There is an option that a cable route may be buried under (via directional drilling) the River Trent channel at a depth of more than 5m, far beyond the distance to which EMF would extend. Environmental measures will ensure that connectivity between and throughout watercourses will be maintained and pollution or runoff will be controlled through the oCEMP.

Ecological feature	Importance (legislation and policy)	Importance (project level)	Scoped in or out of detailed assessment
SPIs (hare and hedgehog)	National	County	Scoped out – these species occur within the ZoI for all environmental changes. However, the extent of land take will be far exceeded by habitat creation and enhancement which will benefit these species.
Invertebrates	International to Local	International to Local	Scoped out – no protected or notable invertebrates recorded within the ZoI.
Plants	International to Local	International to Local	Scoped out – no protected or notable plants recorded within the ZoI.

Temporal Scope

7.87. The temporal scope of the biodiversity assessment is consistent with the period over which our Project will be carried out and therefore covers construction, operation, maintenance, and decommissioning phases. Further details regarding each phase of our Project are provided within **Chapter 4: Our Project**, with a summary relevant to biodiversity provided below:

- Construction: years 1 to 2.
- Operation and maintenance: years 3 to 63.

7.88. Within this assessment the majority of likely significant adverse effects are associated with the construction phase, and even though they may have longer term consequences are only considered at one point of time (e.g. land take). The assessment describes the effects on the ecological features scoped in and highlights the importance of the temporal scope as necessary; however there is not a separate consideration (with a separate conclusion) of the same likely significant effect on each feature in different phases.

Methodology for PEIR Assessment

7.89. Our Project-wide generic approach to assessment is set out in **Chapter 2: Environmental Impact Assessment**. The biodiversity assessment methodology for the PEIR is consistent with that provided in the Scoping Report (November 2023) and no changes to that methodology have been made since the scoping phase.

7.90. The assessment methodology within this chapter is aligned with the standard industry guidance provided by CIEEM (2018, updated 2019), informed by the general approach described in this document. The assessment is based upon the results of the desk study and field surveys (partially complete at present), and relevant published information (for example on the status, distribution, sensitivity to environmental changes and ecology of the features scoped into the assessment, where this information is available), technical engagement with stakeholders, and professional knowledge of ecological processes and functions.

7.91. For each scoped-in ecological feature (see **Table 7-8**), effects are assessed against the baseline conditions for that feature during construction, operation and decommissioning phases. Throughout the assessment process, findings about likely significant effects have been used to inform the definition of requirements for additional baseline data gathering and the identification of embedded environmental measures to avoid or reduce adverse effects or to deliver enhancements.

7.92. It is acknowledged that the assessment that will be documented within the Environmental Statement that will accompany the DCO application will have been informed by more detailed baseline data and also by a greater understanding of the specific details of our Project's design. This assessment is therefore by its very nature preliminary although still meets all statutory requirements.

Significance evaluation methodology

7.93. CIEEM (2018) defines a significant effect as one 'that either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general'.

7.94. When considering likely significant effects on ecological features, whether these are negative or positive, the following characteristics of environmental change are taken into account:

- Extent – the spatial or geographical area over which the environmental change may occur.
- Magnitude – the size, amount, intensity or volume of the environmental change.
- Duration – the length of time over which the environmental change may occur.
- Frequency – the number of times an environmental change may occur.
- Timing – the periods of the day / year / season during which an environmental change may occur.
- Reversibility – whether the environmental change can be reversed through restoration actions or regeneration.

7.95. Although the characteristics described above are all important in assessing effects, the magnitude of the environmental change as a result of our Project provides useful context, described in **Table 7-9**, to provide understanding of the relative scale of change from the baseline position.

Table 7-9: Defining Importance of Ecological Features

Magnitude	Criteria and resultant effect
High	The change permanently (or over the long-term) affects the conservation status of a habitat/species, reducing or increasing the ability to sustain the habitat or the population level of the species within a given geographic area. Relative to the wider habitat resource or species population, a large area of habitat or large proportion of the wider species population is affected. For designated sites, integrity is compromised. There may be a change in the level of importance of the feature in the context of our Project.

Magnitude	Criteria and resultant effect
Medium	The change permanently (or over the long term) affects the conservation status of a habitat/species reducing or increasing the ability to sustain the habitat or the population level of the species within a given geographic area. Relative to the wider habitat resource or species population, a small-medium area of habitat or small-medium proportion of the wider species population is affected. There may be a change in the level of importance of this feature in the context of our Project.
Low	The quality or extent of designated sites or habitats or the sizes of species' populations, experience some small-scale reduction or increase. These changes are likely to be within the range of natural variability and they are not expected to result in any permanent change in the conservation status of the species or habitat or integrity of the designated site. The change is unlikely to modify the evaluation of the feature in terms of its importance.
Very Low	Although there may be some effects on individuals or parts of a habitat area or designated site, the quality or extent of sites and habitats, or the size of species populations, means that they would experience little or no change. Any changes are also likely to be within the range of natural variability and there would be no short-term or long-term change to conservation status of habitats/species features or the integrity of designated sites.
Negligible	A change, the level of which is so low, that it is not discernible on designated sites or habitats or the size of species' populations, or changes that balance each other out over the lifespan of a project and result in a neutral position.

Negative and Positive Effects

7.96. A negative effect is assessed as being significant if the favourable conservation status of an ecological feature would be compromised or lost as a result of our Project. Conservation status is defined in CIEEM 2018, updated in 2019 as follows:

- 'habitats - conservation status is determined by the sum of the influences acting on the habitat that may affect its extent, structure and functions as well as its distribution and its typical species within a given geographical area'; and
- 'species - conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area".

7.97. The decision as to whether the conservation status of an ecological feature has been compromised will be made using professional judgement, drawing upon the results of the assessment of how each feature is likely to be affected by our Project.

7.98. A similar procedure will be used where designated sites may be affected by our Project, except that the focus will be on the effects on the integrity of each site; defined as: "the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified."

7.99. The assessment of effects on integrity will draw upon the assessment of effects on the conservation status of the features for which our Site has been designated.

7.100. A development may result in positive effects where there is a resulting change from baseline that improves the quality of the environment (for example increases species diversity, increases the extent of a particular habitat etc.), or halts or slows down an existing decline. For a positive effect to be considered significant, the level of importance of an ecological feature determined at the baseline state would need to increase by one or more geographical levels (for example where an ecological feature of borough importance becomes of county importance following delivery of our Project).

7.101. The likely significance (or otherwise) of identified effects is defined as follows:

- Not significant – no significant effect to an environmental resource or receptor.
- Significant beneficial – advantageous or positive effect to ecological feature.
- Significant adverse – detrimental or negative effect to ecological feature.

Preliminary Assessment

Fledborough to Harby Dismantled Railway LWS

7.102. Likely significant effects of our Project include changes to ground water levels and surface water movement patterns, accidental spread of invasive non-native species and pollution of terrestrial habitats during the construction and operational phase.

7.103. Habitats within the LWS (scrub and grassland) will not be directly impacted by construction activities and will be protected from indirect impacts through the implementation of environmental measures as detailed earlier. These include the use of buffers, standoff distances from solar panels and best practice construction methods to control dust and other potential pollutants and spread of invasive non-native plant species, as well as the use of spill kits and strategic drainage design to prevent pollution resulting in negative effects of negligible magnitude, on a feature of importance at the County scale and therefore not significant.

7.104. Environmental measures (habitat creation and enhancement) resulting in positive effects of a low magnitude, by improving connectivity and planting in and around the LWS to improve species diversity and increase the overall extent of habitats.

Dunham Dubs, Dunham Oxbow, Darnsyke Marsh, and Fledborough Holme LWSs

7.105. Likely significant effects of our Project include changes to ground water levels and surface water movement patterns, accidental spread of invasive non-native species and pollution of freshwater habitats during the construction and operational phase.

7.106. These LWSs lie outside of our Site and will not be directly impacted during the construction phase. They will be protected through best practice construction methods as well as the use of spill kits and strategic drainage design to prevent pollution resulting in negative effects of negligible magnitude, on a feature of importance at the County scale and therefore not significant.

7.107. The change in habitat from arable to grassland over much of our Site likely to result in positive effects of a low magnitude due to the reduction in chemical (pesticides, fertiliser, etc) runoff associated with arable management. This would result in improved water quality, in turn likely improving the state of biodiversity in the sites.

Coastal and Floodplain Grazing Marsh HPI

7.108. Likely significant effects of our Project include direct land-take, habitat fragmentation, changes to ground water levels and surface water movement patterns, accidental spread of invasive non-native species and pollution of freshwater habitats during the construction and operational phase.

7.109. Although this HPI is said to occur within our Site, in its current condition it does not qualify as the habitat type described. Notwithstanding, the area will not be directly impacted by construction activities, with environmental measures preventing any indirect impacts, namely those relating to best practice construction methods i.e. spill kits, and suitable drainage preventing changes to surface water runoff and pollution of the water table. These measure will result in overall negative effects of negligible magnitude, on a feature of importance at the National scale and therefore not significant.

7.110. Environmental measures associated with the delivery of BNG will result in positive effects on this habitat at a low magnitude, with seeding and ongoing management aiming to restore it to its former condition (for which it was allocated priority status).

Other HPI habitats (Hedgerow, Ponds and Ditches)

7.111. Likely significant effects of our Project include direct land-take, habitat fragmentation, changes to ground water levels and surface water movement patterns, accidental spread of invasive non-native species and pollution of freshwater habitats during the construction and operational phase.

7.112. Hedgerows, ponds and ditches are HPI habitats which occur within our Site. Direct land-take of these features will only occur where there is no other alternative, with features of poor condition selected over those of good. They will be protected from indirect effects through environmental measures including the use of buffers and standoff distances from solar panels and best practice construction activities relating to the prevention and control of pollution and appropriate drainage design to prevent impacts from pollution and changes in surface water. These measure will result in negative effects of negligible magnitude, on a feature of importance at the National scale and therefore not significant.

7.113. Environmental measures associated with the delivery of BNG will include enhancement and creation of these habitat types, resulting in positive effects on these habitats at a low magnitude, with seeding and ongoing management aiming to restore it to its former condition (for which it was allocated priority status).

Higher Value Habitats (Plantation Woodland and Neutral Grassland)

7.114. Likely significant effects of our Project include direct land-take, habitat fragmentation, changes to ground water levels and surface water movement patterns, accidental spread of invasive non-native species and pollution of freshwater habitats during the construction and operational phase.

7.115. These habitats occur within our Site, although are not included within the proposed development footprint and, as such, will not be directly impacted by construction activities and will be protected from indirect impacts through environmental measures. These include the use of buffers, standoff distances from solar panels and best practice construction methods to control dust, noise and other potential pollutants, as well as the use of spill kits and strategic drainage design to prevent pollution resulting in negative effects of negligible magnitude, on a feature of importance at the National scale and therefore not significant.

7.116. Environmental measures (habitat creation and enhancement) resulting in positive effects of a low magnitude for plantation woodland and medium magnitude for neutral grassland, by improving connectivity and seeding/planting in and around the these habitats to improve species diversity and increase the overall extent of habitats.

The River Trent

7.117. Likely significant effects of our Project include changes to ground water levels and surface water movement patterns, accidental spread of invasive non-native species and pollution of freshwater habitats during the construction and operational phase.

7.118. The River Trent lies outside of our Site but within the ZoI for watercourses. This feature will be protected through best practice construction methods including the use of spill kits and strategic drainage design to prevent pollution, spread of invasive non-native plant species and changes to surface water patterns resulting in negative effects of negligible magnitude, on a feature of importance at a National scale and therefore not significant.

7.119. Should horizontal directional drilling under the River Trent be undertaken for the cable crossing, this will consider and avoid breeding seasons and migration of protected water species (such as lamprey). The impacts of the cable crossing on the River Trent is therefore not significant.

7.120. The change in surrounding habitat, from arable to grassland, will likely result in positive effects of a low magnitude due to the reduction in chemical (pesticides, fertiliser, etc) runoff associated with arable management. This would result in improved water quality, in turn improving the state of biodiversity within the river.

Badger

7.121. Likely significant effects of our Project include direct land-take, habitat fragmentation, increases in noise, vibration and human presence, increases in temporary and permanent lighting and changes to ground water levels and surface water movement patterns during the construction and operational phase.

7.122. The preconstruction walkover will confirm active setts and identify new ones within our Site and the application of buffers surrounding setts will protect them from noise, vibration and human presence during the construction phase. There will be no temporary or permanent lighting used and appropriate licensing will be sought where construction activity is required within 30m of a sett. Suitable drainage design will prevent changes in surface water movement patterns and oraging territories will be maintained through embedded measures. These measures will result in an overall negative effect of low magnitude, on a feature of importance at a Local scale and therefore not significant.

7.123. Although there will be an initial loss of foraging habitat for this species, this will be small, with habitat creation and enhancement mitigating for this loss, whereby the diversity of species will result in an abundance of berry producing plants and an increase in invertebrates, which make up a significant proport of the badger's diet. These measures will result in an overall positive effect of low magnitude.

Bats

7.124. Likely significant effects of our Project include direct land-take, habitat fragmentation, increases in noise, vibration and human presence, increases in temporary and permanent lighting during the construction and operational phase.

7.125. Construction-related effects on bats are likely to involve the loss of a small extent of low value foraging habitat (arable farmland). All features of moderate or high interest for bats (hedgerows, woodland edge, mature trees, ponds, strips of semi-improved grassland) will be retained unless there is no alternative and protected from construction activities. Where unavoidable, removal of moderate or high value habitat for bats will be limited.

7.126. There will be no habitat fragmentation and no permanent lighting of the facility will be required. Pre-construction walkover surveys will identify trees which provide suitable roosting opportunities for bats, the application of buffers around these trees will protect than from noise and vibration during the construction phase. Where walk is required within these buffers, further surveys will be required to establish the necessity for, and support licence applications.

7.127. Natural England Guidance TIN101 states that there is some evidence from a laboratory-based study that bats may occasionally collide with solar panels; however, there is no evidence to date substantiating any associated collision risk[11]. The panels to be used for our Project will have a matt metal frame which breaks up the surface visual effect.

7.128. The above measures will result in an overall negative effect of negligible magnitude on a feature of importance at a County scale and therefore not significant.

7.129. Habitat enhancements proposed as part of the design and delivering BNG include new native species hedgerow planting which along with extensive grassland creation, will enhance foraging opportunities and strengthen habitat links for commuting, which results in a positive effect of low magnitude.

Birds

7.130. Likely significant effects of our Project include direct land-take, habitat fragmentation, increases in noise, vibration and human presence, increases in temporary and permanent lighting and changes to ground water levels and surface water movement patterns during the construction and operational phase.

7.131. Land-take during the construction phase may result in the loss of breeding or foraging habitat, directly within our Project footprint, or indirectly within adjacent areas through disturbance or displacement, if undertaken within the bird breeding season. Hedgerows and trees located along field boundaries (which will largely be retained and protected) will typically support a range of farmland nesting bird species; these habitats will likely be subject to some level of localised indirect disturbance or displacement for a temporary period during the construction phase (should this occur during the breeding season).

7.132. Specifically, the potential for disturbance to skylark, depending on the period of construction, may result in significant effects at a Local scale. On a precautionary basis, potential effects on either individuals or local populations of skylark are therefore assessed as being of low magnitude (breeding season only), temporary and not significant on this receptor of importance at a Local scale, in the absence of mitigation (embedded measures and the Construction Environmental Register). Effects would be negligible if undertaken outside the breeding season.

7.133. In relation to other species (the general bird population), temporary disturbance, habitat loss and displacement impacts on small numbers of birds during construction are considered to be temporary and low magnitude (breeding season only), on receptors of importance at the Local scale, in the context of this rural agricultural landscape, temporary (during the construction phase only).

[11] Harrison, C., Lloyd, H. & Field, C. (2016). *Evidence review of the impact of solar farms on birds, bats and general ecology*. Manchester Metropolitan University.

7.134. The reversion of arable land into extensive meadow grassland on completion of construction works will increase the value of our Site for most bird species, providing strengthened habitat connectivity; as such any habitat losses or disturbance during construction would be considered short-term and reversible.

7.135. Measures are proposed to ensure legal compliance and prevent the risk of accidental destruction of nests if works are undertaken during the breeding season and to reduce the overall potential disturbance effects on farmland birds.

7.136. Habitat enhancements proposed as part of the design include new native species hedgerow planting which, along with extensive grassland creation, results in a positive effect of low magnitude for this feature.

Otter

7.137. Likely significant effects of our Project include direct land-take, habitat fragmentation, increases in noise, vibration and human presence, changes to ground water levels and surface water movement patterns, and pollution of freshwater habitats during the construction and operational phase.

7.138. Otter have been recorded within the ZoI and habitats within our Site are suitable for this species, namely the River Trent and smaller associated watercourses. However, surveys are yet to be conducted to establish their presence or likely absence within our Site.

7.139. If they are found to be present, it is unlikely that they would be directly impacted during construction activities, with watercourses avoided in the most part. A cable route across the River Trent is either to use an existing structure or to be buried under the River via directional drilling. As a result there will be no effect to otter, should they be present, from this crossing.

7.140. Current designs do however, include the crossing of one ditch within our Site, environmental measures for which will ensure connectivity for riparian mammals. In addition, watercourses will be protected from adverse impacts through best practice construction methods and appropriately designed drainage. Overall, negative effects on otter from construction are considered to be of low magnitude and temporary, on a feature of importance at the Local scale and are therefore not significant.

7.141. The permanent change of habitat from arable to grassland will likely result in positive effect of a low magnitude due to the reduction in chemical (pesticides, fertiliser, etc) runoff associated with arable management. This would result in improved water quality, in turn improving the state of biodiversity throughout our Site. Environmental measures associated with BNG will result in the enhancement of water ways and associated bankside habitats and the creation of scrub habitat which may be used as a resting place for otters along the River Trent.

Reptile

7.142. Likely significant effects of our Project include direct land-take, habitat fragmentation, increases in noise, vibration and human presence, changes to ground water levels and surface water movement patterns, and pollution of freshwater habitats during the construction and operational phase.

7.143. One species of reptile; grass snake, was identified in the ZoI for environmental changes. This species is closely associated with riparian habitats which occur within our Site itself. However, surveys are yet to be conducted to establish their presence or likely absence on-Site.

7.144. If they are found to be present, it is unlikely that they would be directly impacted during construction activities, with watercourses avoided in the most part. Current designs include the crossing of one ditch within our Site, environmental measures for which will ensure connectivity for riparian fauna. In addition, watercourses will be protected from adverse impacts through best practice construction methods and appropriately designed drainage. Overall, negative effects on grass snake from construction activities are likely to be of low magnitude and temporary, on a feature of importance at the Local scale and therefore not significant.

7.145. A permanent change of habitat from arable to grassland will likely result in positive effects of a low magnitude due to the reduction in chemical (pesticides, fertiliser, etc) runoff associated with arable management. This would result in improved water quality, in turn improving the state of biodiversity throughout our Site. Environmental measures associated with BNG will result in the creation of waterbodies and improved management of bankside habitats.

Water Vole

7.146. Likely significant effects of our Project include direct land-take, habitat fragmentation, increases in noise, vibration and human presence, changes to ground water levels and surface water movement patterns, and pollution of freshwater habitats during the construction and operational phase.

7.147. Water vole was identified in the ZoI for environmental changes as a result of the desk study, some records occurred within our Site itself. In addition, agricultural drains and ditches within our Site provide suitable habitat for this species. Surveys are yet to be conducted to confirm their current presence on our Site.

7.148. If they are found to be present, it is unlikely that they would be directly impacted during construction activities, with watercourses avoided in the most part. A cable route across the River Trent is either to use an existing structure or to be buried under the River via directional drilling. As a result there will be no effect to water vole, should they be present, from this crossing.

7.149. Current designs do however, include the crossing of one ditch within our Site, environmental measures for which will ensure connectivity for riparian mammals. In addition, watercourses will be protected from adverse impacts through best practice construction methods and appropriately designed drainage. Overall, negative effects on otter from construction are considered to be of low magnitude and temporary, on a feature of importance at the Local scale and are therefore not significant.

7.150. No negative effects would be associated with the operational phase, with a permanent change of habitat from arable to grassland likely to result in positive effects of a low magnitude due to the reduction in chemical (pesticides, fertiliser, etc) runoff associated with arable management. This would result in improved water quality, in turn improving the state of biodiversity throughout our Site. Environmental measures associated with BNG will result in the creation of waterbodies and improved management of bankside habitats.

Further Data Collection

- Due to the refinement and subsequent amendments made to our Site boundary, the Phase 1 habitat survey requires minor updating to cover areas not previously incorporated into the study area and to 'ground truth' areas which were subject to assessment at this stage, from satellite imagery.
- Minor changes to our Site boundary will not impact the extended study area, from 1 to 10km, however, prior to submission of the ES, an updated data search will be conducted to ensure that any recent records are considered in the final assessment.
- Any new or recent signs of badgers recorded during other ecology surveys in 2024 will be considered. Badger are highly mobile species, moving around the landscape and sometimes switching between main setts.
- Additional information regarding the activity of bats within our Site will be recorded over the active bat season (April to October) at strategically selected monitoring locations. These locations will aim to compare bat activity within the full range of habitat types present, providing a baseline for monitoring conducted during the operational phase.
- Species specific surveys for riparian mammals: water vole and otter, will be carried out in 2024. Specifically this will involve the survey of water-courses identified during habitat assessment, as providing suitable habitat for these species.
- A small proportion of habitats within our Site provide suitability for common and widespread reptile species. In response to consultation, a sample of riparian/bankside habitat will be surveyed, with the specific aim to establish a population estimate of grass snake which were identified as occurring within the study area by the desk study.

Conclusions

7.151. **Table 7-10** presents a summary of the preliminary likely significant effects, with further information. Where further works will be undertaken **Tabel 7-10** also includes the next steps to be undertaken as part of the Environmental Impact Assessment.

Table 7-10: Summary Ecological Features

Ecological feature	Preliminary Likely Significant Effect	Further Information	Next Steps
Fledborough to Harby Dismantled Railway LWS	No likely significant effects	The adoption of a CEMP will mitigate any significant effects.	-
Dunham Dubs, Dunham Oxbow, Darnsyke Marsh, and Fledborough Holme LWSs	No likely significant effects	The adoption of a CEMP will mitigate any significant effects.	-
Coastal and Floodplain Grazing Marsh HPI	No likely significant effects	The adoption of a CEMP will mitigate any significant effects.	-
Other HPI habitats (Hedgerow, Ponds and Ditches)	No likely significant effects	The adoption of a CEMP will mitigate any significant effects.	-
Higher Value Habitats (Plantation Woodland and Neutral Grassland)	No likely significant effects	The adoption of a CEMP will mitigate any significant effects.	-
The River Trent	No likely significant effects	The adoption of a CEMP will mitigate any significant effects.	-
Badger	No likely significant effects	The adoption of a CEMP will mitigate any significant effects.	Incidental observations of badger activity will update current records.

Ecological feature	Preliminary Likely Significant Effect	Further Information	Next Steps
Bats	No likely significant effects	The adoption of a CEMP will mitigate any significant effects.	Further survey will establish constant effort acoustic monitoring locations.
Birds	No likely significant effects	The adoption of a CEMP will mitigate any significant effects.	-
Otter	No likely significant effects	The adoption of a CEMP will mitigate any significant effects.	Further survey required of suitable habitat.
Reptiles	No likely significant effects	The adoption of a CEMP will mitigate any significant effects.	Further survey required of suitable habitat.
Water vole	No likely significant effects	The adoption of a CEMP will mitigate any significant effects.	Further survey required of suitable habitat.

Appendices

Appendix 7-1: Key Policy and Legislation

Appendix 7-2: Phase 1 Habitat Survey

Appendix 7-3: Bat Baseline

Appendix 7-4: Breeding Bird Baseline

Appendix 7-5: Great-Crested Newt Baseline

Appendix 7-6: Badger and Riparian Mammal Baseline

Appendix 7-7: Wintering Bird Baseline

Appendix 7-8: List of Species with Scientific names

Appendix 7-1: Key Policy and Legislation

Review of Policy, Legislation and Relevant Guidance

Legislation, planning policy and guidance relating to biodiversity, and pertinent to the our Project comprises:

Legislation

The Environment Act (2021)

This legislation is part of a post-Brexit legal framework in the UK for environmental protection. The Act makes provisions for targets, plans and policies toward general improvement of the natural environment. Specifically in relation to biodiversity, Part 6 of the Act, introduced a 10% Biodiversity Net Gain (BNG) mandatory requirement for new development falling under the Town and Country Planning Act 1990.

The Act also introduces new measures toward the conservation of biodiversity, specifically on the duty of local authorities, including the strengthening of woodland protection enforcement measures, Conservation Covenants, Protected Site Strategies, Species Conservation Strategies, and Local Nature Recovery Strategies to supplement a Nature Recovery Network.

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

Also referred to as the Habitats Directive, this legislation sets out the designation of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) across the UK. These designations give an increased level of legal environmental protection in comparison to domestic protections. Specific species listed under this legislation are also given a higher level of protection. The 2017 regulations were amended in 2019 and became operable from 1st January 2021, which included an amended process for the designation of SACs, and further amendments to ensure operational effectiveness when excluding functions from the European Commission.

Natural Environment and Rural Communities Act (2006) (as amended)

Also referred to as the NERC Act (2006), Section 40 of this legislation set out the need for public bodies and statutory undertakers to have regard to biodiversity to ensure no net loss of biodiversity going forward. This legislation also establishes Natural England as a non-departmental public body. Section 41 of the Act places a duty on the Secretary of State to maintain species and habitat lists that are of principal importance for the conservation of biodiversity in England, also known as priority species or habitats.

Countryside and Rights of Way Act (2000) (as amended)

This legislation relates to right of access across the UK, giving public access to land which is mapped as “open country” or registered common land. Collectively, these areas are referred to as “open access land” through the CROW Act. The Act sets out the rights permitted on open access land, and subsequently what isn’t permitted. The Act also clearly sets out the exclusion of access to land which is referred to as ‘excepted land.’

Hedgerow Regulations (1997)

The Hedgerow Regulations (1997) were introduced as part of the Environment Act 1995, specifically relating to arrangements for local authorities in England and Wales to protect hedgerow. These regulations set out protections to control removal of ‘important’ hedgerows via the implementation of a system of notification. This means that local planning authorities must be notified when managers of land (or utility operators) want to remove hedgerow and must provide robust justification. Local authorities can refuse consent for hedgerow removal.

Protection of Badgers Act 1992 (as amended)

This Act consolidates previous legislation on the protection of badgers and outlines that it is an offence to take, injure, kill, or ill-treat a badger, interfere with badger setts, sell and come into possession of live badgers, or marking a badger, without obtaining a license from a statutory authority. The Act lists the explicit exceptions to this, as well as the licensing process, enforcement and penalties associated with any offence.

Wildlife & Countryside Act (1981) (as amended)

This Act consolidated previous legislation on the protection and conservation of birds, wild creatures and wild plants, and now provides protection to a range of species of flora and fauna. This Act also details the law relating to Sites of Special Scientific Interest (SSSI). Schedule 9 of the Act lists the flora and fauna for which it is illegal to introduce into the wild or cause the spread of, within the UK.

National Planning Policy

Overarching National Policy Statement for Energy (EN-1) (2023)

This provides overarching government policy on energy NSIPs, and the way in which any impacts and mitigation measures will be considered. Specific extracts relating to the Proposed Development are as follows:

Paragraph 4.6.2 states that *“Biodiversity net gain is an essential component of environmental net gain. Projects in England should consider and seek to incorporate improvements in natural capital, ecosystem services and the benefits they deliver when planning how to deliver biodiversity net gain.”*

Paragraph 4.6.7 states that *"In England applicants for onshore elements of any development are encouraged to use the latest version of the biodiversity metric to calculate their biodiversity baseline and present planned biodiversity net gain outcomes. This calculation data should be presented in full as part of their application."*

Paragraph 5.4.19 states that *"The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests."*

Paragraph 5.4.21 states that *"…the design process should embed opportunities for nature inclusive design. Energy infrastructure projects have the potential to deliver significant benefits and enhancements beyond Biodiversity Net Gain, which result in wider environmental gains (see Section 4.6 on Environmental and Biodiversity Net Gain). The scope of potential gains will be dependent on the type, scale, and location of each project."*

Paragraph 5.4.36 states that *"Applicants should produce and implement a Biodiversity Management Strategy as part of their development proposals. This could include provision for biodiversity awareness training to employees and contractors so as to avoid unnecessary adverse impacts on biodiversity during the construction and operation stages."*

Paragraph 5.4.53 states that *"The Secretary of State should not grant development consent for any development that would result in the loss or deterioration of any irreplaceable habitats, including ancient woodland, and ancient and veteran trees unless there are wholly exceptional reasons, and a suitable compensation strategy exists."*

National Policy Statement for Renewable Energy Infrastructure (EN-3) (2023)

This provides overarching government policy on energy NSIPs, and the way in which any impacts and mitigation measures will be considered. Specific extracts relating to the Proposed Development are as follows:

Paragraphs 2.10.75 to 2.10.83 state that *"Generic environmental, biodiversity, ecology, geological and water management impacts are covered in section 4.3 (Environmental Principles), section 4.6 (Environmental and Biodiversity Net Gain), section 5.4 (Biodiversity and Geological Conservation) and section 5.8 (Flood Risk) of EN-1.*

The applicant's ecological assessments should identify any ecological risk from developing on the proposed site.

Issues that need assessment may include habitats, ground nesting birds, wintering and migratory birds, bats, dormice, reptiles, great crested newts, water voles and badgers.

The applicant should use an advising ecologist during the design process to ensure that adverse impacts are avoided, minimised or mitigated in line with the mitigation hierarchy, and biodiversity enhancements are maximised.

The assessment may be informed by a 'desk study' of existing ecological records, an evaluation of the likely impacts of the solar farm upon ecological features, and should specify mitigation to avoid or minimise these impacts, and any further surveys required.

Applicants should consider earthworks associated with construction compounds, access roads and cable trenching.

Where soil stripping occurs, topsoil and subsoil should be stripped, stored, and replaced separately to minimise soil damage and to provide optimal conditions for site restoration. Further details on minimising impacts on soil and soil handling are above at paragraphs 2.10.33 and 2.10.34.

Applicants should consider how security and lighting installations may impact on the local ecology. Where pole mounted CCTV facilities are proposed the location of these facilities should be carefully considered to minimise impact. If lighting is necessary, it should be minimised and directed away from areas of likely habitat.

Applicants should consider how site boundaries are managed. If any hedges/scrub are to be removed, further surveys may be necessary to account for impacts. Buffer strips between perimeter fencing and hedges may be proposed, and the construction and design of any fencing should account for enabling mammal, reptile and other fauna access into the site if required to do so in the ecological report."

National Planning Policy Framework (2023)

The National Planning Policy Framework (NPPF) is an overarching document which sets out government planning policy for development outside of the NSIP regime in England, and how this is expected to be applied by local authorities and developers. The NPPF can be an important and relevant consideration for NSIPs as well, but in the event of any conflict, the NPS policy prevails. The NPPF provides a framework for local sustainable development via local plans. Specific extracts relating to this Proposed Development are as follows:

Paragraph 179 states that *"Local planning authorities should limit the planned lifetime of development in a Coastal Change Management Area through temporary permission and restoration conditions, where this is necessary to reduce a potentially unacceptable level of future risk to people and the development."*

Paragraph 180 states that *"Planning policies and decisions should contribute to and enhance the natural and local environment by:*

> *a) protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan);*
>
> *b) recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland;*

c) maintaining the character of the undeveloped coast, while improving public access to it where appropriate;

d) minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and

f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."

Local Planning Policy

Local planning policy relevant to our Site is set out below. Local policies can be an important and relevant consideration for NSIPs as well, but in the event of any conflict, the NPS policy prevails.

Newark and Sherwood District Council (2023) Local Development Framework, Amended Allocations and Development Management Development Plan Document (AADMDPD), Submission Version, January 2024

This amended local Development Plan Document (DPD) has been compiled to ensure that the wider development framework within Newark and Sherwood District Council sufficiently allocates land for development to meet the needs of the area, up until 2033.

The document includes *"new and amended Housing and Affordable Housing Policies which replace those included in the Amended Core Strategy and new Gypsy Roma Traveller policies and allocations. The document also sets out amendments to urban boundaries and village envelopes, retail boundaries as well as sites requiring continued protection from development (open space and green infrastructure designations). It also includes a suite of Development Management policies to provide greater direction, help deliver specific allocations and assist in the day-to-day assessment of planning applications."* This DPD is currently under examination via the Secretary of State with an independent planning inspector.

Specific policies within the AADMDPD relevant to our Project include Policy DM7 "Biodiversity and Green Infrastructure", which states that *"New development, in line with the requirements of Core Policy 12 of the Amended Core Strategy, should protect, promote and enhance biodiversity and the ecological network of habitats, species and sites of international, national and local importance."*

Policy DM8 “Development in the Open Countryside” is also specifically relevant to our Project and states that *“In accordance with the requirements of Spatial Policy 3 of the Amended Core Strategy, development away from villages or settlements, in the open countryside, will be strictly controlled and limited to the following types of development:*

Agricultural and Forestry Development Requiring Planning Permission;

New and Replacement Rural Workers Dwellings, the Extension of Existing Rural Workers Dwellings, and the Removal of Occupancy Conditions Attached to Existing Dwellings;

New and Replacement Dwellings;

Replacement of Non-Residential Buildings;

Conversion of existing buildings;

Rural Diversification;

Equestrian Uses;

Employment uses;

Community and Leisure Facilities;

Roadside Services; and

Visitor Based Tourism Development and Tourist Accommodation.”

Newark and Sherwood District Council (2019) Amended Core Strategy Development Plan (2019)

The Amended Core Strategy for Newark and Sherwood District is part of the Local Development Framework for the area. This strategy outlines the overarching issues and objectives to address over a 20-year period, contextualising this into wider vision, series of objectives and core policies toward delivery.

Core Policy 12 “Biodiversity and Green Infrastructure” is relevant to this Proposed Development and states that *“The District Council will seek to conserve and enhance the biodiversity and geological diversity of the District by working with partners to implement the aims and proposals of the Nottinghamshire Local Biodiversity Action Plan, the Green Infrastructure Strategy and the Nature Conservation Strategy. The District Council will therefore:*

Expect proposals to take into account the need for continued protection of the District’s ecological, biological and geological assets. With particular regard to sites of international, national and local significance, Ancient Woodlands and species and habitats of principal importance identified in Section 41 of the Natural Environment and Rural Communities Act 2006 and in the Nottinghamshire Local Biodiversity Action Plan;

Seek to secure development that maximises the opportunities to conserve, enhance and restore biodiversity and geological diversity and to increase provision of, and access to, green infrastructure within the District;

Promote the appropriate management of features of major importance for wild flora and fauna;

Provide for Suitable Alternative Natural Green Space to reduce visitor pressure on the District's ecological, biological and geological assets, particularly in the Newark area and for 5kms around the Birklands and Bilhaugh Special Area of Conservation;

Support the development of a Green Infrastructure Network, as illustrated in the Green Infrastructure Diagram, linking together Key Strategic Routes throughout the District and providing for, in appropriate locations, visitor infrastructure that improves accessibility. The District Council will, in particular, promote improved green infrastructure linkages between:

- *Newark and Southwell; and*
- *Southwell and the north-west of the district*

Development proposals crossing or adjacent to the network should make provision for its implementation and/or enhancement;

Positively view proposals that seek to enhance the District's Green Infrastructure resource in support of tourism development. Proposals in the Bilsthorpe, Edwinstowe and Ollerton & Boughton areas, in connection with the Sherwood Forest Regional Park, will be supported. In Newark, new Green Infrastructure schemes that maximise the potential of the Trent Riverside area will be supported;

Support the implementation of area-based Strategic Green Infrastructure interventions; and

Work with partners to develop a strategic approach to managing Air Quality in the Sherwood Area, including through the development of a Supplementary Planning Document."

Central Lincolnshire Local Plan (2023)

The Local Plan for the central Lincolnshire area sets out the approach to planning policy and overarching development allocations to drive growth in the area over a 20-year period. The Local Plan is contextualised into a wider vision, series of objectives and core policies toward delivery.

Specific policies detailed in the Local Plan and are relevant to our Project, as below.

Policy S59 "Green and Blue Infrastructure Network" states that:

"The Central Lincolnshire Authorities will safeguard green and blue infrastructure in Central Lincolnshire from inappropriate development and work actively with partners to maintain and improve the quantity, quality, accessibility and management of the green infrastructure network.

Proposals that cause loss or harm to the green and blue infrastructure network will not be supported unless the need for and benefits of the development demonstrably outweigh any adverse impacts. Where adverse impacts on green infrastructure are unavoidable, development will only be supported if suitable mitigation measures for the network are provided.

Development proposals should ensure that existing and new green and blue infrastructure is considered and integrated into the scheme design from the outset. Where new green infrastructure is proposed, the design and layout should take opportunities to:

> *a) incorporate a range of types and sizes of green and blue spaces, green routes and environmental features that are appropriate to the development and the wider green and blue infrastructure network to maximise the delivery of multi-functionality;*
>
> *b) deliver biodiversity net gain and support ecosystem services;*
>
> *c) respond to landscape/townscape and historic character;*
>
> *d) support climate change adaptation and resilience including through use of appropriate habitats and species; and*
>
> *e) encourage healthy and active lifestyles.*

Development proposals must protect the linear features of the green and blue infrastructure network that provide connectivity between green infrastructure assets, including public rights of way, bridleways, cycleways, and waterways, and take opportunities to improve and expand such features.

Development will be expected to make a contribution proportionate to their scale towards the establishment, enhancement and on-going management of green and/or blue infrastructure by contributing to the development of the strategic green infrastructure network within Central Lincolnshire, in accordance with the Developer Contributions SPD."

Policy S60 "Protecting Biodiversity and Geodiversity" states that:

"All development should:

a) protect, manage, enhance and extend the ecological network of habitats, species and sites of international, national and local importance (statutory and non-statutory), including sites that meet the criteria for selection as a Local Site;

b) minimise impacts on biodiversity and features of geodiversity value;

c) deliver measurable and proportionate net gains in biodiversity in accordance with Policy S61; and

d) protect and enhance the aquatic environment within or adjoining the site, including water quality and habitat.

Part One: Designated Sites

The following hierarchy of sites will apply in the consideration of development proposals:

1. *International Sites*

The highest level of protection will be afforded to internationally protected sites. Development proposals that will have an adverse impact on the integrity of such areas, will not be supported other than in exceptional circumstances, in accordance with the NPPF.

Development proposals that are likely to result in a significant adverse effect, either alone or in combination with other proposals, on any internationally designated site, must satisfy the requirements of the Habitats Regulations (or any superseding similar UK legislation). Development requiring Appropriate Assessment will only be allowed where it can be determined, taking into account mitigation, that the proposal would not result in significant adverse effects on the site's integrity.

2. *National Sites (NNRs and SSSI's)*
   Development proposals should avoid impact on these nationally protected sites. Development proposals within or outside a national site, likely to have an adverse effect, either individually or in combination with other developments, will not normally be supported unless the benefits of the development, at this site, clearly outweigh both the adverse impacts on the features of the site and any adverse impacts on the wider network of nationally protected sites.

3. *Irreplaceable Habitats*
   Planning permission will be refused for development resulting in the loss, deterioration or fragmentation of irreplaceable habitats, including ancient woodland and aged or veteran trees, unless there are wholly exceptional reasons and a suitable compensation strategy will be delivered.
4. *Local Sites (LNR, LWS and LGS)*
   Development likely to have an adverse effect on locally designated sites, their features or their function as part of the ecological network, will only be supported where the benefits of the development clearly outweigh the loss, and the coherence of the local ecological network is maintained. Where significant harm cannot be avoided, the mitigation hierarchy should be followed.

Part Two: Species and Habitats of Principal Importance

All development proposals will be considered in the context of the relevant Local Authority's duty to promote the protection and recovery of priority species and habitats.

Development should seek to preserve, restore and re-create priority habitats, ecological networks and the protection and recovery of priority species set out in the Natural Environment and Rural Communities Act 2006, Lincolnshire Biodiversity Action Plan, Lincolnshire Geodiversity Strategy and Local Nature Recovery Strategy.

Where adverse impacts are likely, development will only be supported where the need for and benefits of the development clearly outweigh these impacts. In such cases, appropriate mitigation or compensatory measures will be required.

Part Three: Mitigation of Potential Adverse Impacts

Development should avoid adverse impact on existing biodiversity and geodiversity features as a first principle, in line with the mitigation hierarchy. Where adverse impacts are unavoidable they must be adequately and proportionately mitigated. If full mitigation cannot be provided, compensation will be required as a last resort where there is no alternative.

Development will only be supported where the proposed measures for mitigation and/or compensation along with details of net gain are acceptable to the Local Planning Authority in terms of design and location, and are secured for the lifetime of the development with appropriate funding mechanisms that are capable of being secured by condition and/or legal agreement.

If significant harm to biodiversity resulting from development cannot be avoided, adequately mitigated, or, as a last resort, compensated for, then planning permission will be refused."

Policy S61 "Biodiversity Opportunity and Delivering Measurable Net Gains" states that:

"Following application of the mitigation hierarchy, all development proposals should ensure opportunities are taken to retain, protect and enhance biodiversity and geodiversity features proportionate to their scale, through site layout, design of new buildings and proposals for existing buildings with consideration to the construction phase and ongoing site management.

Development proposals should create new habitats, and links between habitats, in line with Central Lincolnshire Biodiversity Opportunity and Green Infrastructure Mapping evidence, the biodiversity opportunity area principles set out in ***Appendix 4*** *to this Plan and the Local Nature Recovery Strategy (once completed), to maintain and enhance a network of wildlife sites and corridors, to minimise habitat fragmentation and provide opportunities for species to respond and adapt to climate change.*

Proposals for major and large scale development should seek to deliver wider environmental net gains where feasible.

Biodiversity Net Gain

The following part of the policy applies unless, and until, subsequently superseded, in whole or part, by national regulations or Government policy associated with the delivery of mandatory biodiversity net gain arising from the Environment Act 2021. Where conflict between the policy below and the provisions of Government regulations or national policy arises, then the latter should prevail.

All qualifying development proposals must deliver at least a 10% measurable biodiversity net gain attributable to the development. The net gain for biodiversity should be calculated using Natural England's Biodiversity Metric.

Biodiversity net gain should be provided on-site wherever possible. Off-site measures will only be considered where it can be demonstrated that, after following the mitigation hierarchy, all reasonable opportunities to achieve measurable net gains on-site have been exhausted or where greater gains can be delivered off-site where the improvements can be demonstrated to be deliverable and are consistent with the Local Nature Recovery Strategy.

All development proposals, unless specifically exempted by Government, must provide clear and robust evidence for biodiversity net gains and losses in the form of a biodiversity gain plan, which should ideally be submitted with the planning application (or, if not, the submission and approval of a biodiversity gain plan before development commences will form a condition of any planning application approval), setting out:

> *a) information about the steps to be taken to minimise the adverse effect of the development on the biodiversity of the onsite habitat and any other habitat;*
>
> *b) the pre-development biodiversity value of the onsite habitat;*
>
> *c) the post-development biodiversity value of the onsite habitat following implementation of the proposed ecological enhancements/interventions;*
>
> *d) the ongoing management strategy for any proposals;*
>
> *e) any registered off-site gain allocated to the development and the biodiversity value of that gain in relation to the development; and*
>
> *f) exceptionally any biodiversity credits purchased for the development through a recognised and deliverable offsetting scheme.*

Demonstrating the value of the habitat (pre and post-development) with appropriate and robust evidence will be the responsibility of the applicant. Proposals which do not demonstrate that the post-development biodiversity value will exceed the pre-development value of the onsite habitat by a 10% net gain will be refused.

Ongoing management of any new or improved onsite and offsite habitats, together with monitoring and reporting, will need to be planned and funded for 30 years after completion of a development."

Bassetlaw District Council (2010) Local Development Framework, Publication Core Strategy and Development Management Policies

The Core Strategy for the Bassetlaw District sets out the overarching vision for the area up until 2026, including the policy approach to deliver this.

Policy DM9 "Green Infrastructure; Biodiversity & Geodiversity; Landscape; Open Space and Sports Facilities" is related to our Project and states:

"A. Green Infrastructure

Development proposals will be expected to support the Council's strategic approach to the delivery, protection, and enhancement of multi-functional Green Infrastructure, to be achieved through the establishment of a network of green corridors and assets (please refer to the Council's Green Infrastructure work for a full list of Green Corridors and Nodes within, and running beyond, the District) at local, sub-regional, and regional levels. Particular support will be given to proposals that will further the development of:

- *The Idle Valley Project;*
- *The Trent Vale Partnership;*
- *Sherwood Forest Regional Park.*

Development proposals (particularly for allocated sites) will be expected to demonstrate, in line with the Council's Green Infrastructure work, that:

- *they protect and enhance green infrastructure assets affected by the development and take opportunities to improve linkages between green corridors;*
- *where they overlap with or will affect existing green infrastructure nodes or corridors, such assets are protected and enhanced to improve public access and use;*
- *where opportunities exist, development proposals provide improvements to the green infrastructure network that benefit biodiversity through the incorporation of retained habitats and by the creation of new areas of habitat;*
- *they provide robust delivery mechanisms for, and means of ensuring the long-term management of, green infrastructure.*

Development that will result in the loss of existing green infrastructure may be supported where replacement provision is made that is considered to be of equal or greater value than that which will be lost. Where new development may have an adverse impact on green infrastructure, alternative scheme designs that minimize impact must be presented to the Council for consideration before the use of mitigation measures (e.g. off-site or through financial contributions for improvements elsewhere) is considered.

B. Biodiversity and Geodiversity

Development proposals will be expected to demonstrate that they will not adversely affect or result in the loss of features of recognized importance, including:

- *Trees and hedgerows subject to preservation orders;*
- *Ancient woodlands;*
- *Sites of Special Scientific Interest(SSSI);*
- *Regionally Important Geodiversity Sites;*
- *Local Wildlife Sites(Sites of Importance for Nature Conservation(SINC));and*
- *Local and UK Biodiversity Action Plan Habitats.*

Development that will result in the loss of such features may be supported where replacement provision is made that is considered to be of equal or greater value than that which will be lost and which is likely to result in a net gain in biodiversity. Where new development may have an adverse impact on such features, alternative scheme designs that minimize impact must be presented to the Council for consideration before the use of mitigation measures is considered. Where sufficient mitigation measures cannot be delivered, compensation measures must be provided as a last resort.

C. Landscape Character

New development proposals in and adjoining the countryside will be expected to be designed so as to be sensitive to their landscape setting. They will be expected to enhance the distinctive qualities of the landscape character area in which they would be situated, as identified in the Bassetlaw Landscape Character Assessment. Proposals will be expected to respond to the local recommendations made in the Assessment by conserving, restoring, reinforcing, or creating landscape forms and features accordingly.

D. Open Space and Sports Facilities

Development proposals will be expected to demonstrate that they will not adversely affect or result in the loss of protected open spaces and sports facilities (please see Proposals Map) identified in the Council's Open Space and Sports Facilities studies. Exceptions may be made if the open spaces or facilities are identified as surplus to demand in a given location and that alternative provision, or a contribution towards new or improved facilities elsewhere, would be preferable. Alternative scheme designs that minimize impact should be considered before the use of mitigation (on-site, off-site, or through contributions as appropriate).

New development proposals (particularly for allocated sites) will be expected to provide functional on-site open space and/or sports facilities (which will become protected for the purposes of this policy), as well as contributions for ongoing maintenance, to meet any deficiencies in local provision (when assessed against locally defined standards as set out in the Council's Open Space and Sports Facilities studies) that will be caused by the development or to provide contributions towards new or improved facilities elsewhere locally."

Draft Bassetlaw Local Plan (2023) 2020-2038: Main Modifications Version, August 2023

This Local Plan sets out Bassetlaw District's planning and policy framework, development strategy and site allocations to inform effective delivery of the overall vision up until 2038.

Policies set out in the Local Plan relate to our Project.

Policy ST39 "Green and Blue Infrastructure" states that:

"The connectivity, quality, multifunctionality, biodiversity and amenity value of the green and blue infrastructure network will be enhanced, extended and managed through:

a) protecting and enhancing the landscape character and the distinctiveness of Green Gaps, Registered Parks and Gardens and ornamental parklands, registered Common Lands and Village Greens, and Local Green Spaces;

b) protecting, enhancing and restoring watercourses, ponds, lakes and water dependent habitats where appropriate;

c) providing for biodiversity net gain, including reconnecting vulnerable and priority habitats (see policy ST41);

d) protecting and enhancing ancient and mature woodland and hedgerows, and providing for tree planting to secure recreational benefits and/or to aid carbon offsetting climate change mitigation;

e) making appropriate provision for new green/blue infrastructure in new development including open space, allotments, playing fields and outdoor sports facilities, and natural and semi natural greenspace and bluespace; and/or incorporating and where practicable facilitating the improvement of existing provision through the design of development;

f) applying climate change mitigation and adaptation measures through new development, including flood risk and watercourse management;

g) linking walking and cycling routes, bridleways and public rights of way to and through development, where appropriate;

The function, setting, and biodiversity, landscape, access and recreational value of the following main and minor green corridors, as identified on the Policies Map will be protected and enhanced:

a) Main green corridors

i. Chesterfield Canal

ii. River Idle

iii. River Ryton

iv. River Trent

b) Minor green corridors

i. Trent Valley Way

ii. Cuckoo Way

iii. National Cycle Route 6

iv. River Maun

v. Robin Hood Way

vi. River Meden

vii. River Poulter

c) Major development proposals that lie wholly or partly within the minimum buffer zone of a main green corridor (30m measured from each side of the centre point), or a minor green corridor (15m measured from each side of the centre point) should be supported by an Ecological Impact Assessment and/or landscape statement proportionate to the type, nature and scale of the proposal. This should confirm the extent of the buffer zone in that location and demonstrate how the design and layout of the scheme will positively respond to its green/blue infrastructure location and minimise the environmental effects upon the green corridor.

All new green and blue infrastructure should be accompanied by appropriate management and maintenance arrangements."

Policy ST40 "Biodiversity and Geodiversity" states that:

"The Council will seek to protect and enhance the biodiversity and geodiversity of Bassetlaw, including:

International Sites

a) a proposal that may impact on a Special Area of Conservation (SAC), Special Protection Area (SPA), Ramsar site and/or the Sherwood Forest ppSPA will only be supported where it can be demonstrated that there will be no adverse effects on their integrity, unless there are no alternative solutions and it is justified by an 'imperative reasons of overriding public interest' assessment under the Habitats Regulations;

b) any scheme within the 5km buffer zone of the Sherwood Forest ppSPA will require a project level 'shadow level' Habitats Regulations Assessment to ensure any significant adverse effects on the Sherwood Forest ppSPA are identified and appropriately mitigated;

National Designations

c) a proposal (either individually or in combination with other developments) that may either directly or indirectly adversely impact a Site of Special Scientific Interest (SSSI), National Nature Reserve (NNR) or ancient woodland and their buffer zones will be refused, other than in wholly exceptional circumstances where it can be demonstrated that the benefits of the development in the location proposed clearly outweigh any harm to the special interest features of the asset. In such circumstances measures should be identified through an Ecological Impact Assessment to mitigate the adverse effects resulting from the development. proposals of 50 dwellings or more (which includes piecemeal planning applications for less than 50 dwellings within a wider site) that fall within an 'Impact Risk Zone' of a SSSI will be required to demonstrate that appropriate consideration has been given to the development's impact upon the integrity of that SSSI, including recreational impact. Where relevant, appropriate Bassetlaw Local Plan 2020-2038: Publication Version 160 mitigation measures will be sought, which may include an appropriate design and layout on a development site to protect the integrity of the SSSI, and/or a financial contribution to help mitigate identified impacts at the affected SSSI.

Local Designations and Locally Important Ecological Features

d) proposals having a direct or indirect adverse effect on a Local Nature Reserve, Local Wildlife Site or Local Geological Site and their buffer zones or other biodiversity/geodiversity asset, will only be supported where there are no reasonable alternatives; and the case for development clearly outweighs the need to safeguard the ecological, recreational and/or educational value of the site.

In all cases, where the principle of development is considered appropriate the mitigation hierarchy must be applied so that:

a) firstly harm is avoided wherever possible; then

b) appropriate mitigation is provided to ensure no net loss or a net gain of priority habitat and local populations of priority species;

c) as a last resort, compensation is delivered to offset any residual damage to biodiversity;

d) they protect, restore, enhance and provide appropriate buffers around wildlife and geological features at a local and wider landscape-scale to deliver robust ecological networks, to help deliver priorities in the draft Nottinghamshire Biodiversity Opportunity Model for Bassetlaw and Idle Valley 201814 or any successor;

e) they establish additional ecological links to the Nature Recovery Network.

Biodiversity Net Gain

In line with national legislation, all new development should make provision for net biodiversity gain on site, or where it can be demonstrated that for design reasons this is not practicable, off site through an equivalent financial contribution.

A commuted sum equivalent to 30 years maintenance will be sought to manage the biodiversity assets in the long term."

Policy ST41 "Trees, woodlands and hedgerows" states that:

"The Council will protect existing trees, woodland and hedgerows and secure additional planting that increases canopy cover in the interests of biodiversity, amenity and climate change adaptation by:

> *a) retaining, protecting and improving woodland and trees subject to Tree Preservation Orders (TPOs), trees within conservation areas, and 'important' hedgerows as defined by the Hedgerows Regulations 1997;*
>
> *b) making Tree Preservation Orders;*
>
> *c) giving consideration to trees and hedgerows both on individual merit as well as their contribution to amenity and interaction as part of a group within the broader landscape setting;*
>
> *d) resisting the loss or deterioration of ancient woodland and ancient or veteran trees unless there are wholly exceptional reasons and a suitable compensation strategy exists;*
>
> *e) seeking from major development provision for new trees or an equivalent financial contribution to help mitigate the impacts of climate change in accordance with Policy ST50.*

Where development would adversely affect trees or hedgerows the application must be accompanied by:

> *a) an accurate tree survey and arboriculture assessment, undertaken by an experienced arboriculturist, of all existing trees and hedgerows on site in accordance with BS5837 (Trees in relation to design, demolition and construction – Recommendations) 201217;*
>
> *b) details of protective measures to be put in place during the development to ensure the health and safety of each specimen and hedgerow to be retained;*
>
> *c) an avoidance and mitigation strategy to include replacement planting for specimens of at least equal amenity and ecological value of a local provenance; and*
>
> *d) a detailed management plan providing details of maintenance arrangements for 10 years."*

National Guidance

Planning Policy Guidance (2023) – Guidance Natural Environment (2019)

This guidance sets out the key issues in implementing the policies which protect and enhance the natural environment, also taking into consideration any local requirements. This guidance gives further specific information on land and soil of environmental value, green infrastructure, biodiversity (including geodiversity and ecosystems) and landscape considerations.

Chartered Institute Ecology and Environmental Management (2018, updated 2022) Guidelines for Ecological Impact Assessment in the UK and Ireland

The aim of these guidelines is to promote good practice when producing ecological impact assessments across a variety of environments, relevant to the UK and Ireland. In regard to our Project, these guidelines can be used to help provide decision makers with a rigorous EcIA which details any relevant likely ecological effects as a result of our Project.

British Standards Institution (2013) Biodiversity – Code of Practice for Planning and Development (BS 42020:2013)

This British Standard provides *"recommendations on professional ethics, conduct, competence and judgement that are intended to give confidence that proposals for biodiversity conservation, and consequent decisions/actions taken, are sound and appropriate."*

Local Guidance

Lincolnshire Biodiversity Partnership (2011) Lincolnshire Biodiversity Action Plan 2011-2020 (3rd Edition)

This Action Plan was developed in collaboration with local authorities and other stakeholders to set overarching priorities for conservation of wildlife within the county of Lincolnshire, in line with local authority obligations within the NERC Act 2006.

Nottinghamshire Biodiversity Action Group (date unknown) Local Biodiversity Action Plan

This Action Plan is specific to the local Nottinghamshire area and helps to ensure that wider national targets for species and habitats are effectively actioned at local level. This Action Plan identifies targets to the local area, provides a basis for monitoring progress, aims to raise awareness of local biodiversity conservation, and aims to ensure that this conservation is maintained through a long-term approach.

Appendix 7-2: Phase 1 Habitat Survey

Report

One Earth Solar Farm

Appendix 7-2 Phase 1 Habitat Survey

For One Earth Solar Farm Ltd

17 May 2024

Document control

Project Title:	One Earth Solar Farm
Project Number:	14529A
Client:	One Earth Solar Farm Ltd
Document Title:	Appendix 7-2 Phase 1 Habitat Survey
Document Number:	14529AA
Prepared By:	[redacted]
[redacted]	[redacted]

Revision History

01	16/05/2024	First Draft
02	17/05/2024	Final Draft

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1 Introduction

1.1 Background

1.2 This Appendix should be read in conjunction with Chapter 7: Biodiversity of the Preliminary Environmental Information Report (EN010159) which provides information pertaining to the approach taken in establishing a biodiversity baseline for our Project.

1.2.1 This Appendix describes the methods and summarised results of the Extended Phase 1 habitat surveys undertaken between April and June 2023.

1.3 Purpose of this Annex

1.3.1 To inform an assessment of potential likely significant effects of our Project upon biodiversity, an Extended Phase 1 habitat survey was scoped into the assessment to provide baseline information about the habitats within our Project area.

1.3.2 The proposed Development Consent Order (DCO) Order Limits cross through habitats with the potential to support priority habitats, irreplaceable habitats and legally protected or controlled and otherwise notable vascular plant species, it is therefore necessary to assess these habitats and gather information as to their potential presence and baseline condition. Information gathered for protected, controlled or notable faunal species during the Extended Phase 1 habitat survey is presented within individual species appendices (**Appendix 7-3 to 7-7**).

1.3.3 This Appendix outlines the methodologies used, and summarises the habitat results gathered as part of an Extended Phase 1 habitat survey within the proposed DCO Order Limits (as defined in **Chapter 4: Our Project**) hereafter referred to as the Study Area (shown on **Figure A-2, Annex A**).

1.4 Structure of this Annex

1.4.1 This Annex is structured as follows:

- **Section 2:** Methods
- **Section 3:** Results
- **Section 4:** References
- **Annex A:** Figures

2 Methods

2.1 Phase 1 Habitat Survey

2.1.1 The Phase 1 habitat survey is an established field-scale vegetation survey method that classifies land parcels into various habitat categories. In line with the Joint Nature Conservation Committee (JNCC) Phase 1 Habitat survey methodology (JNCC. 2010). A Phase 1 habitat survey was undertaken between April 2023 and June 2023 of all accessible habitats within the proposed DCO Order Limits and within a 30m buffer of it.

2.1.2 Distinct habitats were identified and any conservation-notable habitats or interest features that were too small to map were subject to a more detailed description, presented in the results. As the standard Phase 1 habitat survey methodology is largely concerned with vegetation communities only, the survey was 'extended' in accordance with the Guidelines for Baseline Ecological Assessment (IEA 1995) to include:

- Preliminary searches for evidence of protected or conservation-notable species species-groups (including dormice; bats; great crested newts; badger; water voles; reptiles; and otters), and for habitats or features likely to support them if direct evidence is absent.
- Hedgerow assessments, aimed at identifying hedges that might be classified as 'important' based on the relevant ecological and structural criteria set out in The Hedgerows Regulations 1997.
- The identification of other constraints (e.g. non-native invasive plant species) or opportunities (e.g. opportunities for micro-siting or enhancement) that may be present at the site; and

2.1.3 It should be noted that while every effort has been made to provide a comprehensive description of the Site, this survey did not constitute a full botanical survey.

2.1.4 The nomenclature for the vascular plants in this report follows Stace (2019) for both scientific and English names, see **Annex 7.8**.

2.2 Legally controlled species

2.2.1 The presence of any legally controlled, non-native, invasive plants, such as Japanese knotweed and Himalayan balsam, was recorded during the Phase 1 habitat surveys.

3 Results

3.1.1 The following sections describe the Phase 1 habitat types recorded within and adjacent to the proposed DCO Order Limits. The distribution of habitats present is shown in **Annex A, Figure A-2** and are described below in order of prevalence within the Site.

3.1.2 The Phase 1 Habitat surveys were undertaken during the optioneering phase of the Project before design freeze was reached. As such, some of the recorded areas now fall outside of the proposed DCO Order Limits, with additional areas included in the Order Limits following completion of the Phase 1 Habitat survey.

3.1.3 At the time of survey, a total of 85.5% of the DCO Order Limits was subject to ground-based Phase 1 habitat survey, with the additional 14.5% remotely sensed using aerial imagery. Following design changes, approximately 68.5% of the 1592 hectare (ha) Order Limits have been subject to ground survey, with 31.5% remotely sensed. Areas surveyed are shown in **Annex A, Figure A-1**. Areas without previous survey coverage due to land access limitations or Order Limits changes will be subject to further survey throughout 2024.

3.2 Arable

3.2.1 This habitat type was the most prevalent within the Site, accounting for approximately 1,165ha of the Order Limits. The arable fields are located either side of the River Trent, with an average size of 12.45ha to the west of the River Trent and 6.98ha to the east. In general, arable fields were noted to be low-lying, intensely farmed with limited to no field margins recorded.

3.2.2 Arable crops planted at the time of survey include a range of spring and autumn sown crops, predominantly cereals, wheat and barley, and non-cereal crops including oil seed rape, broad beans, potato and maize. Depending on the time of year and crop rotation, fields were noted to have been recently sown, cropped, ploughed or fallow at the time of survey.

3.3 Improved grassland

3.3.1 Grass-leys, one field to the west of the River Trent and nine fields to the east, consist of one or two grass species and are maintained short with frequent watering prior to harvest for use as turf.

3.3.2 There are seven grassland fields, one to the west of the River Trent with six to the east, either grazed by sheep or used as hay meadows, some of which were being cut during the field survey. Narrow grass margins (less than 1m in width) were recorded within the majority of arable fields, with wider margins recorded in the east of the Order Limits, tending to support a higher diversity of species.

3.4 Poor quality semi-improved grassland

3.4.1 A continuous length of poor-quality semi-improved neutral grassland extended either side of the River Trent, along the bund which supports the Public Footpath. Some areas of this were sheep grazed, whilst others were managed, with cutting taking place at the time of the field survey.

3.4.2 Due to the recent cutting of large areas, species identification was limited during the survey, however, species were typical of the types of grassland recorded and their management regime. Grasses included soft brome, barren brome, Yorkshire fog, meadow foxtail, crested dog's tail, meadow grass, bent-grass, red fescue, perennial rye-grass, tall fescue and cocksfoot grass. Herb species included common and widespread white clover, creeping buttercup, ribwort plantain, greater plantain, cleavers, common nettle, creeping thistle, yarrow, spear thistle, tufted vetch, dandelion, ground ivy

and broad-leaved dock. Locally common species were white campion, field pansy, stitchwort, mugwort, herb-Robert, weld, bugloss, hemlock, white dead-nettle and red dead-nettle, common vetch, common sorrel, and various sedge and rush species in locations with water logging.

3.5 Semi-natural broadleaved woodland

3.5.1 There are three parcels of potential ancient semi-natural woodland (ASNW) within the area including an intact woodland parcel on the sloping escarpment directly east of the River Trent that sits partially within the Site, and a remnant parcel with associated scrub in the field adjacent to the escarpment.

3.5.2 These two parcels consist semi-mature and mature examples of ash, field maple, sycamore and elder. There is a dense understorey of hawthorn and elder, with standing and fallen deadwood present. The canopy is partially open before opening out further south within the parcel (outside of the Site boundary) as the woodland grades into scrub. Due to environmental factors including the gradient and soil structure on this escarpment, it is possible that scrub represents the ecological climax community – the final successional stage a habitat can reach. Within the Site boundary, these two parcels are 0.118ha (remnant potential ASNW) and 0.727ha (potential ASNW).

3.5.3 The third parcel of potential ANSW is 0.361ha in size and is located towards the south of the Site, bordering the historic railway (to the south) that runs east-west. This parcel consists of semi-mature oak, ash, and field maple with a good understorey of hawthorn and elder. The ground flora is dominated by grasses at the edge, with abundant *Claytonia* spp.

3.5.4 In addition to the three parcels of potential ancient semi-natural woodland, there are nine small parcels of semi-natural woodland found along boundary features / surrounding ponds that have grown out into self-sustaining woodland parcels, two of these parcels are west of the Trent, with seven on the east.

3.6 Broadleaved woodland-plantation

3.6.1 There are five plantation woodland parcels, with one on the west of the Trent and four in the east. These woodlands are of plantation origin, with evidence of planting and in some cases, on-going management. All plantation woodlands are broadleaf deciduous or mixed plantation; containing mainly broadleaved species. There are no conifer plantations within the Order Limits.

3.6.2 The plantation woodlands vary in age and structure, with signs of planting and recent management such as tree guards or recently compressed ground and with no established ground flora. Two of the plantations are classed as semi-mature, with some large, well-established trees present. Species vary between parcels, though oak is present in all plantation mixes. Field maple is the second most commonly occurring species, followed by sweet chestnut, sycamore and single occurrences of holly, cherry, elder, privet, hazel, guelder rose, rowan, blackthorn and hawthorn.

3.7 Scrub-dense/ continuous or scattered

3.7.1 Due to the intensive agricultural nature of the Site, there are very few areas of scrub present within the landscape. Pockets of habitat within the Site, that do qualify as scrub, are associated with grown out field margins, where a lack of management of hedgerows has enabled them to develop into a wider scrub belt, and along the embankment of the now disused railway line.

3.7.2 All scrub habitats within the area are hawthorn dominated, with blackthorn and bramble frequently present. Such habitats are typical of areas where there is limited land management and if left, will continue expanding with eventual succession to woodland habitat.

3.7.3 The largest aggregation of scrub habitat within the survey area is along the embankments of the Sustrans Route 647 that runs east-west through the Order Limits.

3.8 Hedgerows

3.8.1 A total of 242 hedgerows were recorded within the Survey equating to a total of approximately 58.3km. Hedgerows are first divided into two broad categories (defunct or intact) before further divisions based on species assemblage and hedge characteristics. Within the Order Limits are 137 intact hedges totalling 32.9km in length, and 105 defunct hedges totalling 25.4km.

3.8.2 Defunct hedges are considered to be hedges that no longer function as stock-proof boundary features predominantly due to horizontal gappiness or large canopy breaks, with intact hedges considered to be continuous linear features that lack horizontal gappiness (other than field gates).

3.8.3 Hedgerows were then categories based on their physical characteristics and species abundance into the following groups:

- Native species-poor hedgerow – hedgerows with fewer than five woody species present within a 30m stretch.
- Native species-poor hedgerow associated with a bank or ditch – hedgerows with fewer than five woody species present within a 30m stretch that are associated with a bank or dry- or wet ditch running parallel to the hedge line.
- Native species-poor hedgerow with trees – hedgerows with standard trees present, though fewer than five woody species present within a 30m stretch.
- Native species-poor hedgerow with trees, associated with a bank or ditch – hedgerows with standard trees present, though fewer than five woody species present within a 30m stretch that are associated with a bank or dry- or wet ditch running parallel to the hedge line.
- Native species-rich hedgerow – hedgerows with five or more woody species present within a 30m stretch, or where the hedgerows contain fewer woody species but have rich basal herbaceous flora.
- Native species-rich hedgerow associated with a bank or ditch – hedgerows with five or more woody species present within a 30m stretch, or where the hedgerows contain fewer woody species but have rich basal herbaceous flora that are associated with a bank or dry- or wet ditch running parallel to the hedge line.
- Native species-rich hedgerow with trees – hedgerows with standard trees and five or more woody species present within a 30m stretch, or where the hedgerows contain fewer woody species but have rich basal herbaceous flora.
- Native species-rich hedgerow with trees, associated with a bank or ditch – hedgerows with standard trees and five or more woody species present within a 30m stretch, or where the hedgerows contain fewer woody species but have rich basal herbaceous flora Native species-rich hedgerow with trees – hedgerows with standard trees and five or more woody species present within a 30m stretch, or where the hedgerows contain fewer woody species but have rich basal herbaceous flora.
- Non-native / Ornamental hedge – Hedge made up of predominantly non-native species such those associated with landscaped gardening (*Leylandii)*.

3.8.4 The majority of hedgerows within the Order Limits were considered to be either native species poor intact hedgerows, native species poor defunct hedgerows or non-native / ornamental hedgerows (*Leylandii*). With hedgerows varying in length, width and structure though it is evident most receive a similar level of management; with annual flailing to reduce height and width within fields adjacent to agricultural cropland. The hedgerows are cut into box shapes and field margins that lie adjacent are closely mown, maintaining the floral structure as grass and forb species only, with successional scrubby growth removed. There is evidence of under-management in places, with hedges along the northern boundary having grown tall and leggy.

3.8.5 Within the Order Limits there are fewer hedgerow features within the area west of the River Trent, than the east. This is likely due to historic land management practices where boundary features have been removed to create larger agricultural fields within the west. Hedgerows within the west of the Order Limits are on average smaller, more species poor and more frequently defunct than those east of the Trent.

3.8.6 Species present within the hedgerows include hawthorn, blackthorn, elder, goat willow, hazel, dog rose, sycamore, field maple, pedunculate oak, privet, lilac and wych elm, with guelder rose cherry and holly recorded less frequently. No hedgerows were recorded to have more than six woody species per 30-metre stretch, with most being dominated by hawthorn, or hawthorn and two to three other commonly found species.

3.8.7 Several hedgerows have standard trees present, including semi-mature sycamore, lime, pedunculate oak and ash. There are two large non-native ornamental hedgerows adjoining residential properties, these are Leylandii dominated, with lilac also present.

3.9 Treelines

3.9.1 There are 50 treelines within the Order Limits, equalling approximately 9.2km in length, the majority (31) of which are located to the east of the River Trent. Treelines form borders to agricultural fields, grassland fields, highways and byways, and vary considerably in species assemblage, age and structure.

3.9.2 The most common tree species found within the treelines are oak and ash. Other species present include sycamore, horse chestnut, rowan, lime, willow, field maple, sweet chestnut, and Scot's pine.

3.9.3 The treelines range from lines of young saplings to those with semi-mature and mature specimens. There are no veteran trees identified within treelines within the Order Limits. The majority of trees within the lines are considered to be semi-mature.

3.10 Hardstanding

3.10.1 Hardstanding was recorded along highways, byways, access roads and tracks, and railway sidings and lines associated with Sustrans Route 647.

3.11 Tall ruderal vegetation

3.11.1 Tall ruderal habitats are rare within the Order Limits, with small areas found within field margins and associated with banks and ditches. These habitats are typically dominated by hemlock, bracken, common nettle and creeping thistle.

3.12 Standing water

3.12.1 There are 18 waterbodies identified within the Study Area, four of which (Ponds 1, 5, 9 and 11) are located within the Order Limits. Ponds within the Order Limits, in addition to Ponds 6, 7 and 28 located outside of the Order Limits, are small farm pits that appeared to be of low biodiversity value with dense scrub vegetation surrounding the edges and wildfowl present.

3.12.2 Of the remaining 11 ponds that all lie outside of the Order Limits:

- 17 was dry at the time of field survey
- 3, 4, 10, 11 and 12 are woodland ponds with high levels of shading resulting from surrounding trees. 12 is within a private garden and could not be accessed.
- 13 is a farmyard pond with sparse, shallow banks and high presence of waterfowl.
- 2 and 8 are dominated by reedbed,
- 27 is a garden pond with sparse vegetation.

3.12.3 There are two main ditch systems to the west of the River Trent, both appear to support agricultural land drainage. Many branches of these two major ditch systems appear to remain wet year-round, with outlier (and connecting) branches found to be dry during the field survey. These ditch systems are named on OS mapping as Fledborough Beck and the Old Trent. It is possible that during periods of high flow, these systems become connected via unidentified pathways.

3.12.4 The Fledborough Beck drains the fields west of Ragnall village, with the ditch extending more than 6km through the landscape when all systems (including currently dry ditch branches) are considered. The ditch is cut into the landscape at depths varying between 1.5 and 5m deep, with its width at its base being between 0.5 and 1m. At the time of survey there was only shallow water evident, with tall ruderal vegetation and goat willow present.

3.12.5 The Old Trent drains fields east of Ragnall, with the ditch extending more than 5km through the landscape. This ditch is cut into the landscape at depths varying between 1.5 and 4m deep with width varying between 0.5 and 2m. At the time of survey there was slow flowing water within this system that was estimated to be 0.5m deep. Tall ruderal vegetation including nettles and bramble occur, with sluice gates present to manage water levels found toward the eastern edge of the ditch.

3.12.6 Two major ditch systems are also located to the east of the River Trent, Sewer Dyke – which predominantly runs north to south parallel to the River Trent, with branching arms draining adjacent fields, and; a large unnamed channel that is fed by ditches off the fields east of North Clifton and flows north through the Order Limits.

3.12.7 The Sewer Dyke is a large ditch system that extends more than 5km through the Order Limits, flowing south to north with water levels managed via a series of sluice gates that feed directly into the River Trent at the Dyke's northern extent. The ditch is between 2 and 4m deep, and 1.5m wide at its base. Water within the base of the ditch appears to be between 0.5 and 1m deep, though water within the system was turbid at time of survey making this difficult to establish with certainty. There was no evidence of emergent or aquatic vegetation in any part of the Dyke at the time of survey.

3.12.8 The unnamed channel that drains the fields east of North Clifton is a large ditch system cut between 2 and 3m into the landscape which varies in width between 1.5 and 2m at its base. At the time of survey there was a water depth of approximately 0.3m though, for safety reasons, this was estimated from its bank tops. The main channel is dominated by tall ruderal growth including with reeds. There

was evidence during the surveys that this ditch system was used to irrigate the fields adjacent, with a large pump seen to be extracting water.

3.13 Running water

3.13.1 The River Trent, a large and navigable river, dissects the DCO Order Limits along a roughly north-south axis. Within the Order Limits, the River Trent presents itself as a major river with a large tidal range, measuring on average 75m wide as it flows for approximately 3.2km through the Order Limits.

3.13.2 The River Trent at this location is considered a key migratory route for Atlantic salmon, smelt, sea lamprey, river lamprey, Allis shad, Twaite shad and European eel.

3.13.3 The banks along both sides of the river have been raised adjacent to areas of coastal floodplain grazing marsh and farmland to defend the landscape against frequent flooding events. However the River still functions semi-naturally and is connected to its floodplains via a complex of ditches and main dykes (which flood during spate flow).

3.13.4 The River has historically been deepened and dredged to ensure there is a clear navigable route for large vessels moving quarried materials up and down the Trent between major industrial cities.

3.14 Protected and rare plant species

Notable Species

3.14.1 No protected and rare plant species were recorded on Site.

Legally controlled plant species

3.14.2 No legally controlled invasive non-native plant species were recorded within the Order Limits.

Legally protected species

3.14.3 **Table 3-3** indicates habitat suitability of the Phase 1 Habitats recorded within the Study Area for legally protected species. Information pertaining to legally protected species can be found in Appendix 7-3 to 7-7.

Table 3-1: Protected species with the potential of occurring within the DCO Order Limits

Legally protected species	Suitable habitat
Badger	All woodland types, all grassland types, arable fields and scrub.
Bats	Broadleaved woodland, all grassland types, hedgerows, tree lines and standing and running water.
Breeding and wintering birds	Broadleaved woodland, hedgerows, scrub, arable fields and their margins, rivers and ditches.
Riparian mammals	Rivers and ditches
Reptiles	Improved/semi-improved grassland, dense scrub, tall ruderal vegetation, marginal areas of ponds, rivers and ditches
Great Crested Newt (GCN)	Improved/semi-improved grassland, dense scrub, tall ruderal vegetation, ponds and ditches

Legally protected species	Suitable habitat
Invertebrates	Improved/semi-improved grassland, dense scrub, tall ruderal vegetation, marginal areas of ponds, rivers and ditches

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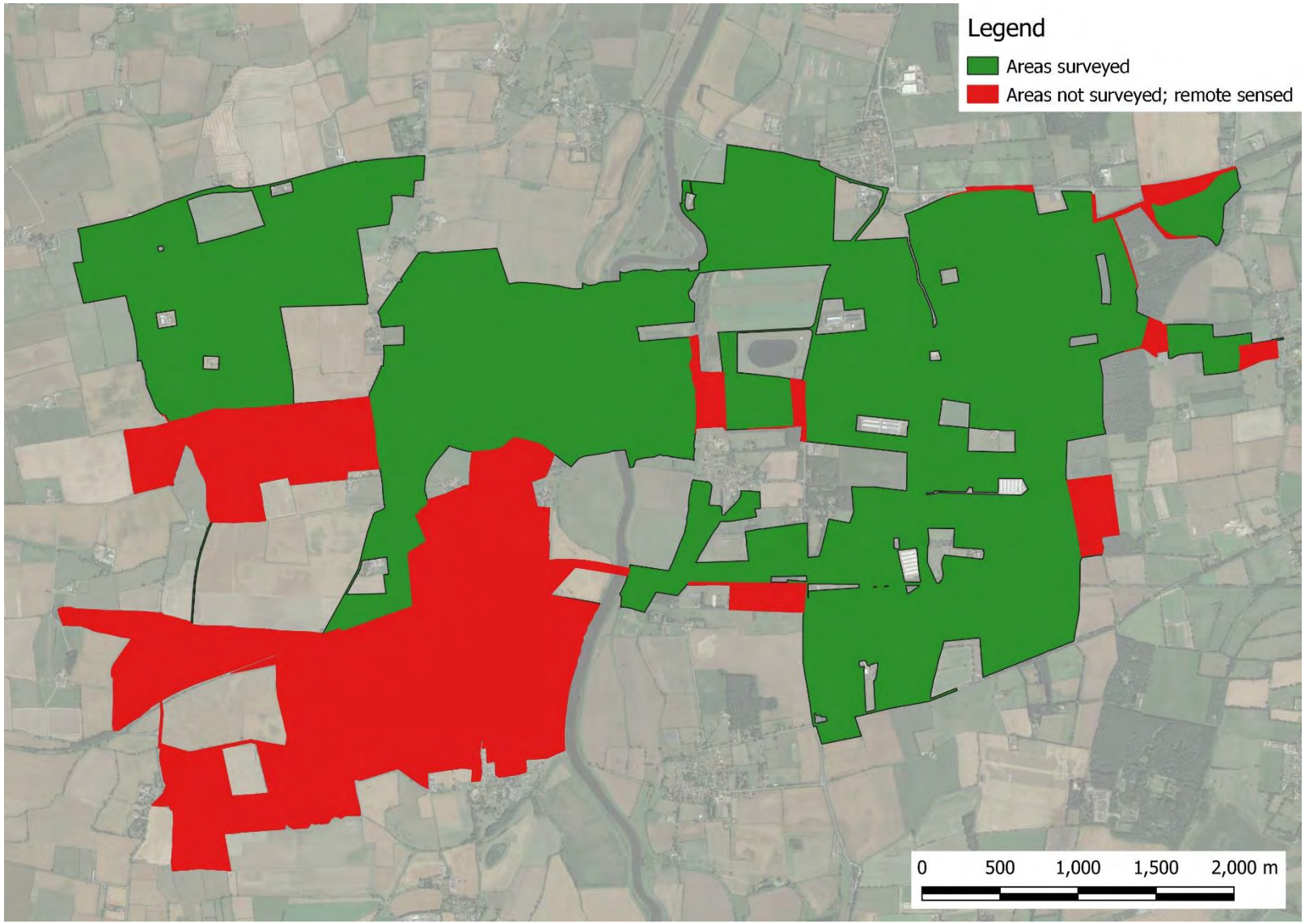
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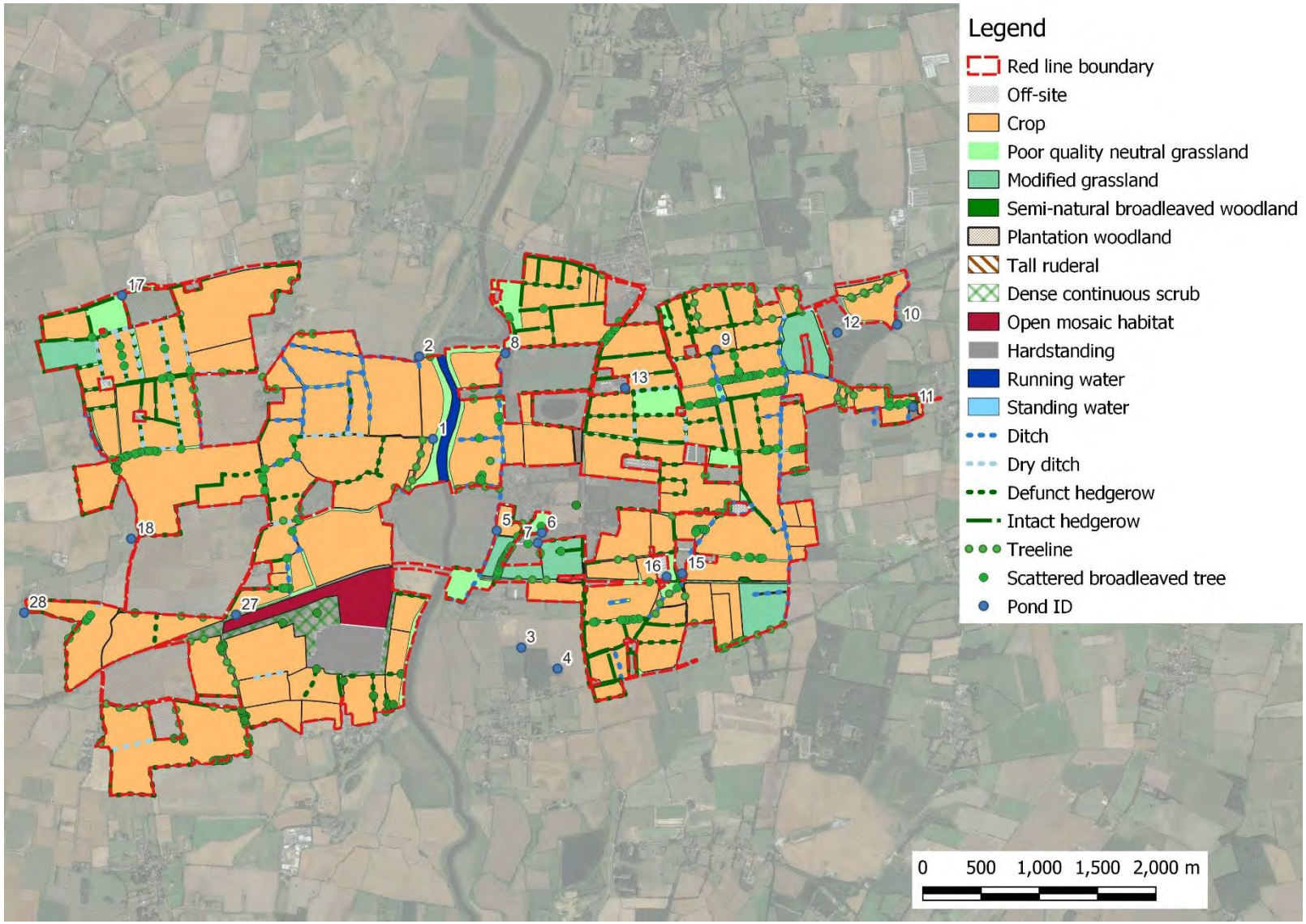
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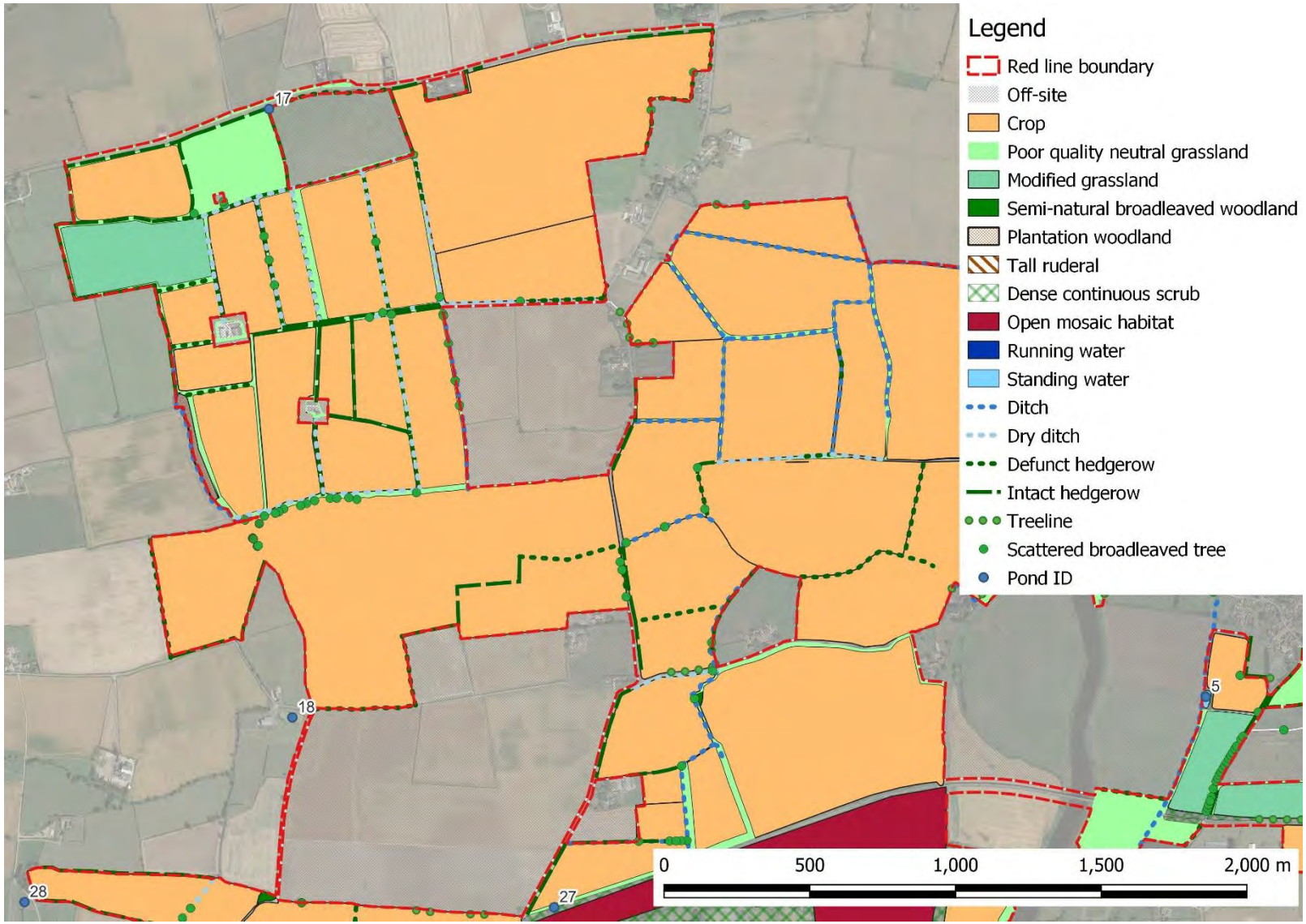
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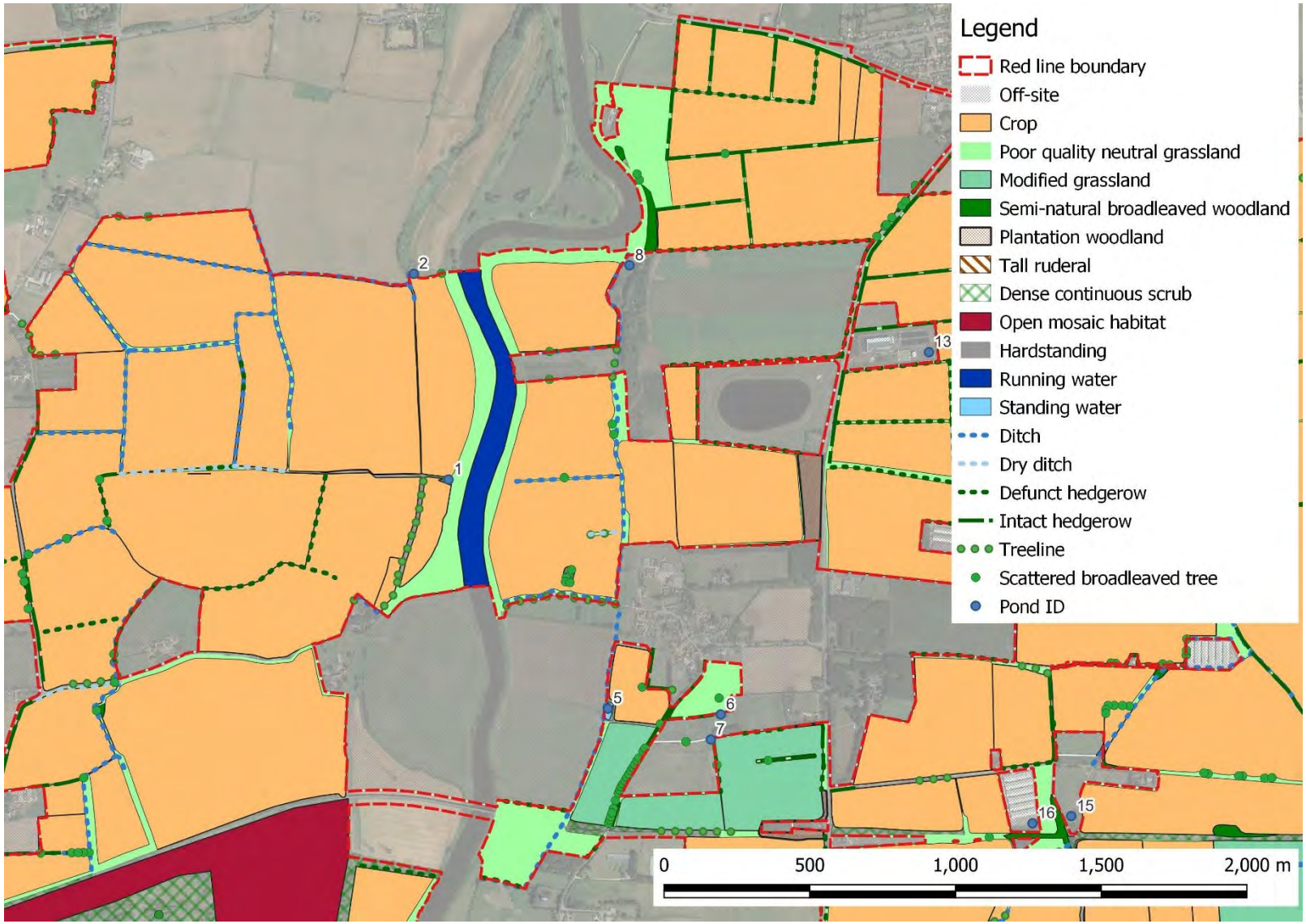
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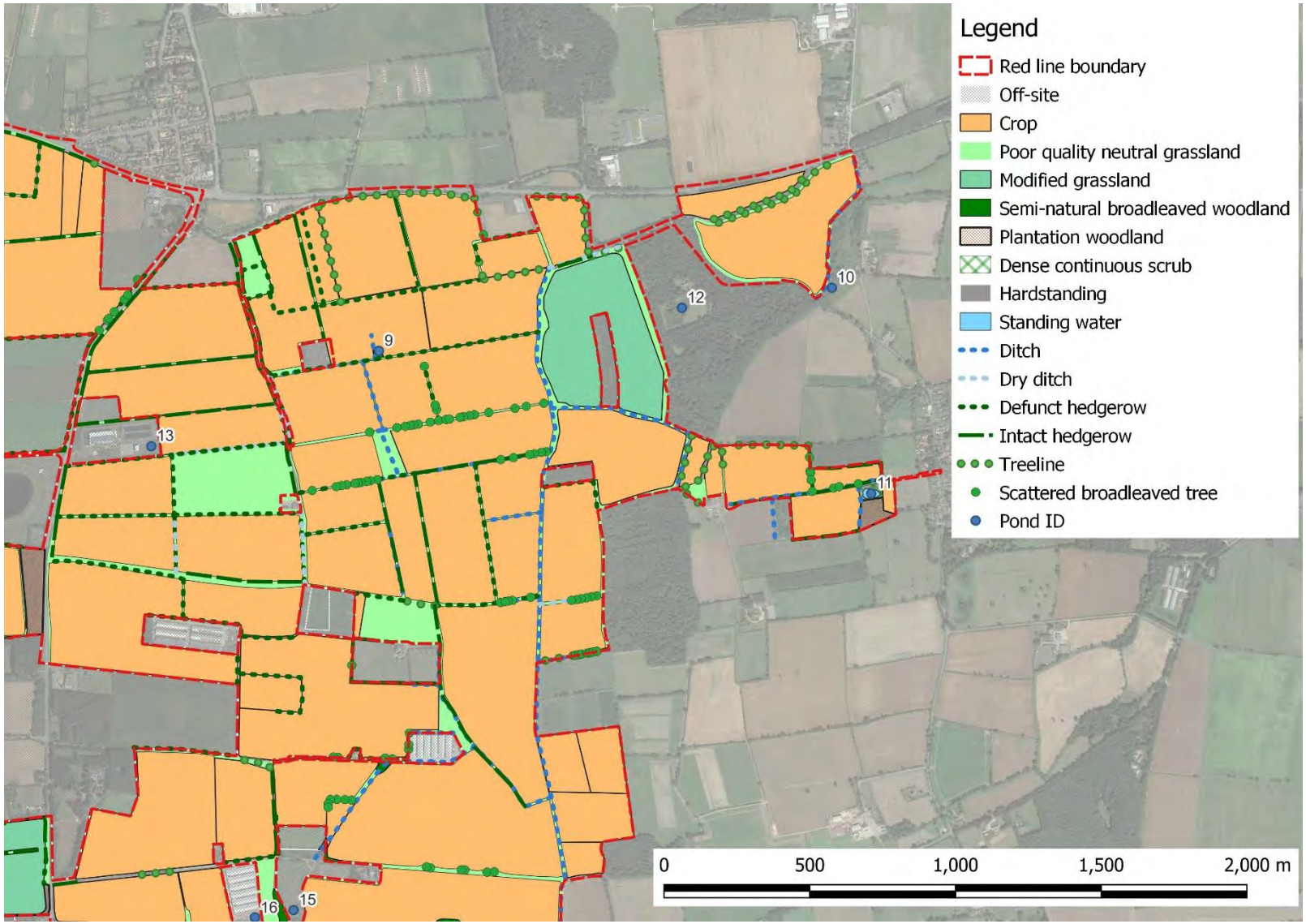
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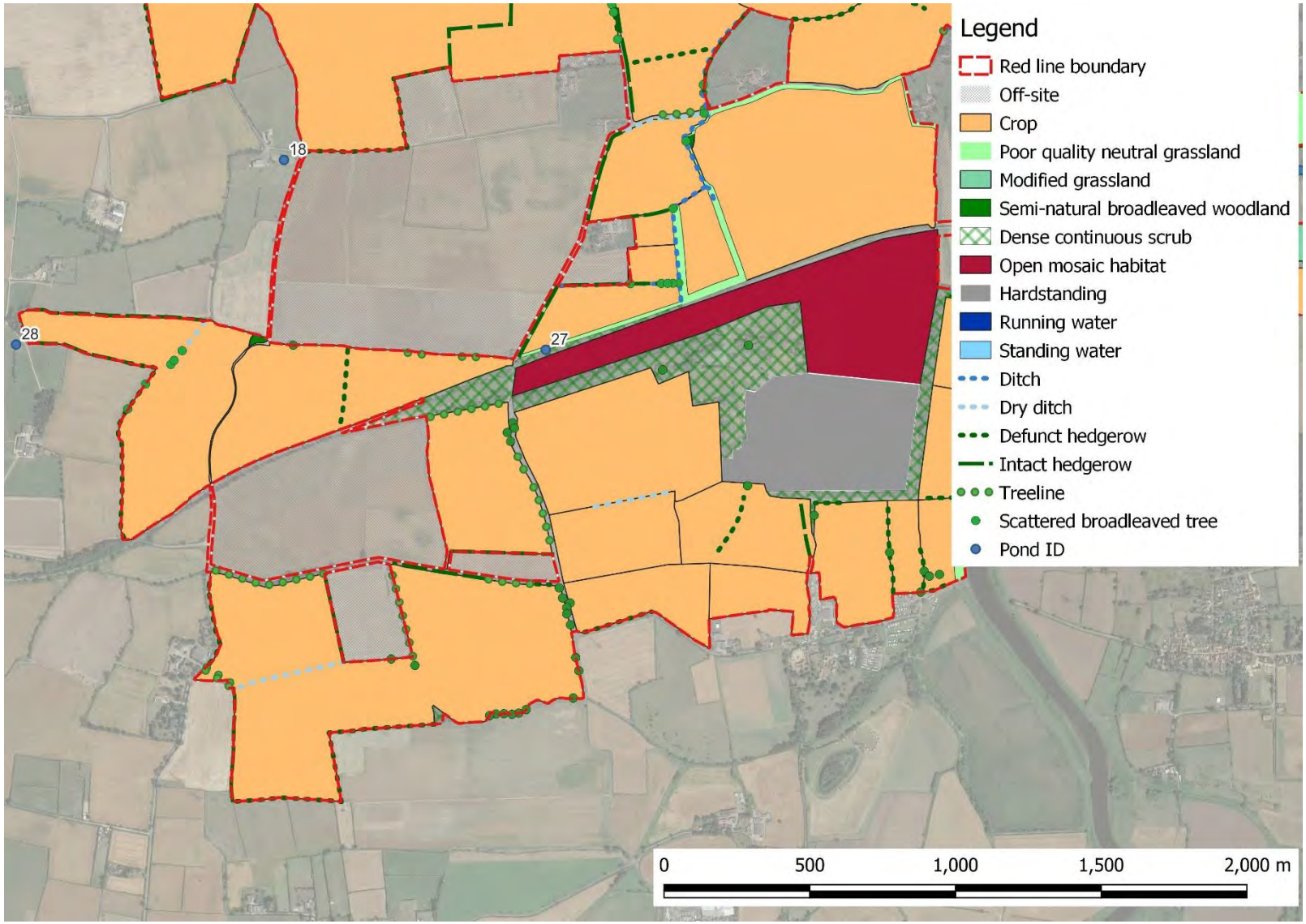

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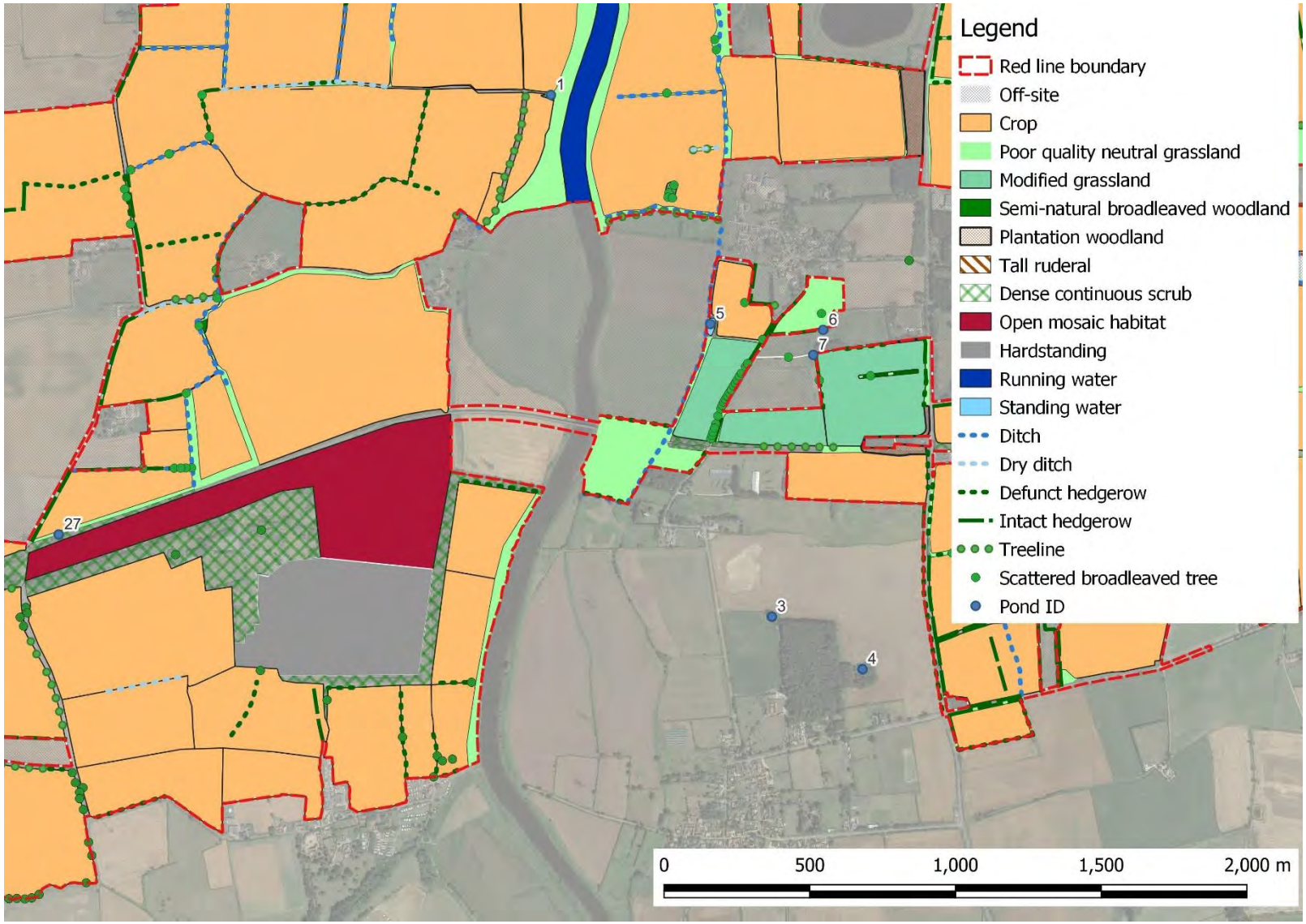

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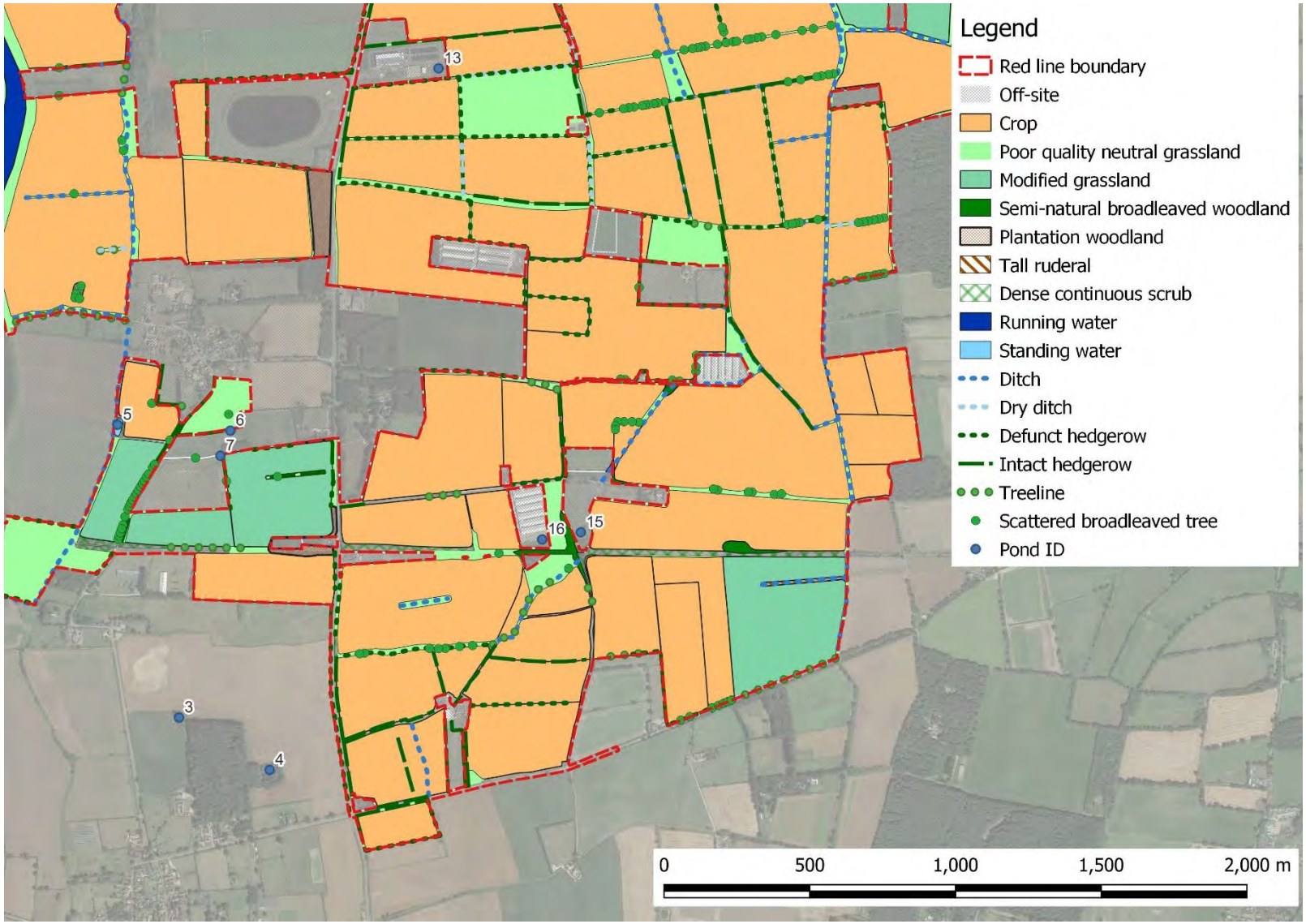

Legend
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Dense continuous scrub
Open mosaic habitat
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Standing water
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Defunct hedgerow
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Red line boundary
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Modified grassland
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Plantation woodland
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Dense continuous scrub
Open mosaic habitat
Hardstanding
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Red line boundary
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Poor quality neutral grassland
Modified grassland
Semi-natural broadleaved woodland
Plantation woodland
Dense continuous scrub
Hardstanding
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Dry ditch
Defunct hedgerow
Intact hedgerow
Treeline
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Legend
Red line boundary
Off-site
Crop
Poor quality neutral grassland
Modified grassland
Semi-natural broadleaved woodland
Dense continuous scrub
Open mosaic habitat
Hardstanding
Running water
Standing water
Ditch
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Defunct hedgerow
Intact hedgerow
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Legend
Red line boundary
Off-site
Crop
Poor quality neutral grassland
Modified grassland
Semi-natural broadleaved woodland
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Dense continuous scrub
Open mosaic habitat
Hardstanding
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Standing water
Ditch
Dry ditch
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Intact hedgerow
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Legend
Red line boundary
Off-site
Crop
Poor quality neutral grassland
Modified grassland
Semi-natural broadleaved woodland
Plantation woodland
Tall ruderal
Dense continuous scrub
Running water
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Appendix 7-3: Bat Baseline

Report

One Earth Solar Farm

Appendix 7-3: Bat Baseline

For One Earth Solar Farm Ltd

17 May 2024

Document control

Project Title:	One Earth Solar Farm
Project Number:	14529A
Client:	One Earth Solar Farm Ltd
Document Title:	Appendix 7-3: Bat Baseline
Document Number:	14529A
Prepared By:	[redacted]
[redacted]	[redacted]

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Revision History

01	14/05/2024

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1 Introduction

1.1 Background

1.2 This Appendix should be read in conjunction with Chapter 7 of the Preliminary Environmental Information Report (PEIR) which is provided in support of the delivery of an Environmental Impact Assessment (EIA) associated with the One Earth Solar Farm, hereafter referred to as the 'Site'.

1.3 Purpose of this Appendix

1.3.1 The purpose of the Appendix is to present the methods and findings of the baseline bat surveys which were undertaken to identify and assess the assemblage of bat species potentially impacted by the Project.

1.3.2 Surveys were completed within the active bat season between April and October in 2023 following an adapted method based on the Bat Surveys for Professional Ecologists: Good Practice Guidelines third edition (Collins 2016).

1.3.3 The bat surveys were designed to identify the distribution, density and activities of bats within the Site. The adapted method involved a sampling approach, focusing on habitats considered to be of high-quality for bats and to represent the full range of habitats present within the Site.

1.3.4 This report does not allude to any requirements for mitigation and/or compensation in respect of bats, nor does it assess the potential impacts that proposals might have upon bats, as both issues will be covered in detail as part of an ES.

1.4 Structure of this Appendix

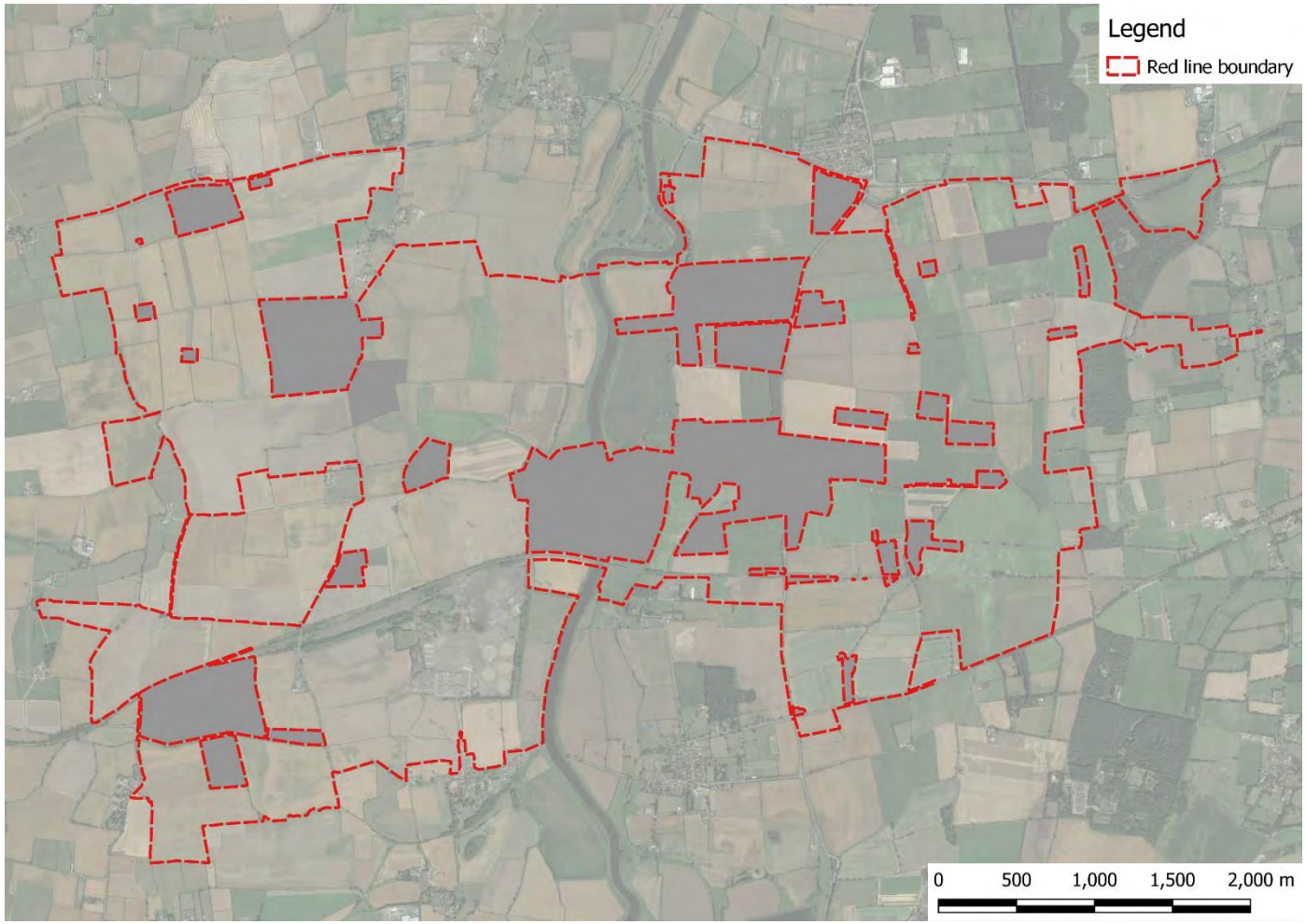
1.4.1 The remainder of this Appendix is structured as follows:

- **Section** Error! Reference source not found.**: Methods**
- **Section** Error! Reference source not found.**: Results**
- **Section** Error! Reference source not found.**: Summary**
- **Section 5: References**
- **Annex A: Details of Preliminary Roost Assessment**

1.5 The Site

The Site is approximately 1,500ha and comprises approximately 170 agricultural fields bordered in parts by hedgerows, treelines, woodlands and ditches. The Site is bisected north to south by the River Trent, and falls across two county boundaries and three local authorities. The Site has a central grid reference of SK816718 and is shown in **Figure 1-1**.

Figure 1-1: Site boundary



2 Methodology

2.1 Survey Guidance

2.1.1 Survey methods follow best practice guidelines, interpreted using professional experience. Survey design was informed by Bat Surveys for Professional Ecologists: Good Practice Guidelines third edition (Collins 2016). The fourth edition of these guidelines was published in September 2023 and were therefore not available at the time of survey design.

2.1.2 The Bat Mitigation Guidelines (Reason & Wray 2023) and Bat Workers' Manual (Mitchell-Jones 2004) provide further guidance which has been taken into account when designing the survey methods. With regard to trees, the British Standard (BS 8596:2015) and Bat Roosts in Trees (Andrews 2018) have also been considered. Surveys were designed and conducted by Alexandra Jackson MZool (Hons) and Kelly Jones MSc MCIEEM (Natural England survey licence levels 3 and 4: 2020-45088-CLS-CLS & 2020-45091-CLS-CLS)).

2.2 Desk Study

2.2.1 An environmental desk study was undertaken in September 2023 to identify records of bats within 2km of the Site boundary, from Greater Lincolnshire Nature Partnership (GLNP) and Nottinghamshire Biological and Geological Records Centre (NBGRC) and for European Protected Species Licences (EPSL) using the Multi-Agency Geographic Information for the Countryside (MAGIC) website (an internet-based Geographic Information Systems database provided by the Department for Environment, Foods and Rural Affairs (DEFRA) (Defra, 2024)).

2.3 Environmental Conditions

2.3.1 All active bat surveys were undertaken when there was little to no rain, no excessive wind and the temperature was above 10ºC. In these weather conditions, bats are unlikely to be deterred from flying. Temperature, humidity, cloud cover and rainfall levels were recorded by surveyors during each survey visit. Any other environmental conditions that may affect bat activity, such as noise or artificial light levels, were also recorded. Environmental conditions are given in Table 2.1.

2.4 Preliminary Roost Assessment

Ground-Level Tree Assessment

2.4.1 A Ground Level Tree Assessment (GLTA) was carried out between 25th May and 20th June 2023. Trees were assessed for their potential suitability to support roosting bats using close focussing binoculars and a powerful light source to search for potential roost features (PRFs). Suitable features include cracks in limbs and trunks, split branches, knot or woodpecker holes, rot holes, or areas of dense ivy forming plates. Details of trees supporting PRFs were recorded, including:

- Grid reference.
- Tree species.
- Approximate height and diameter at breast height (DBH).
- PRF number and type.
- Approximate location, height and aspect of PRF.

2.4.2 Trees which could not be fully assessed due to their age and/or size or where visibility was limited by foliage, were also recorded where the species and condition indicated that PRFs could be present.

2.4.3 Trees were categorised as either:

- None – Either no PRFs in the tree or highly unlikely to be any,
- FAR – Further assessment required to establish if PRFs are present in the tree, or
- PRF – A tree with at least one PRF present.

2.5 Bat Activity

Scoping

During the initial scoping process, habitats within the Site were assessed for their potential suitability to support foraging and commuting bats and were allocated to the following categories:

- **None**:
  - No habitat features on Site likely to be used by any commuting or foraging bats at any time of the year (i.e. no habitats that provide continuous lines of shade/protection for flight lines, or generate/shelter insect populations available to foraging bats).
- **Negligible**:
  - No obvious habitat features on Site likely to be used as flight-paths or by foraging bats; however, a small element of uncertainty remains in order to account for non-standard bat behaviour.
- **Low**:
  - Habitat that could be used by small numbers of bats as flight-paths such as a gappy hedgerow or unvegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitat.
  - Suitable but isolated habitat that could be used by small numbers of foraging bats, such as a lone tree (not in a parkland situation) or a patch of scrub.
- **Moderate**:
  - Continuous habitat connected to the wider landscape that could be used by bats for flight-paths, such as lines of trees and scrub or linked back gardens.
  - Habitat that is connected to the wider landscape that could be used by bats for foraging, such as trees, scrub, grassland or water.
- **High**:
  - Continuous, high-quality habitat that is well connected to the wider landscape and is likely to be used regularly by bats for flight-paths, such as river valleys, streams, hedgerows, lines of trees and woodland edge.
  - High-quality habitat that is well connected to the wider landscape and is likely to be used regularly by foraging bats, such as broadleaved woodland, tree-lined watercourses and grazed parkland.

- The Site is close to and connected to known roosts.

Transect Survey

2.5.1 Following the desk study and initial habitat surveys, the majority of the Site was considered to be of low suitability for commuting and foraging bats, dominated by large, open arable fields. Due to the large extent of the Site and the limited anticipated impacts on high-quality habitats for bats, a sampling approach was designed to assess bat activity at carefully selected locations considered to be representative of the Site.

2.5.2 Three transect routes were designed to incorporate potential bat foraging habitat and flight-lines that might be used for commuting (for locations refer to **Figure 2-1**) and focussed on moderate and high-quality habitat. However, due to the spatial distribution of habitats across the Site, low-quality habitat was also incorporated into the transect routes.

2.5.3 Each transect route was between 3 and 5km in length and was surveyed once per season at dusk; spring, summer and autumn. Transect routes were not walked simultaneously, but over a series of nights, usually one after the other to improve chances of similar environmental conditions.

2.5.4 Details of these surveys are summarised in **Table 2-1**.

Table 2-1: Bat activity transect dates and environmental data

Transect Route	Season	Date	Timing	Weather*
1	Spring	01/06/2023	21:33 – 23:33	Start: 15°C, 8/8 cloud cover, wind 1, no rain End: 10°C, 8/8 cloud cover, wind 2, no rain
	Summer	07/08/2023	20:47 – 22:47	Start: 15°C, 0/8 cloud cover, wind 0, no rain End: 10°C, 1/8 cloud cover, wind 1, no rain
	Autumn	08/10/2023	18:23 – 20:23	Start: 22°C, 7/8 cloud cover, wind 1, no rain End: 17°C, 6/8 cloud cover, wind 0, no rain
2	Spring	25/05/2023	21:11 – 23:42	Start: 17°C, 8/8 cloud cover, wind 1, no rain End: 12°C, 8/8 cloud cover, wind 1, no rain
	Summer	08/08/2023	20:45 – 23:06	Start: 17°C, 1/8 cloud cover, wind 1, no rain End: 11°C, 0/8 cloud cover, wind 0, no rain
	Autumn	09/10/2023	18:21 – 20:21	Start: 20°C, 1/8 cloud cover, wind 0, no rain End: 16°C, 1/8 cloud cover, wind 0, no rain
3	Spring	24/05/2023	21:09 – 23:20	Start: 23°C, 7/8 cloud cover, wind 1, no rain End: 14°C, 8/8 cloud cover, wind 0, no rain
	Summer	09/08/2023	20:46 – 22:53	Start: 20°C, 7/8 cloud cover, wind 0, no rain End: 18°C, 8/8 cloud cover, wind 0, no rain
	Autumn	10/10/2023	18:19 – 20:19	Start: 20°C, 4/8 cloud cover, wind 2, no rain End: 14°C, 1/8 cloud cover, wind 2/3, no rain

* Wind speed measured in Beaufort scale; cloud cover measured in Oktas

2.5.5 During each survey visit, surveyors walked two circuits of the transect route, from sunset until two to three hours after sunset. Surveyors used a combination of visual observation (light levels permitting) and aural full spectrum detectors (Elekon Batlogger M2 and EchoMeter Touch Pro) to monitor bat

activity; recording the number of passes of each bat species heard or seen, and the type of activity observed or heard (for example foraging or social calls). For the purpose of this assessment, a 'pass' is defined as a sequence of calls (individual clicks made by bats as they echolocate) that a bat emits as it flies past, typically getting louder and then quieter as the distance between the bat and the surveyor changes.

2.5.6 It should be noted that acoustic records collected during manual surveys are intended to give an indication of relative levels of bat activity during each season, on each transect, and do not represent actual numbers of bats. A single bat may pass the surveyor several times, with each pass counted separately.

Static Acoustic Monitoring

2.5.7 The quality of habitats within the Site were highly varied, comprising large areas of habitat of negligible and low-quality for foraging and commuting bats, with a lower proportion of areas of moderate and high-quality. To allow for comparison of activity across the Site, a consistent survey effort was applied to all areas, with survey effort based on habitat of moderate-quality.

2.5.8 To monitor bat activity throughout the night, static bat detectors (Anabat Swift) were positioned at two locations on each transect route. Monitoring locations are shown in **Figure 2-1**. The static bat detectors were set to record for a minimum of five consecutive nights in each season (spring, summer and autumn). Detectors were set to record from 30 minutes before sunset to 30 minutes after sunrise, dates for which are presented in **Table 2-2.**

Table 2-2: Static acoustic monitoring dates, per static per season

Season	Dates of nights recorded					
	Transect 1		Transect 2		Transect 3	
	East static	West static	North static	South static	North static	South static
Spring	1st – 5th June 2023	1st - 5th June 2023	25th - 29th May 2023	25th - 29th May 2023	24th – 27th May 2023	24th – 28th May 2023
Summer	7th - 11th August 2023	7th -11th August 2023	8th – 11th August 2023	8th – 10th August 2023	-	9th – 13th August 2023
Autumn	8th – 12th October 2023	8th – 12th October 2023	9th – 13th October 2023	9th – 12th October 2023	10th – 14th October 2023	10th October 2023

2.6 Data Analysis

2.6.1 Analysis of bat sound recordings was carried out with reference to Russ (2021) to aid species identification. Where records from bat detector surveys were not identified to species level during the sound analysis process due to overlapping call parameters, records were identified to genus/species group, with the following groups used:

- *Myotis* sp. (bat species within the genus *Myotis*)
- Big bat (noctule, serotine or Leisler's bat)
- Bat sp. (calls that could not be ascribed to a species group).

2.6.2 Usually, *Plecotus* species (brown and grey long-eared bats) calls cannot be differentiated from one another, however the known range for grey long-eared bats is restricted to the south of England, and it is highly unlikely that this species would be recorded in the survey area. As such, all long-eared calls have been identified as brown long-eared bat.

2.7 Limitations

2.7.1 The red line boundary for the Site changed during the survey period, including additional areas, particularly in the west, which were not assessed in the initial scoping survey. This is not considered a major limitation as the surveys were undertaken to gain an understanding of the bat species present, and indicative activity levels. Habitats that were included in the expansion of the red line boundary were common in the Site and generally of low-quality for bats.

2.7.2 Assessment of trees was conducted outside of the optimal period for this type of survey, whereby foliage limits visibility and may have obscured features higher up in the canopy which are suitable for roosting bats. A precautionary approach incorporated any trees of size and status likely to support features.

2.7.3 The sampling design of transect surveys meant that survey visits were conducted in each area on a different night. This means that the data are comparable temporally but not spatially, providing indicative activity levels for each area of the Site.

2.7.4 Due to a fault in the recording equipment during the transect survey in October, only part of the survey for Transect 1 was recorded. Surveyors made recordings based on acoustic outputs of the bat detector during the survey, although subsequent analysis was not possible, and timings were estimated. This did not impact the overall assessment as the transect is designed primarily to establish spatial and behavioural use of the Site, which was achieved.

2.7.5 The static acoustic monitoring surveys aimed to record for a minimum of 5 nights per season at each monitoring location, however some static bat detectors did experience technical failures. A summary of these failures are detailed in **Table 2-3** below.

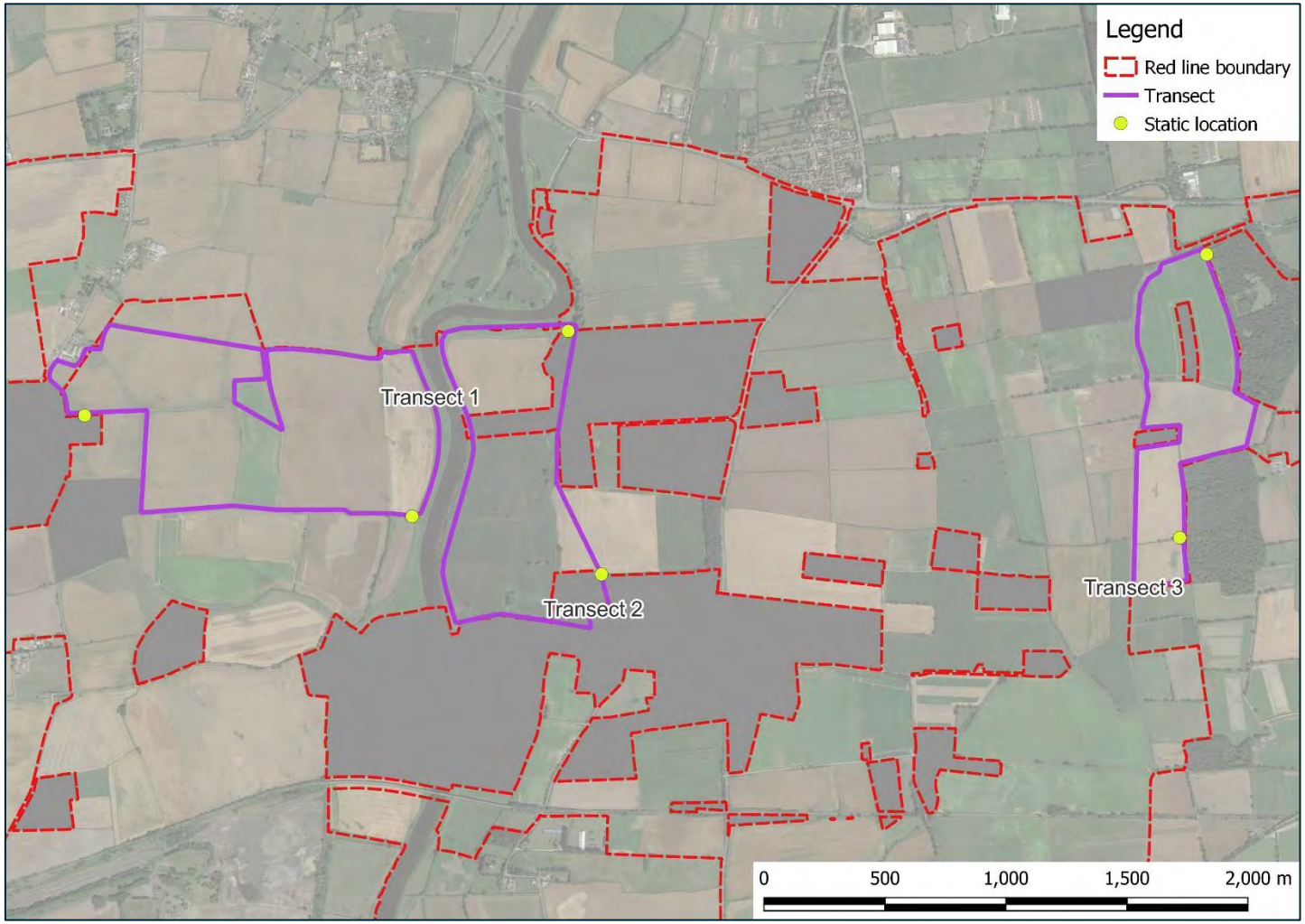
Table 2-3: Number of nights each static recorded, per season

Season	Number of nights recorded					
	Transect 1		Transect 2		Transect 3	
	East static	West static	North static	South static	North static	South static
Spring	5	5	5	5	4	5
Summer	5	5	4	3	0	5
Autumn	5	5	5	4	5	1

2.8 Surveyors

2.8.1 All surveys were undertaken by Kelly Jones MSc MCIEEM (Class 4 licence holder – reference 2020-45088-CLS-CLS & 2020-45091-CLS-CLS) and Alexandra Jackson MZool (Hons), both who have extensive experience in ecological consultancy and bat ecology.

Figure 2-1: Bat survey transect routes and static bat detector locations



3 Results

3.1 Desk Study

3.1.1 GLNP returned a total of nine bat records, within the past decade within 2km of the Site. Among these, six records were for '*Chiroptera*' and not allocated to a species, with the closest sighting being 127m east of the north-eastern boundary near Kettlethorpe, in 2015. Additionally, three records were found for brown long-eared bat *Plecotus auritus*, with the most recent and closest sighting occurring 1.6km north, near Newton-on-Trent, in 2020.

3.1.2 In contrast, the NBGRC yielded a substantial 568 records of at least eight bat species within the last ten years, which are detailed in **Table 3-1**.

Table 3-3-1: Summary of bat records within the search area

Species	No. of Records	Closest Distance from Site	Most Recent Record
Bat sp.	5	On-Site, South Clifton	2019
Barbastelle bat *Barbestella barbastellus*	1	1.72km south, Spalford	2016
Pipistrelle sp.	2	On-Site along hedgerow, near North Clifton	2016
Common pipistrelle *Pipistrellus pipistrellus*	334	On-Site in several locations; North Clifton, Kettlethorpe, Skegby and Marnham	2022
Soprano pipistrelle *Pipistrellus pygmaeus*	13	0.14km north, Dunham-on-Trent	2022
Nathusius pipistrelle *Pipistrellus nathusii*	1	1.4km south, near Spalford	2016
Nyctalus sp.	8	0.25km west of the Site, near High Marnham	2018
Noctule *Nyctalus noctula*	96	On-Site near Ragnal and North Clifton.	2019
Leisler's bat *Nyctalus leisleri*	2	On-Site, along boundary hedgerows near Ragnal	2018
Plecotus sp.	1	0.2km south, within South Clifton	2014
Brown long-eared	59	0.1km south, near Moor Lane in South Clifton	2022
Myotis sp.	46	On-Site along hedgerow, near North Clifton	2022

3.1.3 The MAGIC search identified a single granted European Protected Species Licence (EPSL) within 2 km of the Site. This licence was located 0.08km from the Site boundary, located along Church Lane, near Saint George the Martyr North and South Clifton. In place from 2011 to 2013, it allowed destruction of a resting place for both common pipistrelle and brown long-eared bats.

3.2 On-site Conditions

3.2.1 Most of the Site is agricultural habitat and, as such, there is little vegetation cover. This, in addition with a large amount of ambient light from nearby settlements, including Lincoln City approximately 10km east, means the Site is fairly light at night.

3.2.2 Given the rural nature of the Site, artificial lighting is limited to villages, such as North and South Clifton. Additionally, some illumination is provided along key roadways, including at intersections on the A47 and along the Main Road in Ragnall, near residential homes.

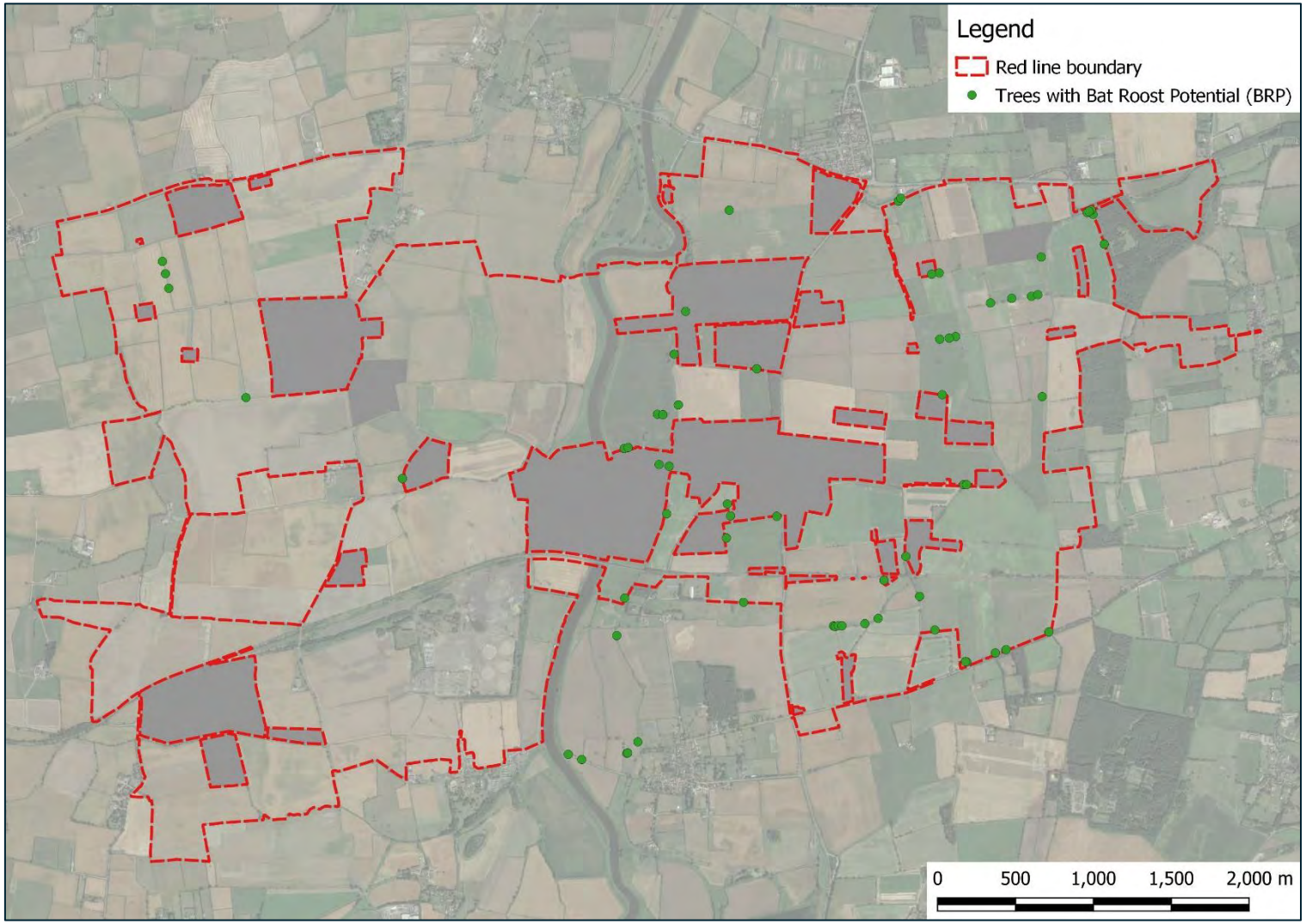
3.3 Preliminary Roost Assessment

Trees

3.3.1 In total, 66 trees were assessed as PRF or FAR, the majority of which were located to the east of the Trent. Species included oak *Quercus robur*, ash *Fraxinus excelsior*, beech *Fagus sylvatica*, willow *Salix sp.*, and poplar *Populus sp.*

3.3.2 Their locations are shown on **Figure 3-1** below, and detailed within **Annex A**.

Figure 3-1: Overall locations of trees with bat roost potential



3.4 Bat Activity

Scoping

3.4.1 The Site is comprissed of habitats that are generally of low suitability for bats. Over 85% of the Site is agricultural habitat (arable fields), with generally small, intensively managed field margins and species-poor hedgerows. Higher quality commuting and foraging habitat is present, with a network of wet ditches throughout the Site, the River Trent with associated floodplain grazing marsh, and nine woodland blocks to the east of the River Trent.

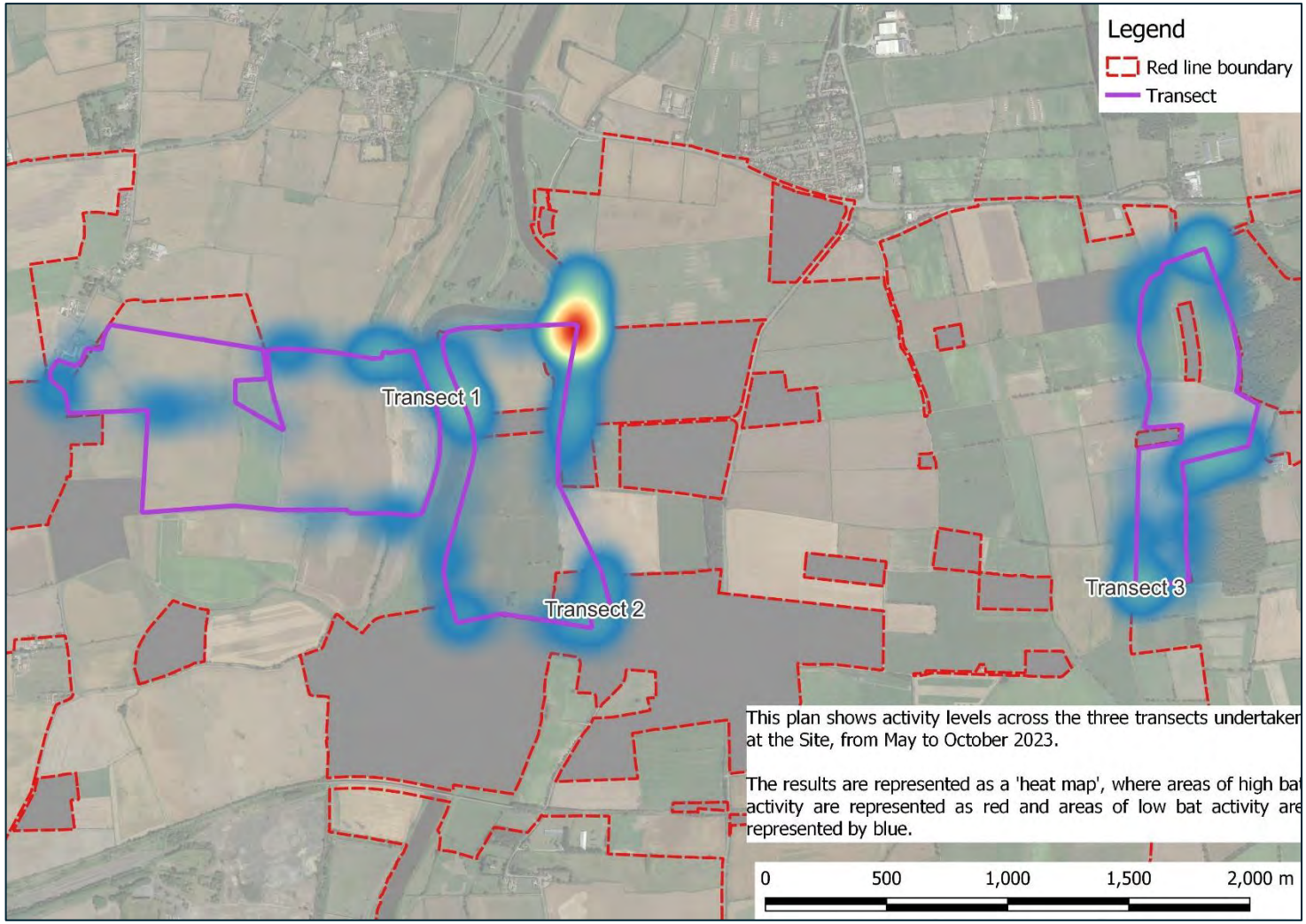
Transect Survey

3.4.2 A minimum of seven species were recorded during the three transect routes surveyed:

- Barbastelle
- Common pipistrelle
- Soprano pipistrelle
- Noctule
- Serotine
- Brown long-eared bat
- *Myotis* sp.

Figure 3-2 presents a heat map of bat activity recorded over the survey period, where light blue shows areas of low activity, and red shows areas of high activity. Overall, the highest levels of bat activity were identified around higher quality habitats such as woodland, floodplain grassland and the River Trent.

Figure 3-2: Bat activity levels across the Site



Barbastelle

3.4.3 The least recorded species during the transect surveys, only being recorded once in August at 22:18 (92 minutes after sunset), along the woodland edge in the southeast of the Site.

***Pipistrellus* sp.**

3.4.4 Common pipistrelle was the most frequently recorded species during the survey, accounting for 70.93 % of all passes, and were found throughout all habitat types of the three transect routes. Although higher levels were recorded along woodland edges and along the River Trent, common pipistrelles were also recorded commuting through open arable fields. In addition, common pipistrelle was generally the first bat recorded, ranging from 31-55 minutes after sunset for Transect 1, 12-30 minutes for Transect 2 and 36 minutes for Transect 3. Activity levels in each season was broadly similar, although a peak was recorded in summer (~226 files), compared to spring and autumn (~186 and ~181 files, respectively).

3.4.5 Soprano pipistrelle was the second most frequently recorded species (11.96 % of all passes), with most of their activity recorded around woodland habitat. In Transect 1, soprano pipistrelles were seen commuting along the northern treeline and ditch, foraging and commuting within the woodland in the north of Transect 2 and foraging and commuting along the woodland edges in the east of Transect 3.

Big bat (Noctule/Serotine/Leisler's bat)

3.4.6 Noctules were recorded at species level, accounting for 8.61 % of all passes and recorded in 3 transects. They were mainly recorded commuting across open arable habitat commuting and along the River Trent. They were the first bats recorded in Transect 3 for the summer and autumn surveys, where they were seen commuting across the Site, towards the woodland 9 and 15 minutes after sunset. Peak activity levels were recorded in summer.

3.4.7 Serotine was recorded at species level only twice within Transect 3, these records were subsequently sent to an acoustic specialist and confirmed to be an atypical call of noctule.

3.4.8 In addition, 1.79 % of all passes were recorded as 'big bat'. These were all recorded in autumn, across all three transects. They were recorded across all habitat types, seen commuting through open arable fields, along the River Trent, woodland edges and wet ditches.

Brown long-eared

3.4.9 Brown long-eared bat were only recorded in Transect 2 and 3, with two passes in both spring and summer, accounting for only 0.48 % of all passes. In Transect 2, records were near the village of North Clifton and in Transect 3, they were recorded along woodland edge and a wet ditch.

***Myotis* sp.**

3.4.10 Myotis sp., was the third most recorded species or species group, accounting for 5.86 % of all passes, and recorded on all three transect routes. In Transect 1, *Myotis* was recorded in the north, near a patch of trees and a pond; in Transect 2, they were recorded within the woodland and along the River Trent; and in Transect 3, they were recorded around the whole route, with highest activity levels along woodland edge in the east. Similar to common pipistrelle, there was not much difference in activity levels across the seasons, with the highest levels recorded in spring (20 passes), followed closely by summer (18) and lowest levels recorded in autumn (11).

Static Acoustic Monitoring

3.4.11 At least seven species of bat were identified during the static acoustic monitoring:

- Barbastelle
- Common pipistrelle
- Soprano pipistrelle
- Nathusius' pipistrelle
- Noctule
- Brown long-eared bat
- *Myotis* sp.

3.4.12 A summary of the results is provided in **Table 3-2**, showing the average number of files per night, for each species or species group, at each location. **Figures 3-3** and **3-4** show the average number of files per night, per species in each location and **Figures 3-5** and **3-6** show the average number of files per night; per species during each monitoring period.

3.4.13 Owing to the high proportion of common and soprano pipistrelle species recorded, a division has been implemented to enhance the visibility of lesser recorded bats on the graphs.

Table 3-2: Average number of files per night in 2023

Species/Species group	Transect 1		Transect 2		Transect 3		Total
	East static	West static	North static	South static	North static	South static	
Barbastelle	1.07	0.00	0.00	1.58	1.78	3.00	**7.43**
Common pipistrelle	244.67	212.73	687.57	261.00	811.22	360.82	**2578.01**
Soprano pipistrelle	24.53	4.60	111.14	13.75	79.89	33.18	**267.10**
Nathusius' pipistrelle	0.40	0.33	1.57	0.00	0.33	0.00	**2.64**
Big bat	0.13	4.80	22.57	7.83	1.67	10.64	**47.64**
Noctule	0.07	0.67	50.57	2.67	0.67	7.91	**62.55**
Brown long-eared	6.53	1.07	3.29	10.75	4.56	15.45	**41.65**
Myotis sp.	18.07	1.73	11.43	38.75	49.56	49.18	**168.72**

Figure 3-3: Average number of files per night, for each species, at each monitoring location

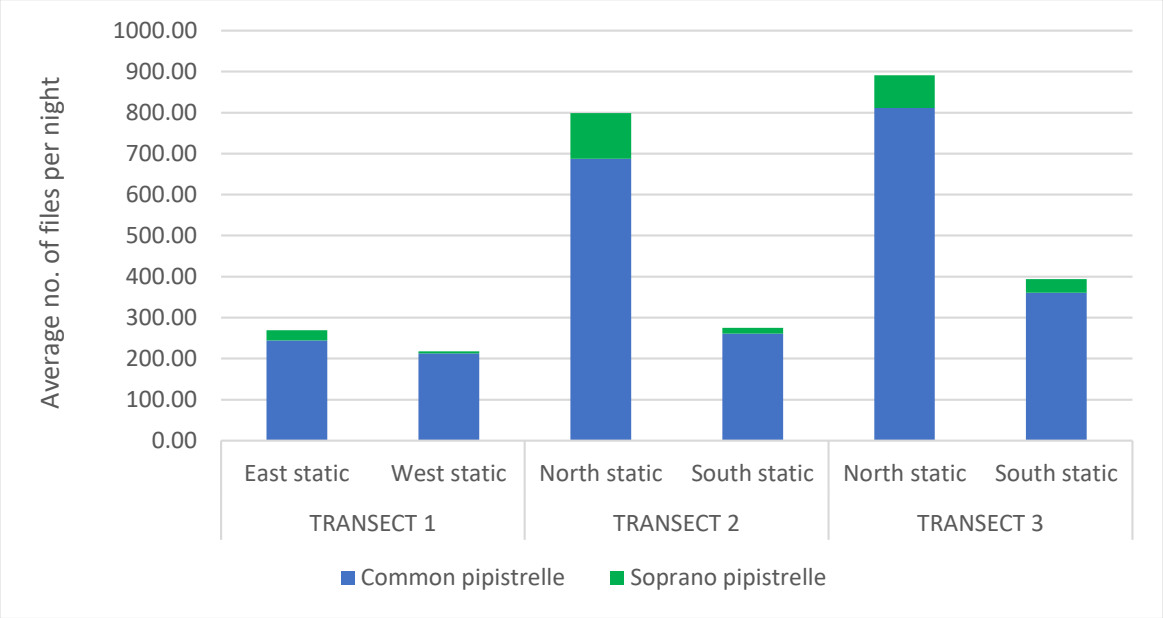


Figure 3-4: Average number of files per night, for each species, at each monitoring location

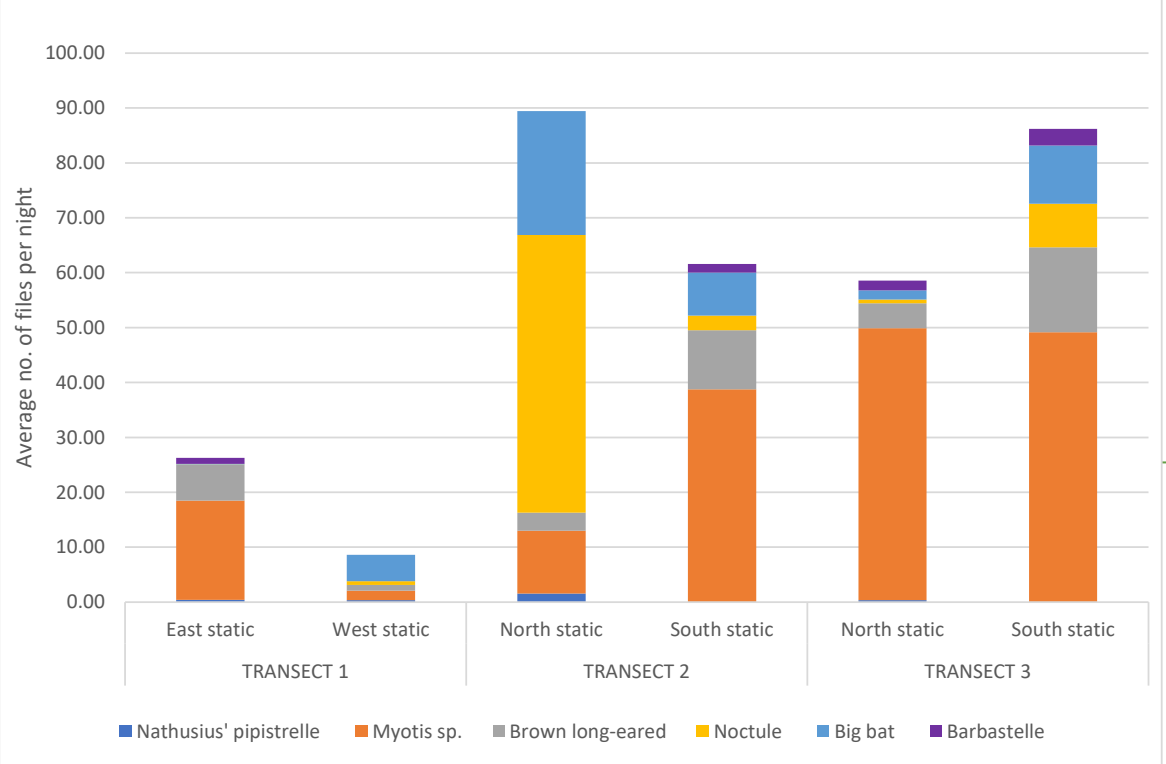


Figure 3-5: Average number of files per night for common pipistrelle, during each monitoring period

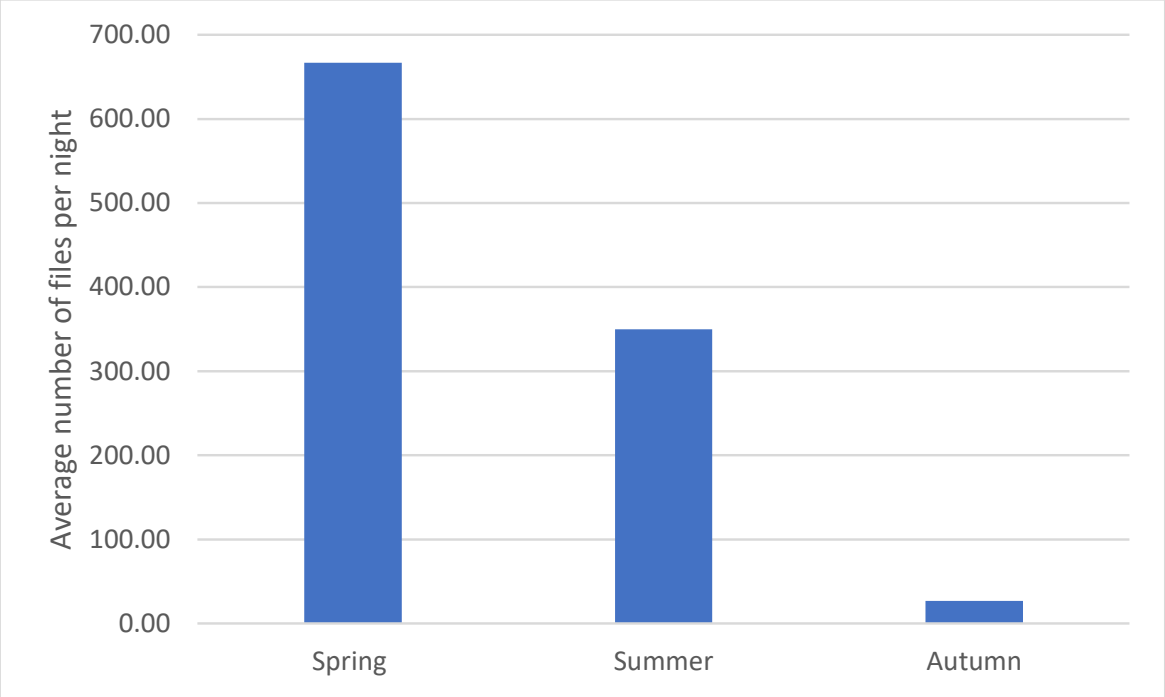
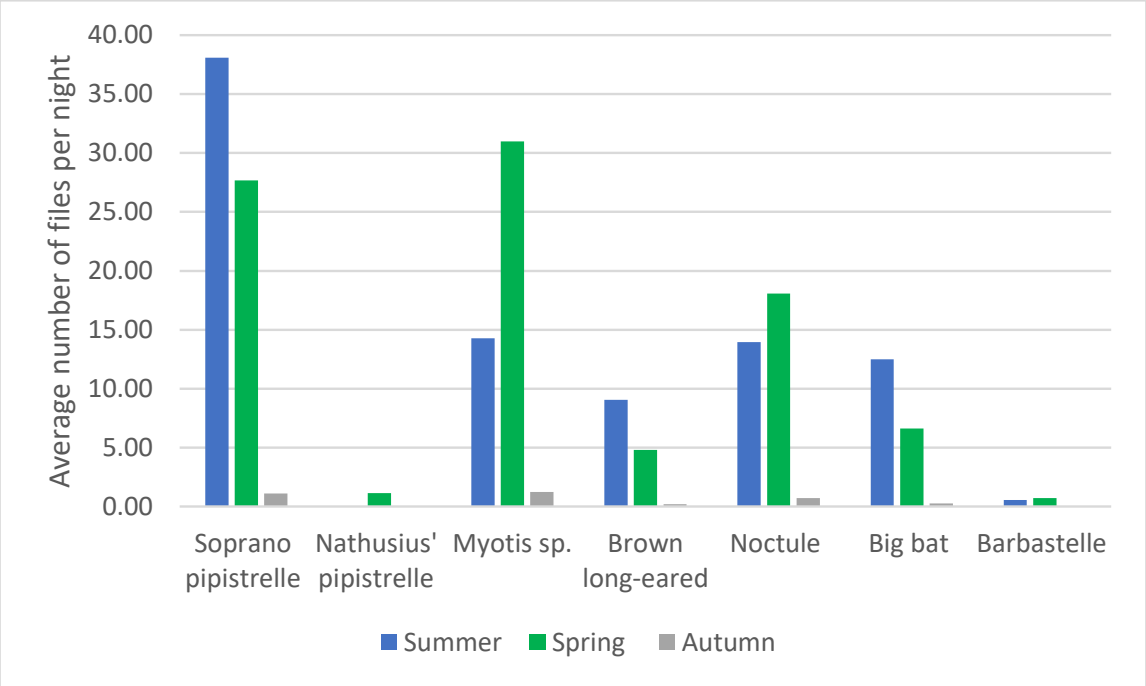


Figure 3-6: Average number of files per night, for each species, during each monitoring period



Barbastelle

3.4.14 Barbastelle accounted for 0.23 % of all files recorded during the static acoustic monitoring, making it the second least recorded species. It was recorded at all static locations bar the western static in Transect 1 and the southern static in Transect 2. Highest levels of activity were recorded in the southern static of Transect 3 and within the spring monitoring period.

Pipistrellus sp.

3.4.15 Following the same trend as for transect survey, common pipistrelle was the most frequently recorded species, accounting for 81.18 % of all files recorded. This species was found across all six static locations, with activity levels peaking within the northern static of Transect 3 and within the spring monitoring period.

3.4.16 Soprano pipistrelle were the second most recorded species, accounting for 8.41 % of all files recorded. This species was recorded at all six static locations, with activity levels peaking within the northern static of Transect 2 within the summer monitoring period.

3.4.17 Nathusius' pipistrelle was the least recorded bat species, with only 72 files (0.08 %) recorded throughout. This species was found at both static locations in Transect 1 and both northern static locations in Transects 2 and 3. Activity levels peaked with an average of 1.57 passes within the northern static of Transect 2. The highest levels of activity were recorded in spring, with none of the static locations recording Nathusius' pipistrelle within the summer monitoring period.

Big bat (Noctule/Serotine/Leisler's bat)

3.4.18 Big bat accounted for 1.50 % of all files and were found across all six static locations. Activity levels peaked within the northern static of Transect 2 during the summer monitoring period.

3.4.19 1.97 % of all files recorded were identified at species level for noctule. Similar to the activity recorded for the big bat species group, this species was recorded at all six locations, with activity levels peaking at the northern static in Transect 2. Unlike the big bat species group however, noctule were observed to have higher activity levels in the spring monitoring period.

Brown long-eared bat

3.4.20 Brown long-eared bat accounted for 1.31 % of all files, making it the third least recorded species during the monitoring period. It was recorded at all static locations, with peak activity levels within the southern static of Transect 3 and within the summer monitoring period.

***Myotis* sp.**

3.4.21 The third most recorded species or species group during the monitoring period, *Myotis* accounts for 5.31 % of all recorded file. This species group was recorded across all six static locations, with peaks within Transect 3, where both northern and southern statics recorded a similar average number of files per night (49.56 and 49.18) respectively. The spring monitoring period yielded the highest activity levels.

4 Summary

4.1 Overview

4.1.1 Sixty-six trees within the Site were unable to be fully assessed or were assessed as providing potential to support roosting bats.

4.1.2 Activity survey results indicate a minimum of seven species of bat recorded across the Site, between April and October 2023.

4.1.3 **Table 4-1** presents a summary of the bat species recorded within, or potentially occurring within, the Site in line with desk study and activity survey results.

Table 4-4-1: Species occurring or potentially occurring on the Site

Species	Desk study	Field survey	Summary
Barbastelle	✓	✓	This species was confirmed on-Site in the desk study and the activity surveys. It was the second lowest recorded species during the static monitoring surveys and recorded only once during the transect surveys and was found along woodland edges. Their status on-Site is consistent with their UK status, as barbastelle are rare, with a restricted range, having a close association with ancient woodland habitat.
Common pipistrelle	✓	✓	Common pipistrelle was identified in the desk study and the activity surveys. They were the most frequently recorded species, foraging and commuting across the Site over the entire survey/monitoring period. These findings are consistent with the species status in the UK, which is common and widespread throughout England and Wales
Soprano pipistrelle	✓	✓	This species was identified in the desk study and in the activity surveys. Soprano pipistrelles were the second most frequently recorded species on the Site, recorded as a result of surveys and monitoring. This species is common and widespread in the UK but is typically associated with riparian and open water habitat.
Nathusius' pipistrelle	×	✓	Nathusius was only recorded during the acoustic monitoring survey and was the least recorded bat species. Although they are typically associated with riparian habitats, particularly near the eastern and southern coasts, they have a patchy distribution across mid and southern England and across Wales.

Species	Desk study	Field survey	Summary
Noctule	✓	✓	Noctule were confirmed on-Site by the desk study as well as the activity surveys. They also have the potential to be roosting on-Site in trees with suitable features. They were recorded frequently across the Site, to species level and within the 'NSL' species group and were recorded both commuting and foraging. This is to be expected as this species is common in England and Wales.
Leisler's bat	✓	Possible	This species was identified in the desk study and potential recorded in the activity surveys to 'NSL' level. This species is widespread but with patchy distribution, possibly due to the difficulty in acoustic identification of this species.
Brown long-eared bat	✓	✓	*Plecotus* species cannot be differentiated by acoustics alone. However, due to the restricted range of grey long-eared bat, it is likely that all records are that of brown long-eared bat. Brown long-eared were recorded within the desk study and during the transect and monitoring surveys. This species is common and widespread in England and Wales, although the quiet calls typical of this species may result in the under-representation of them on the Site.
Daubenton's bat (*Myotis daubentonii)*	✓	Possible	Myotis sp., is the third most recorded species (*Myotis* sp.) and were recorded within the data search during transect and static monitoring surveys. This species group may be under-represented on the Site due to the quiet calls typical of this genus. Daubenton's bats are closely associated with riparian habitat.
Natterer's bat (*Myotis nattereri)*	✓	Possible	Myotis sp., is the third most recorded species (*Myotis* sp.) and were recorded within the data search during transect and static monitoring surveys. This species group may be under-represented on the Site due to the quiet calls typical of this genus. Natterer's bat are closely associated with woodland habitat.
Bechstein's bat	✓	Unlikely	Myotis sp., is the third most recorded species (*Myotis* sp.) and were recorded within the data search during transect and static monitoring surveys. This species group may be under-represented on the Site due to the quiet calls typical of this genus. This species is

Species	Desk study	Field survey	Summary
			rare in the UK, with a known range restricted to the south of England and Wales. This is, in part, due to their close association with ancient woodland, typically requiring extensive parcels of woodland. As such, they are unlikely to occur on the Site.
Whiskered bat (*Myotis mystacinus)*	✓	Possible	Myotis sp., is the third most recorded species (*Myotis* sp.) and were recorded within the data search during transect and static monitoring surveys. This species group may be under-represented on the Site due to the quiet calls typical of this genus. Whiskered bats favour woodland habitat.
Alcathoe's bat (*Myotis alcathoe)*	✓	Unlikely	Myotis sp., is the third most recorded species (*Myotis* sp.) and were recorded within the data search during transect and static monitoring surveys. This species group may be under-represented on the Site due to the quiet calls typical of this genus. Alcathoe's bat has a restricted range, primarily Sussex and Kent, however, this may be in part due to the difficulty in acoustic and visual identification of this species, which was only acknowledged as a separate species (from Whiskered bats) in 2010. Alcathoe's bats favour woodland habitat.
Brandt's bat (*Myotis brandtii)*	✓	Possible	Myotis sp., is the third most recorded species (*Myotis* sp.) and were recorded within the data search during transect and static monitoring surveys. This species group may be under-represented on the Site due to the quiet calls typical of this genus. Brandt's bats are under-recorded in the UK, they are woodland specialists.

5 References

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A1 – Details of Preliminary Roost Assessment

Figure A-5-1: Locations of trees with bat roost potential in the west

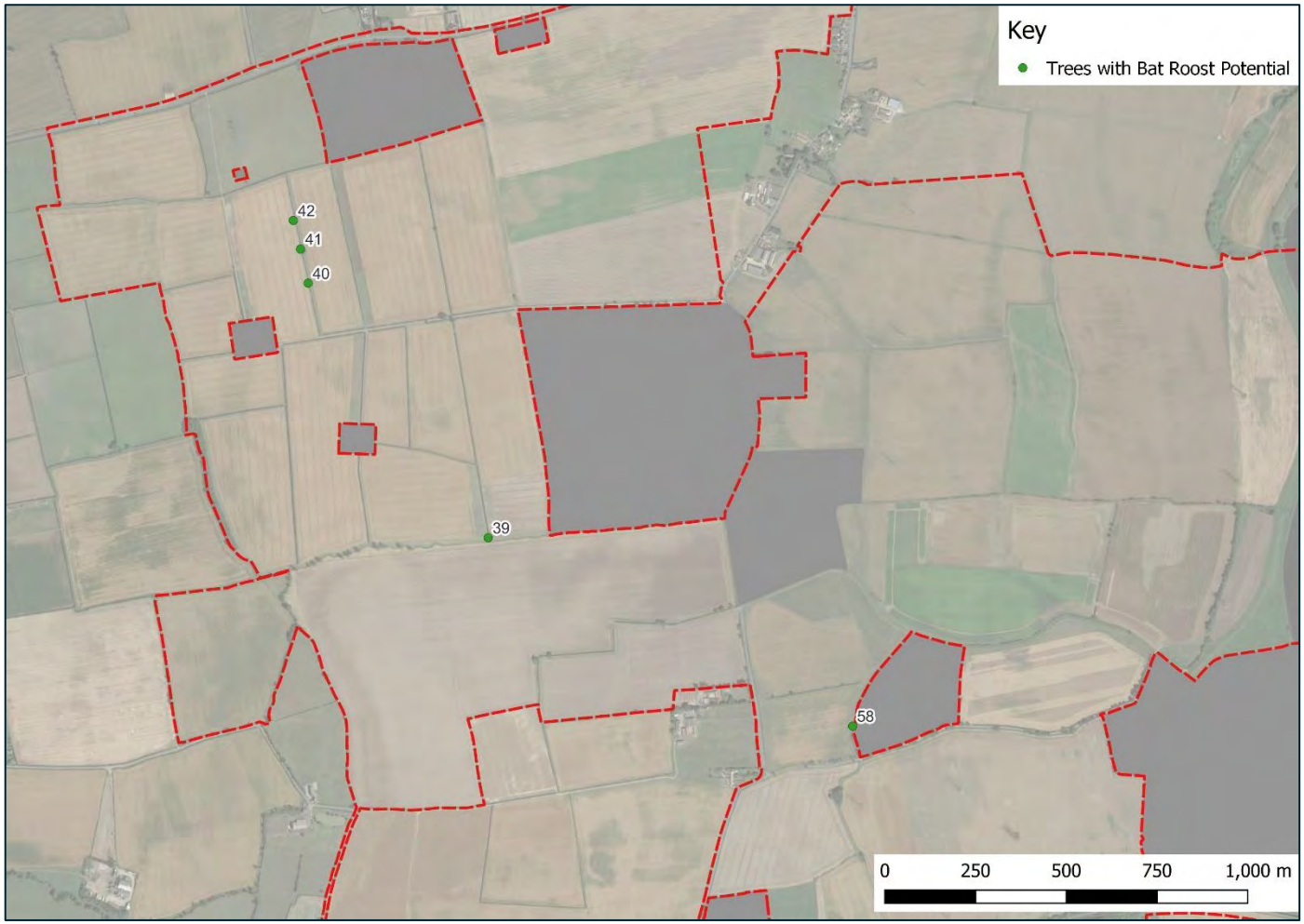


Figure A-5-2: Locations of trees with bat roost potential in the south

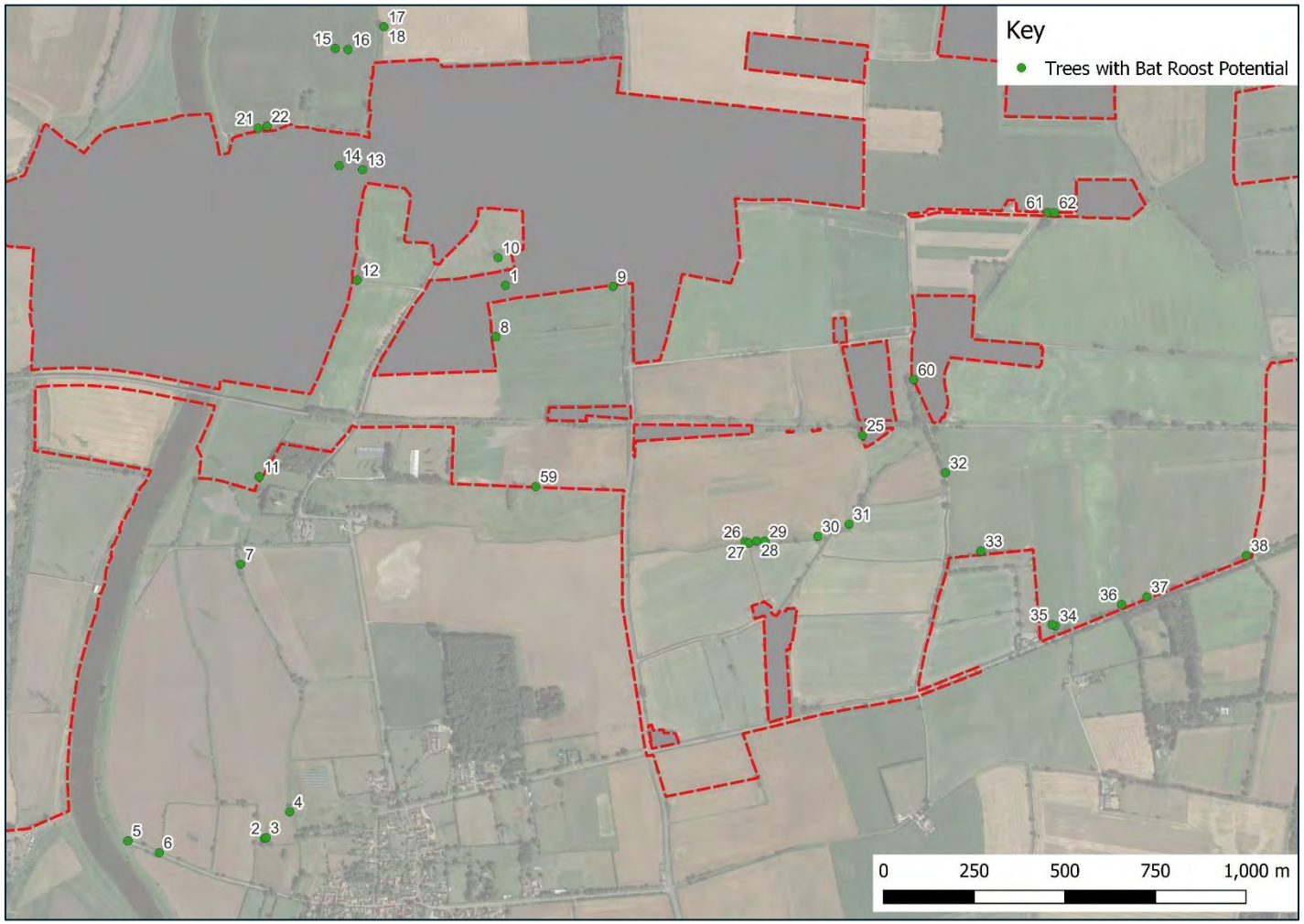


Figure A-5-3: Locations of trees with bat roost potential in the east

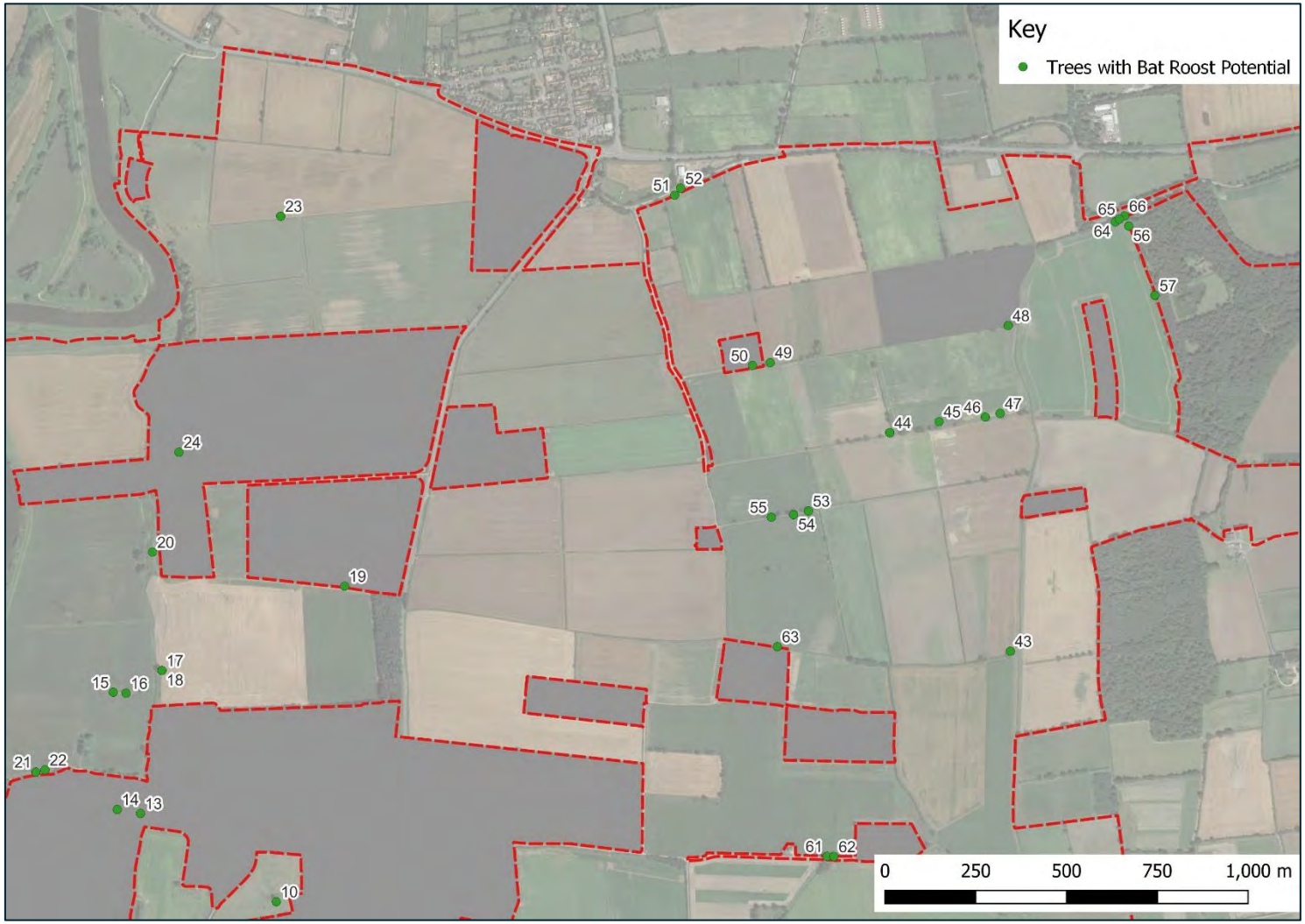


Table A-5-1: Results of Preliminary Roost Assessment

Tree ID	Species	Features
1	Oak	Lifted bark
2	Oak (southern tree)	Barn owl box
3	Ash (western)	Knot hole
4	Ash	None (restricted vis)
5	Oak	None (restricted vis)
6	Oak	Tear out
7	Ash	Dense ivy
8	Ash	Tear out
9	Oak	None (restricted vis)
10	Oak	Lifted bark and splits
11	Crack willow	Tear outs and cracks
12	Ash	Knot holes
13	Ash	None (restricted vis)

Tree ID	Species	Features
14	Ash	Knot hole and ivy
15	Ash	Knot holes
16	Ash	Knot holes
17	Oak	None (restricted vis)
18	Oak	None (restricted vis)
19	Ash	Tear out
20	Poplar	Woodpecker/knot holes
21	Ash	Woodpecker hole
22	Ash	Tear out on limb
23	Oak	Hollow stem
24	Oak	Barn owl box
25	Ash	Tear out
26	Oak	Gaps round heartwood
27	Oak	Knot hole
28	Oak	Knot hole

Tree ID	Species	Features
29	Oak	Knot hole
30	Oak	Tear out and cracks
31	Ash	Knot hole
32	Oak	Dead wood
33	Oak	Woodpecker hole
34	Oak	Knot hole
35	Oak	Dense ivy
36	Oak	Knot hole
37	Oak	Knot hole
38	Oak	Dense ivy
39	Ash	Knot hole
40	Oak	Massive tear out
41	Oak	Spilt and owl box
42	Oak	None (restricted vis)
43	Oak	Knot holes

Tree ID	Species	Features
44	Oak	Woodpecker holes
45	Oak	Hazard beam
46	Oak	None (restricted vis)
47	Oak	Tear out
48	Oak	Tear out
49	Oak	None (restricted vis)
50	Oak	Woodpecker holes
51	Ash	Knot hole/tear out
52	Ash	Hole in dead wood
53	Oak	Multiple
54	Oak	Barn owl box
55	Oak	Tear out
56	Oak	Knot hole
57	Oak	Multiple woodpecker holes
58	Ash	Broken limb
59	Willow	Cracks

Tree ID	Species	Features
60	Beech	Cracked limb
61	Ash	Holes in base
62	Oak	Multiple woodpecker holes 5m up
63	Oak	Large crack
64	Oak	Cracks
65	Oak	Cracks
66	Oak	Cracks

Appendix 7-4: Breeding Bird Baseline

Report

One Earth Solar Farm

Appendix 7-4: Breeding Bird Baseline

For One Earth Solar Farm Ltd

17 May 2024

Document control

Project Title:	One Earth Solar Farm
Project Number:	14529A
Client:	One Earth Solar Farm Ltd
Document Title:	Appendix 7-4: Breeding Bird Baseline
Document Number:	14529A-A
Prepared By:	[redacted]
[redacted]	[redacted]

Revision History

01	08/03/2024

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1 Introduction

1.1 Background

1.1.1 This Appendix should be read in conjunction with Chapter 7 of the Preliminary Environmental Information Report (PEIR) which is provided in support of the delivery of an Environmental Impact Assessment (EIA) associated with the One Earth Solar Farm, hereafter referred to as the 'Proposed Development' or 'One Earth'.

1.1.2 This Appendix described the survey methodologies used and summarised the results of the breeding bird surveys undertaken in 2023 within the proposed DCO Order Limits; with emphasis on open farmland habitats including those containing complex ditch and hedgerow networks that have the potential to support important populations of breeding birds.

1.2 Purpose of this appendix

1.2.1 The purpose of the Appendix is to present the results of the breeding bird assessment which was undertaken to identify and assess the assemblage of breeding birds potentially impacted by the Proposed Development.

1.2.2 Surveys were completed within the breeding period between May and July in 2023 (where breeding species are most likely to be encountered) following an adapted method based on the British Trust for Ornithology's (BTO's) Common Bird Census (CBC) methodology (Gilbert *et al.*, 1998).

1.2.3 The breeding bird surveys were designed to identify the distribution, density and activities of breeding birds within an appropriate sampling area within the DCO Order Limits. This sampling area targeted habitats representative of the DCO Order limits that are likely to support breeding bird assemblages.

1.3 Structure of this appendix

1.3.1 This appendix is structured as follows:

- Section 2: Methods;
- Section 3: Results;
- Section 4: References;
- Annex A: Figures;
- Annex B: Species recorded during the breeding bird survey;
- Annex C: Full survey details; and
- Annex D: Territory mapping criteria.

2 Methods

2.1 Desk Study

2.1.1 An environmental desk study was undertaken to identify statutory designated sites of international and national importance for ornithology within 10km of the proposed DCO Order Limits, and non-statutory designated sites of ornithological importance within 2km of it. The search for statutory sites was carried out using the Multi-Agency Geographic Information for the Countryside (MAGIC) website (an internet-based Geographic Information Systems database provided by the Department for Environment, Foods and Rural Affairs (DEFRA) (Defra, 2024)) and for non-statutory sites through a data request to Greater Lincolnshire Nature Partnership (GLNP). Information on statutory designated sites was gathered from the websites of Natural England (Natural England, 2024) and the Joint Nature Conservation Committee (JNCC) (JNCC, 2024).

2.1.2 In addition to information on designated sites, species specific data was gathered from GLNP within 2km of the proposed DCO Order Limits.

2.2 Breeding bird surveys

2.2.1 Breeding bird surveys were undertaken between May and July 2023 inclusive. The purpose of the breeding bird survey was to collect data to confirm the typical distribution and assemblages of species present within the area surveyed (See **Section 3.1**)

Data collection locations

2.2.2 The survey adopted a sampling approach and focused on large areas of accessible land within which the breeding bird assemblage has the potential to be impacted by the proposed development. The survey area covered 633 hectares (ha) of the 1478 ha red-line boundary, at the time of survey. The survey area covered large areas of open farmland, ditch, and hedgerow complexes on both sides of the river Trent, woodland edge habitats (east of the river Trent) and linear features including the river Trent corridor and the embankment of the dismantled railway line that runs east-west through the Site serving as a functional Sustrans Route 647. The survey was undertaken based on the proposed DCO Order Limits, plus a 50m buffer, where the survey areas directly overlapped Order Limits, information was gathered for birds outside of the Order Limits.

2.2.3 For the purposes of the breeding bird survey, this area was divided into five survey areas. These survey areas received systematic coverage with surveys undertaken by a single surveyor to avoid duplication of counting or overlap of adjacent area recordings (**Figures 2.1 to 2.1e**, **Annex A**). Data from all survey areas was combined for reporting purposes.

2.2.4 Area 1: lies within the northwest of the Site boundary and includes areas of open farmland (with predominantly large rectangular fields), divided in places by narrow hedgerows and ditches. This area covers approximately 136 ha of land and includes a proposed battery storage facility adjacent to the Sustrans route 647, northwest of the National Grid substation at High Marnham. The area is dominated by cereal crop production including wheat and oil seed rape.

2.2.5 Area 2: abuts Area 1 to the southeast and continues south- and eastwards from the hamlet of Ragnall toward Fledborough. This area covers approximately 168 ha and consists of a large expanse of agricultural crop fields including examples of the largest agricultural fields within the DCO Order Limits. These large fields were predominantly used for wheat and oil seed rape production with boundary features of hedgerows and overgrown ditches also present. The area includes a agricultural land considered as coastal floodplain grassing marsh (on the priority habitat inventory) on the west of the river Trent. Three agricultural fields east of the river Trent are also within Area 2, these fields are set

back from the Trent corridor to the north of a small off-site reservoir and west of the A1133 road. These fields are bordered by intact hedgerows and small treelines, which reach approximately 5 metres (m) high in places.

2.2.6 Area 3: Consists of approximately 70 ha of agricultural fields directly east of the river Trent between the villages of South- and North Clifton. These large fields are bordered by linear features including hedgerows and ditches. To the immediate west of the Area is the river Trent, with Church Lane immediately east. These arable fields were cropping wheat, legumes and sports turf during the breeding bird survey period.

2.2.7 Area 4: Includes two satellite parcels of agricultural land within the land east of the river Trent. The largest area, approximately 66 ha, lies immediately east of the river Trent on low-lying agricultural land used for crop production. This area includes fields north of Trent Lane between the river corridor escarpment to the east and the river to the west. This land was used for wheat production and also had a set-aside or sacrificial crop used for game cover. Along the eastern side of these fields there is a large pond and ditch network (the Sewer Dyke) which forms a transitional habitat from low-lying agricultural land into a scrub / wooded escarpment. The other parcel of land within Area 4 consists of 45 ha of agricultural cropland east of the A1133, located immediately north of the decommissioned railway (Sustrans Route 647) which forms a proposed location for battery storage within the Site.

2.2.8 Area 5: Includes a large area of agricultural cropland in the northeast of the Site. The area covers approximately 148 ha. At the time of survey these field were cropping mixed cereals and root crops including wheat, oil seed rape, barley, potatoes, legumes, set-aside and sports turf. Well established hedgerows with trees form boundary features to major blocks of fields with smaller defunct hedgerows and ditch systems also present on field edges. There were three small parcels of young plantation woodland within this area and three small stubble fields which had been ploughed through at the time of survey.

2.2.9 Full survey details, including surveyor names, visit dates and times, and weather conditions are available in **Table C-1**, Annex C.

Data collection methods

2.2.10 The surveys followed an adapted method based on the BTO's CBC methodology (Gilbert *et al*., 1998), whereby the observer undertakes a census of all species present. The location of each bird detected (visually and / or aurally) was mapped using the standard two-character BTO codes, and bird activity was recorded using standard behaviour codes (Marchant, 1983).

2.2.11 Survey visits were undertaken between May and July 2023, at broadly 10-day intervals from the previous visit.

2.2.12 Six survey visits were undertaken during the 2023 breeding season: one in Mid-May, three in June (early, mid-month and late in the month) and two in July (Early and mid-month).

2.2.13 All surveys were undertaken in favourable conditions, avoiding periods of heavy rain, or strong or cold winds, therefore minimising variation in bird activity levels due to weather conditions.

2.2.14 Visits started at least half and hour after dawn and were completed no later than midday, with an exception during visit four (See Deviations, constraints, and limitations section (paragraphs 2.2.19 to 2.2.22).

2.2.15 A different route (start and end point) was used on each survey visit to ensure that certain parts of the survey area did not receive systematically better coverage due to a possible decline in song (or other breeding bird activity) output later in the morning.

Territory mapping

2.2.16 On completion of the field survey, results were collated and analysed, and provided as maps of indicative territory centre-points, made across all visits within the survey period. Territory mapping analysis was based on criteria adapted from Amar *et al*. (2006) (See **Annex D**) and involved an experienced ornithologist looking for spatial groupings of song registrations.

2.2.17 No temporal restrictions have been applied, such that any grouping within more than one visit represented, or consisting of at least one registration of song, has been assessed as a territory. These data have been used to determine the number and distribution of species, and overall breeding assemblage within the survey area.

2.2.18 As territory location were derived from a combination of mapped visits (as per the CBC methodology (Gilbert *et al*., 1998)); it should be noted that mapped territory locations represent indicative breeding territories and not specific nesting locations.

Deviations, constraints and limitations

2.2.19 Surveys were conducted within a sampling area based on the potential for habitats within the DCO Order Limits to provide breeding bird habitat. The sampling area focussed on areas with higher habitat diversity within the DCO Order Limits to assess greater quality habitats for breeding birds and form a baseline (worst case scenario) that can be used to assess the potential impacts of the proposed development. In undertaking these surveys during the early stages of the Scheme, areas subject to survey may no longer fall within the DCO Order Limits at submission, similarly additional areas outside of the current DCO Order Limits may be brought forwards for inclusion with the Scheme. This represents a limitation and constraint to the overall breeding bird assessment of the scheme as potential breeding bird information provided below may no longer be relevant at submission. This limitation, along with the solution to provide a robust assessment will be discussed further within the ES.

2.2.20 During the field survey, there were deviations from the methodology during visits four, five and six within selected Areas; with surveys continuing beyond midday to ensure full survey coverage. During visit four in Area 5, surveys were completed by 12:45, with surveys in Area 2 completed by 14:45. During visit five in Areas 1 and 2 surveys were completed by 13:55, to avoid inclement and sub-optimal weather in the following days. During visit 6 in Area 2, surveys were completed by 13:30, 90 minutes after suggested timings. There were no deviations, constraints, or limitations within Areas 3 or 4.

2.2.21 Surveys were conducted between May and July having commenced slightly later within the field season than would normally be considered appropriate (April – mid-June). However, given the habitats present within the Site and the continuation of surveys beyond mid-June to capture further breeding evidence and provide a robust evidence base for the breeding bird assemblage, it is not considered that this limitation has had a negative impact on the overall breeding bird assessment.

2.2.22 Despite the deviation, constraints and limitations describe above, the dataset is considered to provide a robust approximation of the breeding bird assemblage within the survey area. This conclusion can be drawn as constraints and limitations faces within the breeding bird assessment were not extensive enough to negatively impact the territory mapping exercise undertaken following the completion of the surveys. Further the areas sampled as part of this assessment include the areas most likely to present increased species diversity and density therefore using these areas to extrapolate potential impacts on the overall breeding bird assemblage will create a robust baseline. Expansive areas of open arable land which were not subject to breeding bird survey are considered to be of limited importance to breeding birds due to the homogeneity of the habitats and lack of suitable nesting cover within woody vegetation.

3 Results

3.1 Statutory designated sites of ornithological importance

3.1.1 There are no nationally or internationally statutory designated sites of ornithological importance within 10km of the DCO Order Limits.

3.2 Non-statutory designated sites of ornithological importance

3.2.1 There are no non-statutory designated sites of ornithological importance within 2km of the DCO Order Limits.

3.3 Species records

3.3.1 As part of the environmental desk study, species data for birds likely to be breeding within, or in proximity to the DCO Order Limits was gathered from GLNP. Species data was screened to include all records within the breeding season (here considered to be 1st March – 31st August inclusive) from within the last ten years.

3.3.2 GLNP returned 40 records of 19 species considered to be notable[1] during the breeding season, including:

- Six Schedule 1 listed species – barn owl, corncrake, hobby, kingfisher, marsh harrier and red kite.
- 11 Species of Principal Importance (SPI) (Natural Environment and Rural Communities Act (NERC), 2006) – bullfinch, corncrake, cuckoo, house sparrow, lapwing, linnet, reed bunting, skylark, song thrush, yellowhammer, and yellow wagtail.
- Nine birds of conservation concern[2] (BoCC) Red-listed species – corncrake, cuckoo, house sparrow, lapwing, linnet, skylark, swift, yellowhammer, and yellow wagtail.

3.3.3 Further details of the GLNP records can be found within Appendix 7-2 (Document Reference: Ecology Desk Study).

3.4 Breeding bird survey

3.4.1 A total of thirty-nine species were recorded breeding or holding territory during the breeding bird survey (See **Figures 3.1a** to **3.1m**, **Annex A**), of which:

[1] GLNP returned records of birds considered notable if listed as local priority species (Listed as UK Biodiversity Action Plan (UK BAP) species), protected by Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) or priority species listed on Birds of Conservation Concern 5 – Red List.
2 BoCC Red list = The background to the establishment of a 'traffic light system' of conservation concern for UK birds is discussed in Gregory et al. (2002). The updated criteria and lists are detailed in Stanbury et al. (2021). Broadly, 'Red-listed' species include those that are globally threatened, have suffered a historical population decline in the UK (between 1800 and 1995) or which have experienced rapid declines in their UK breeding population or contractions in their UK range of more than 50% over the past twenty-five years. Amber-listed' species include any species on the European Red List (Critically Endangered, Endangered or Vulnerable), these are detailed in Stanbury et al. (2021).

- Three species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended): barn owl, hobby and quail;
- Ten species listed as SPI: dunnock, grey partridge, house sparrow, linnet, reed bunting, skylark, song thrush, turtle dove, yellowhammer, and yellow wagtail.
- Nine species recorded as BoCC red-listed species: greenfinch, grey partridge, house martin, house sparrow, linnet, skylark, turtle dove, yellowhammer, and yellow wagtail.

3.4.2 **Table 3.1**, below, presents the total number of territories for each species within the survey area, along with any legislative protection or conservation status.

Table 3-1 – Territory assemblage recorded during breeding bird surveys

BTO code	Species	Number of territories	Sch. 1[3]	SPI[4]	BoCC[2]
BO	Barn owl	1	✓		Green
B.	Blackbird	28			Green
BC	Blackcap	10			Green
BT	Blue tit	2			Green
BZ	Buzzard	4			Green
C.	Carrion crow	2			Green
CH	Chaffinch	40			Green
CC	Chiffchaff	12			Green
CD	Collared dove	1			Green
D.	Dunnock	10		✓	Amber
GO	Goldfinch	5			Green
GT	Great tit	7			Green
GR	Greenfinch	5			Red
P.	Grey partridge	3		✓	Red
HY	Hobby	1	✓		Green
HM	House martin	3			Red

[3] **Sch.1** = listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). These species are afforded additional levels of protection making it an offence to intentionally or recklessly disturb at, or near an 'active nest'. Schedule 1 protection extends to the nest, eggs, and dependent young of a Schedule 1 species.
[4] **SPI** = Species "of principal importance for the purpose of conserving biodiversity" covered under Section 41 (England) of the NERC Act (2006).

BTO code	Species	Number of territories	Sch. 1[3]	SPI[4]	BoCC[2]
HS	House sparrow	12		✓	Red
K.	Kestrel	1			Amber
LW	Lesser whitethroat	1			Green
LI	Linnet	7		✓	Red
LO	Little owl	1			Green
MG	Magpie	1			Green
MA	Mallard	3			Amber
OC	Oystercatcher	3			Amber
PW	Pied wagtail	2			Green
Q.	Quail	2	✓		Amber
RB	Reed bunting	14		✓	Amber
R.	Robin	13			Green
SW	Sedge warbler	12			Green
S.	Skylark	98		✓	Red
ST	Song thrush	9		✓	Amber
SD	Stock dove	1			Amber
SL	Swallow	6			Green
TD	Turtle dove	1		✓	Red
WH	Whitethroat	39			Amber
WP	Woodpigeon	13			Amber
WR	Wren	55			Amber
Y.	Yellowhammer	29		✓	Red
YW	Yellow wagtail	7		✓	Red

The breeding bird assemblage recorded within the survey area is typical of open farmland habitats with limited vegetative cover (aside from seasonal crop) to provide breeding cover. The species assemblage and overall abundance of breeding territories recorded is also typical of open farmland with a reduced species count and a low overall breeding density. As the DCO Order Limits do not

include habitats synonymous with breeding bird habitat, such as woodlands, wetland or areas of continuous scrub, the species list is restricted.

There were noticeable increases in species diversity and abundance within well established marginal features such as those found along the river Trent corridor, the escarpment along the east of the Trent and the woodland and scrub edges within the 50m buffer from the DCO Order Limits. There were also notable increases in breeding bird activity around farmsteads and built infrastructure, with species including collared dove, house martin, house sparrow, little owl, pied wagtail, stock dove and swallow nesting within built up areas.

Barn owl nested off-site within the outbuildings surrounding South Clifton.

A full list of species observed during the breeding bird surveys is available in **Annex B.**

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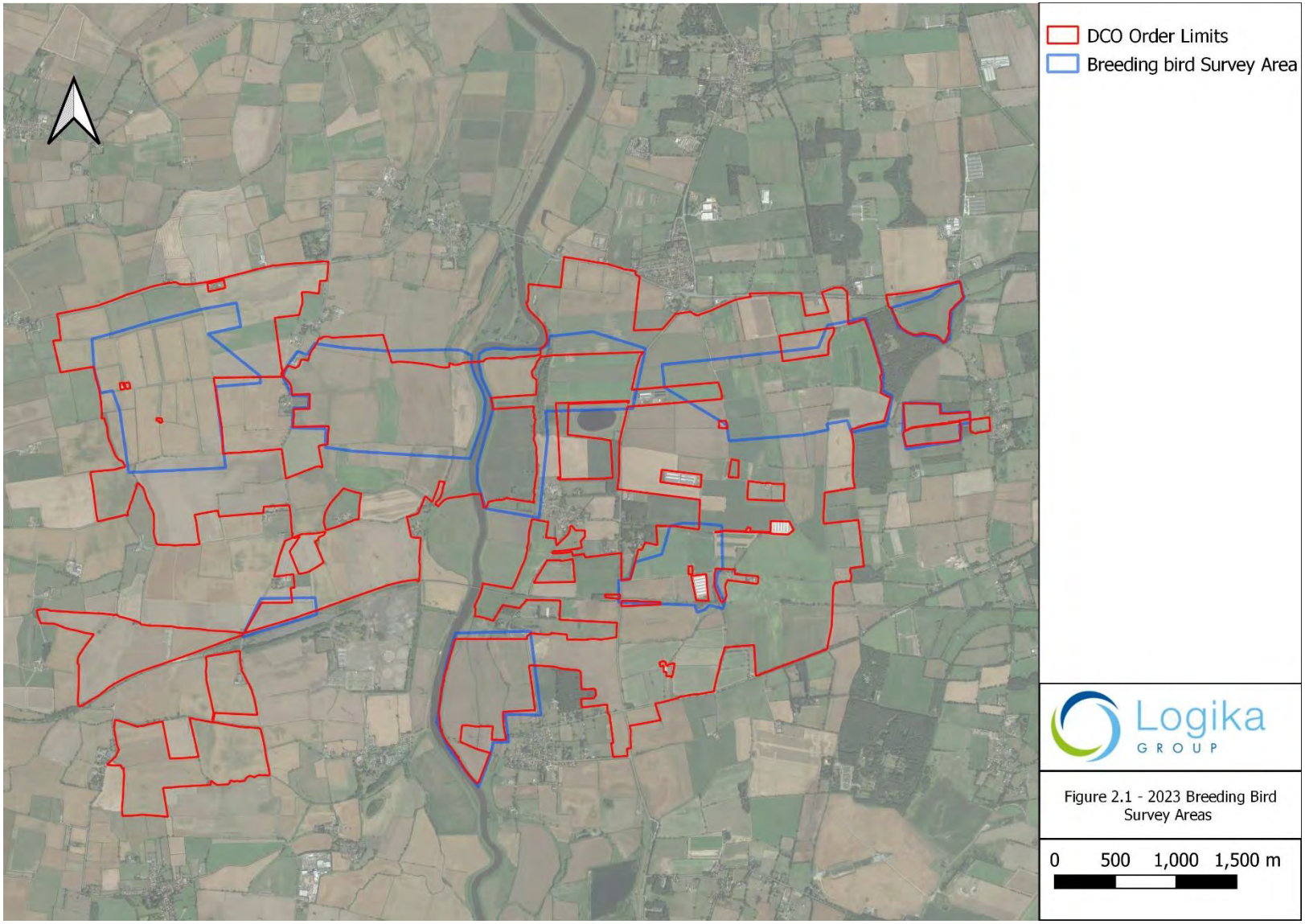
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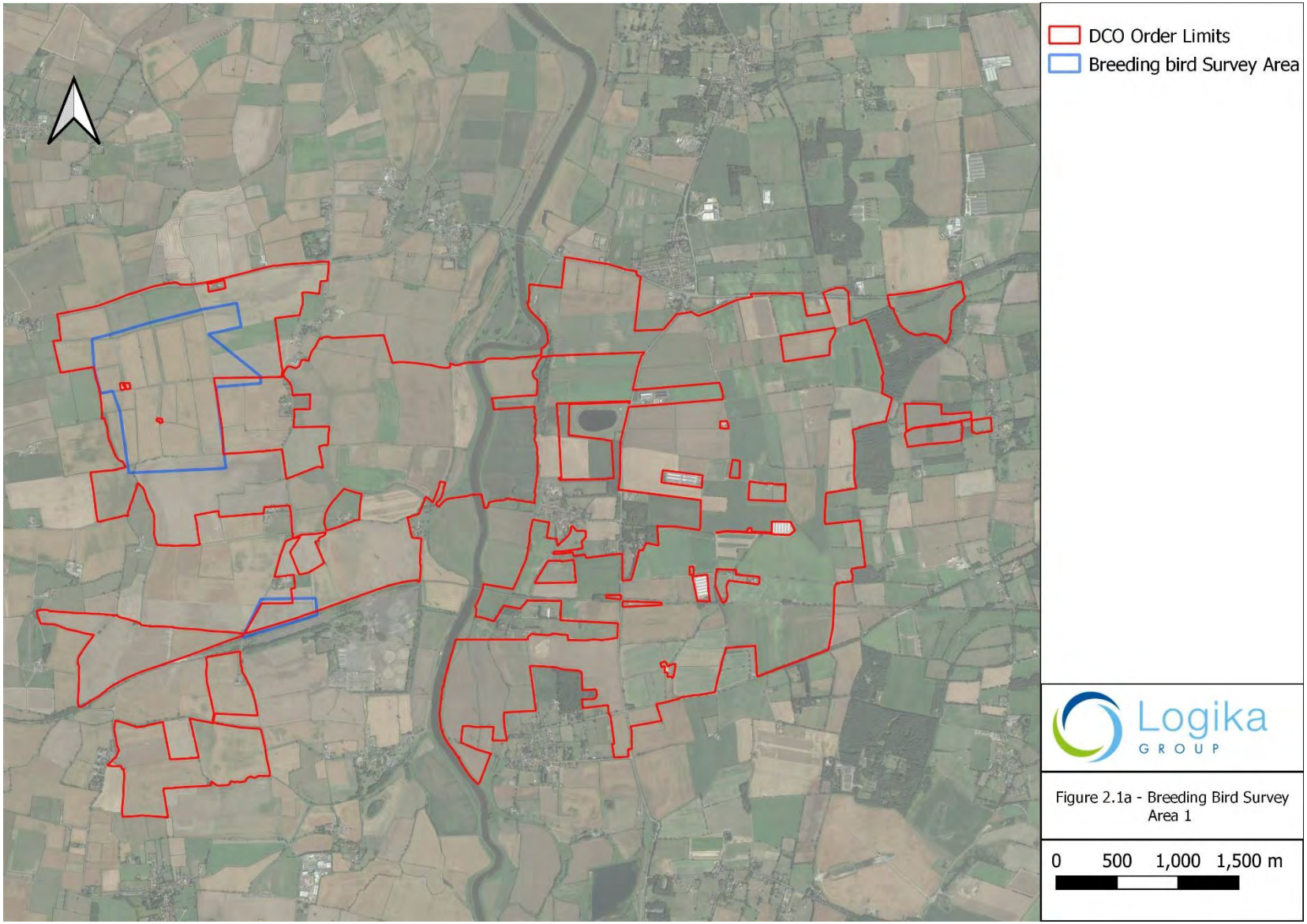
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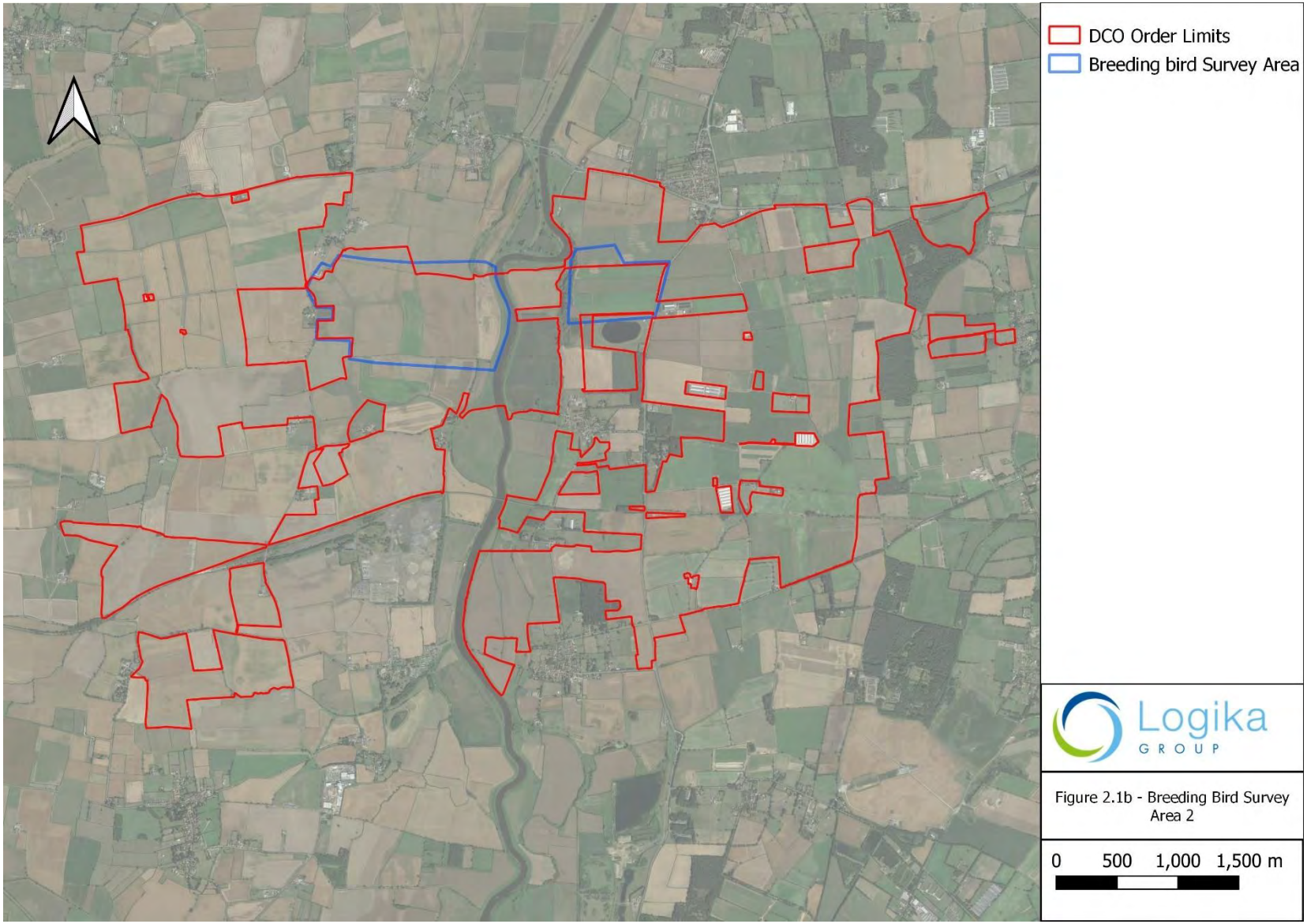
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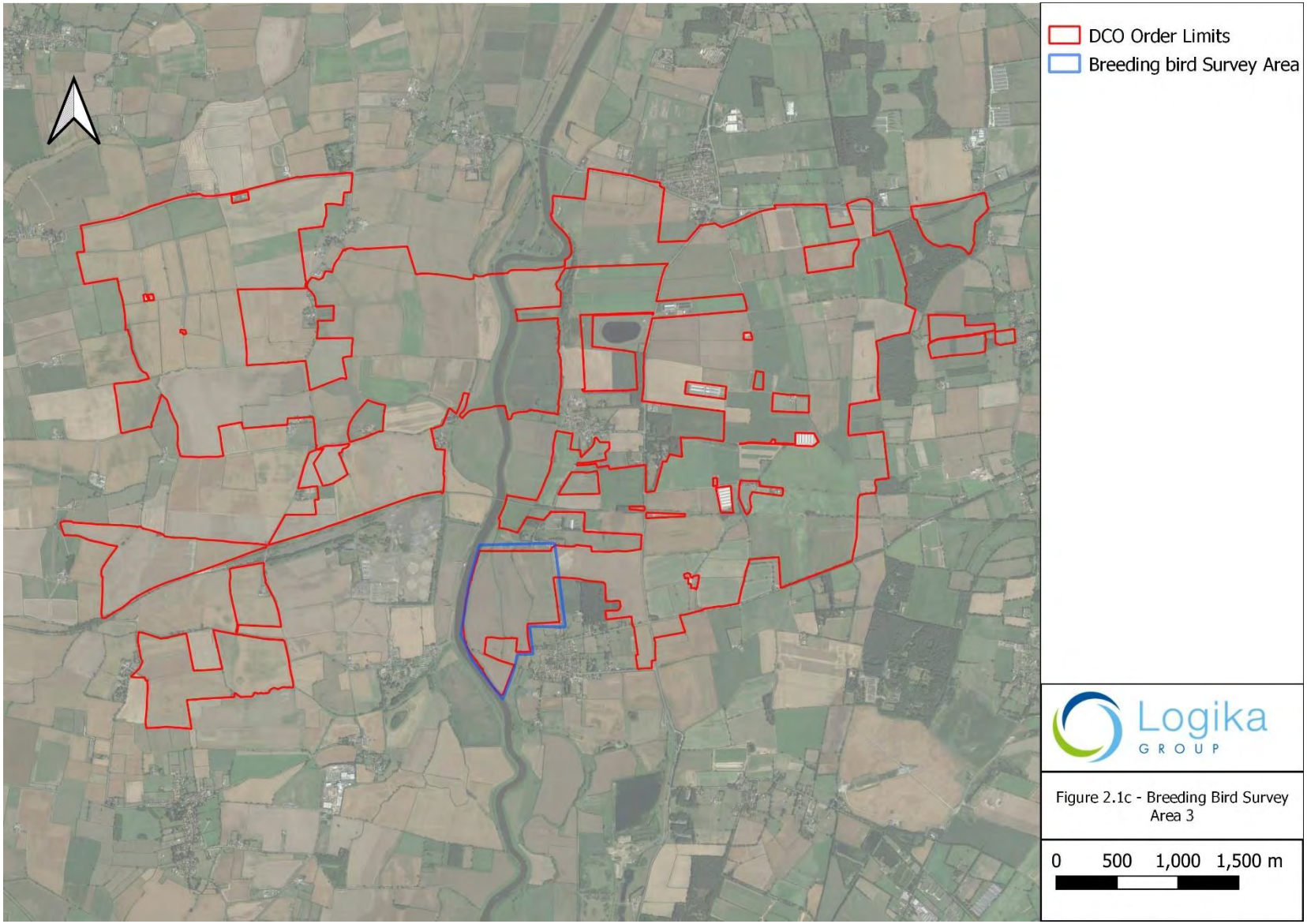
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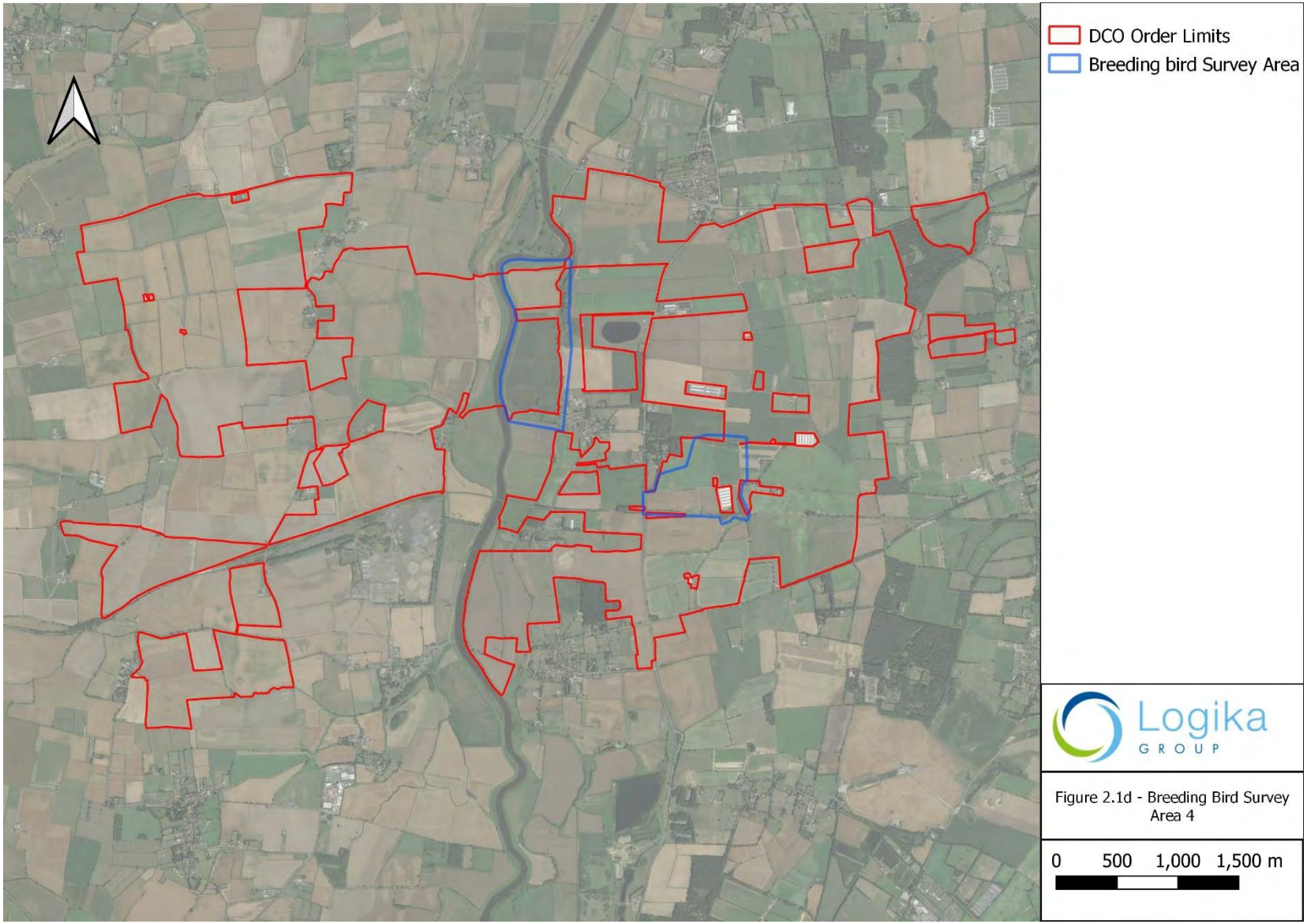
Annex A. – Figures

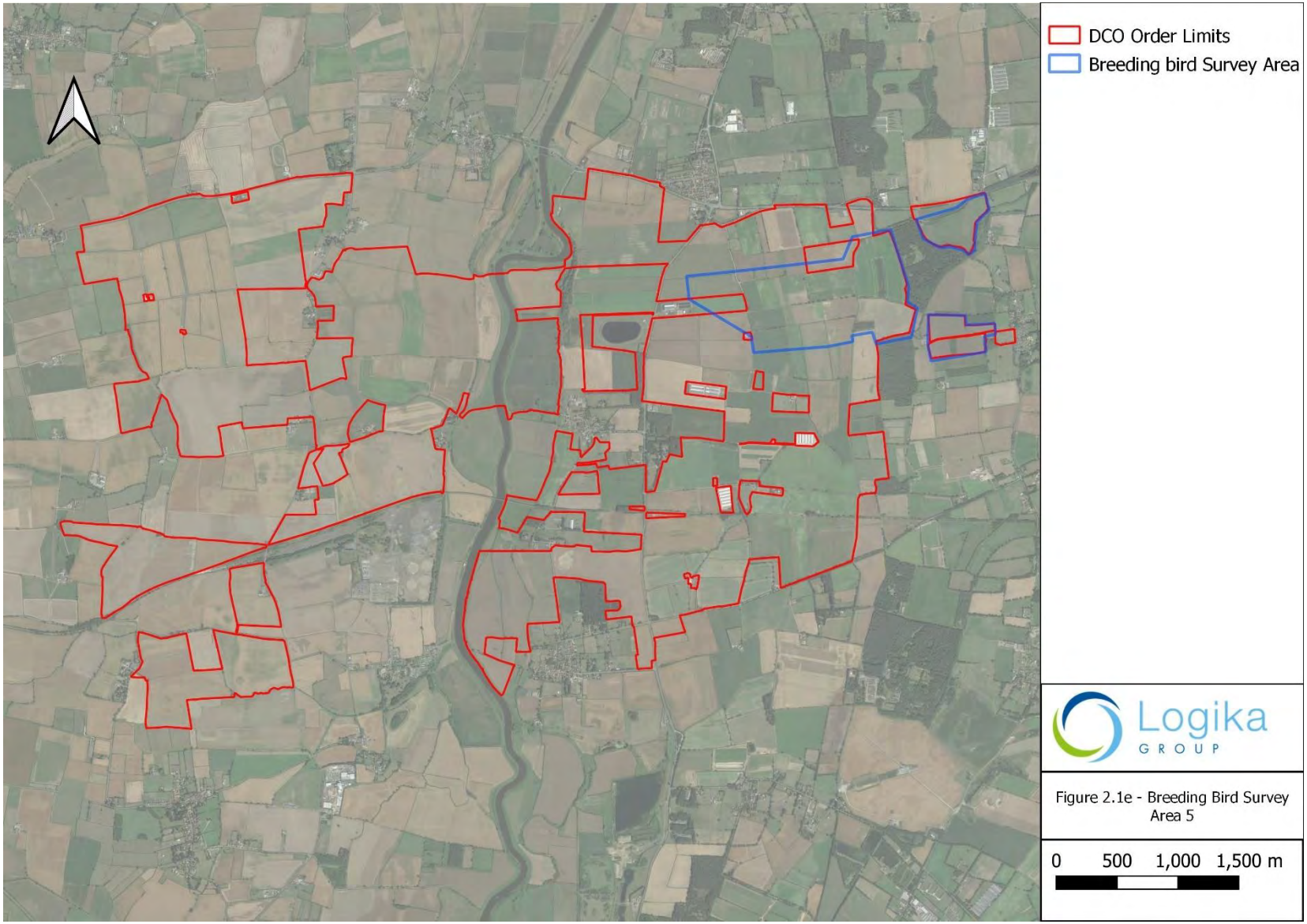

DCO Order Limits
Breeding bird Survey Area
Logika GROUP
Figure 2.1 - 2023 Breeding Bird Survey Areas
0 500 1,000 1,500 m


DCO Order Limits
Breeding bird Survey Area
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Figure 2.1a - Breeding Bird Survey Area 1
0 500 1,000 1,500 m


DCO Order Limits
Breeding bird Survey Area
Logika GROUP
Figure 2.1b - Breeding Bird Survey Area 2
0 500 1,000 1,500 m

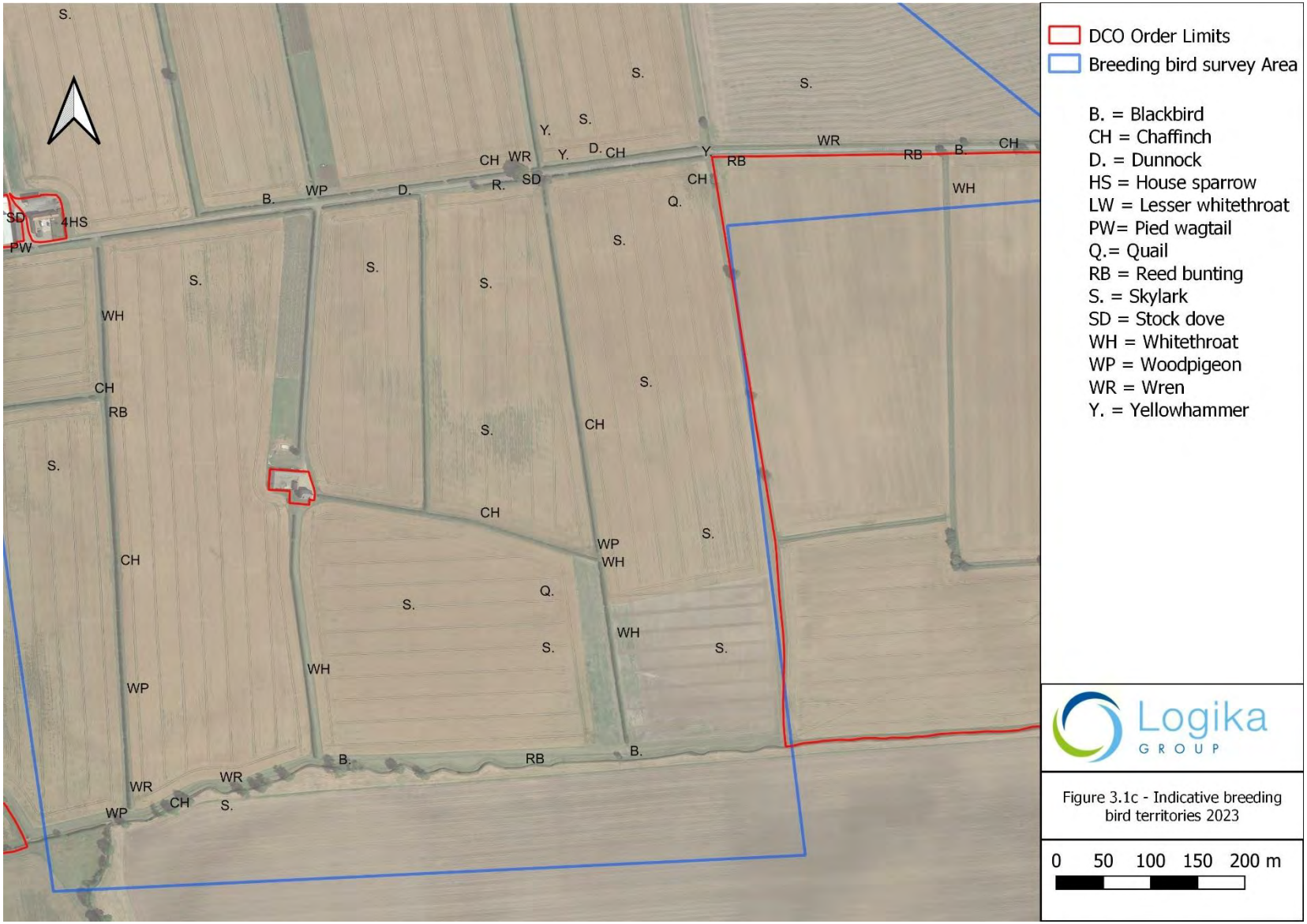

DCO Order Limits
Breeding bird Survey Area
Logika GROUP
Figure 2.1c - Breeding Bird Survey Area 3
0 500 1,000 1,500 m

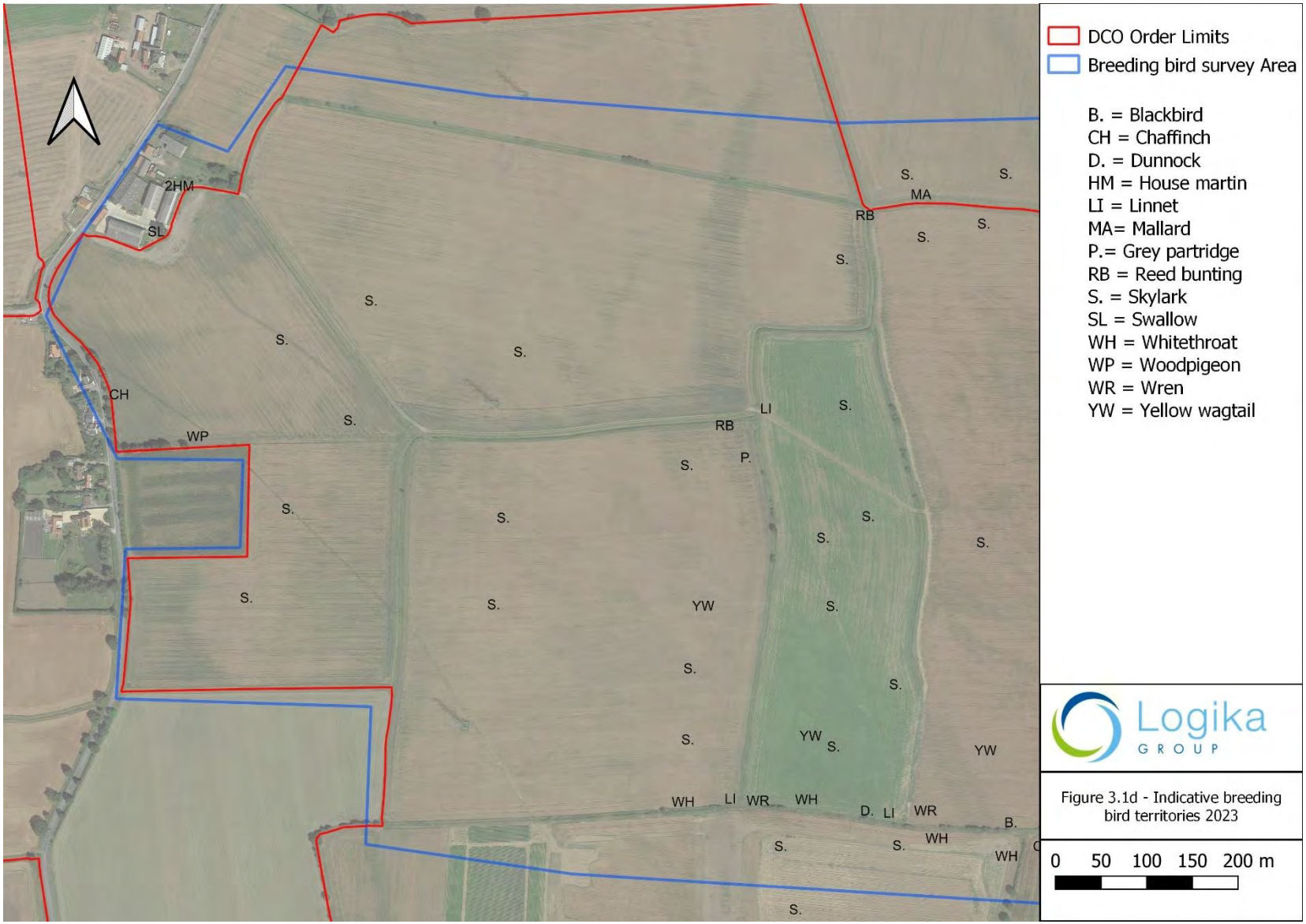

DCO Order Limits
Breeding bird Survey Area
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Figure 2.1d - Breeding Bird Survey Area 4
0 500 1,000 1,500 m

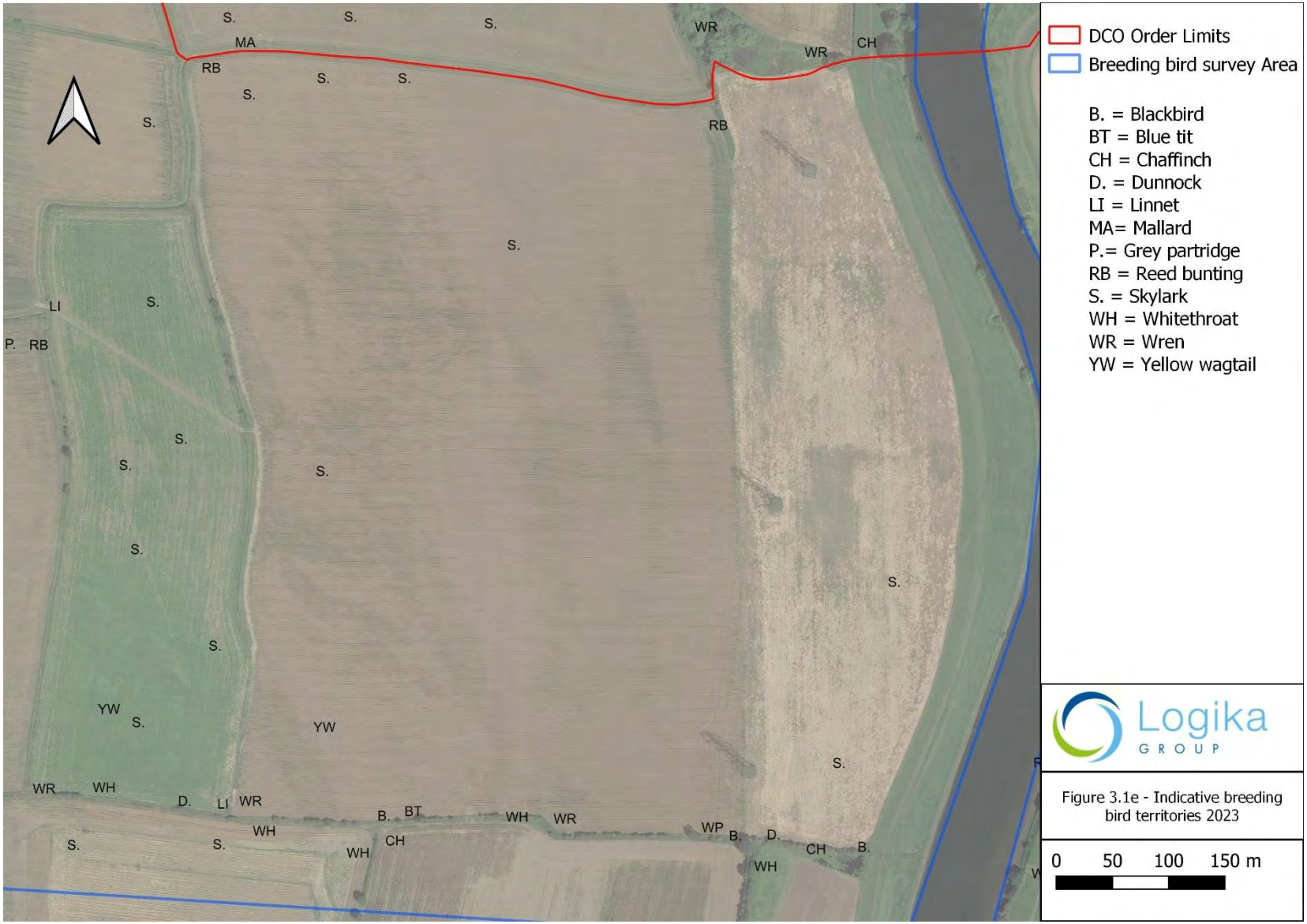

DCO Order Limits
Breeding bird Survey Area
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Figure 2.1e - Breeding Bird Survey Area 5
0 500 1,000 1,500 m

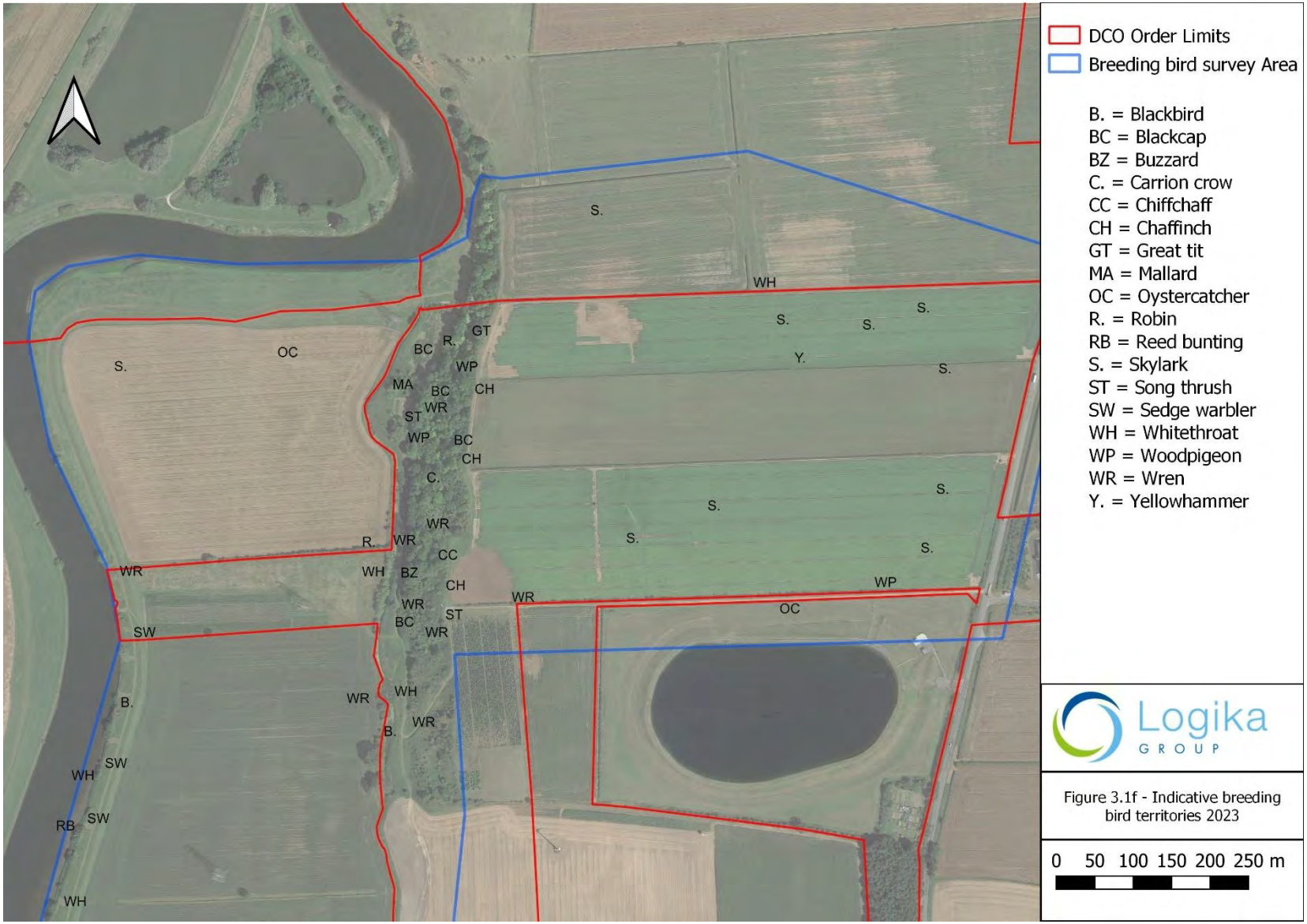

DCO Order Limits
Breeding bird survey Area
B. = Blackbird
CH = Chaffinch
D. = Dunnock
HS = House sparrow
LW = Lesser whitethroat
P. = Grey partrigde
PW= Pied wagtail
R. = Robin
S. = Skylark
SD = Stock dove
WP = Woodpigeon
Y. = Yellowhammer
Logika GROUP
Figure 3.1b - Indicative breeding bird territories 2023
0 50 100 m
S.
CH
R.
LW
Y.
B.
P.
SD
PW
4HS
WP
D.

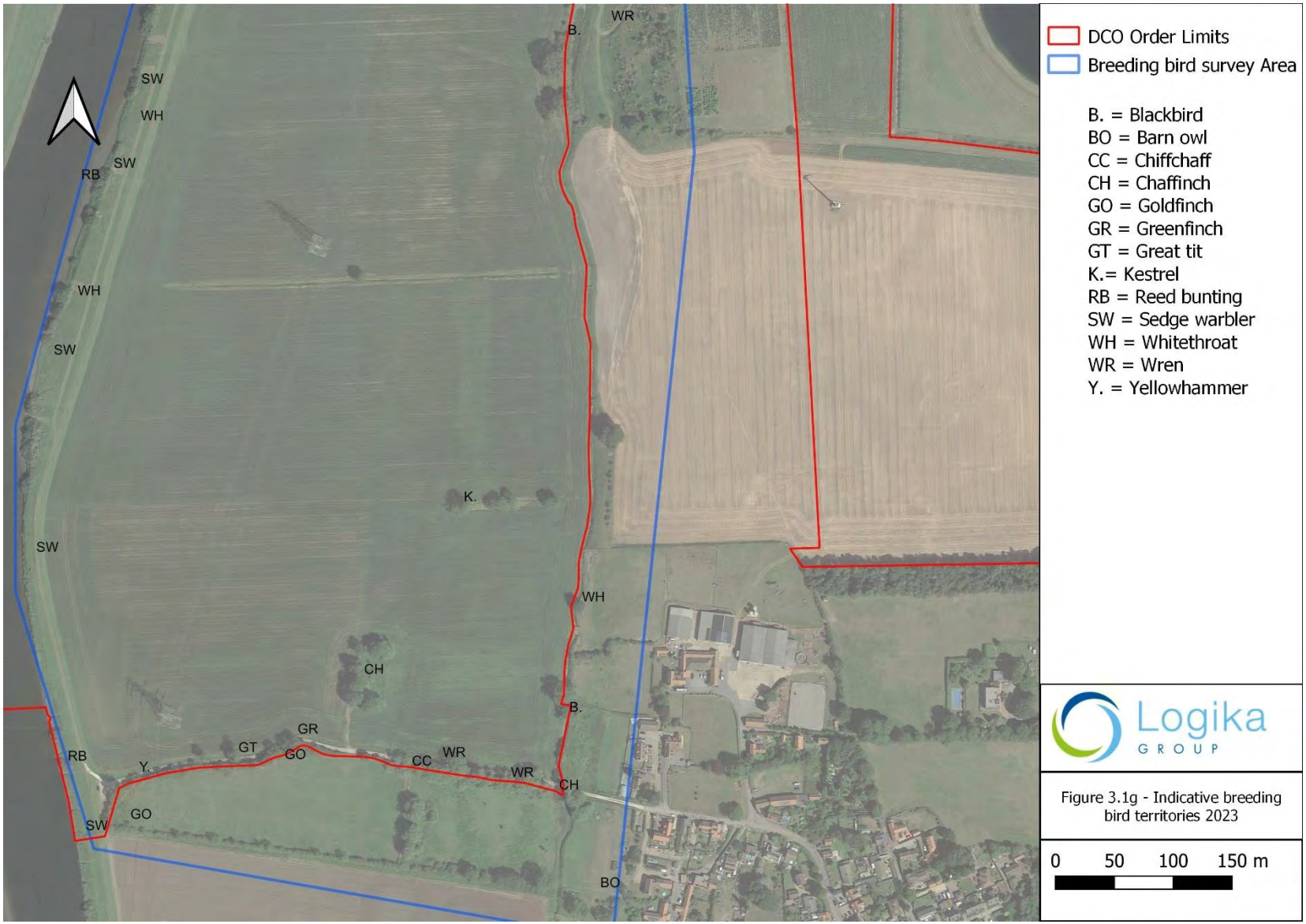

DCO Order Limits
Breeding bird survey Area
B. = Blackbird
CH = Chaffinch
D. = Dunnock
R. = Robin
RB = Reed bunting
S. = Skylark
SD = Stock dove
WR = Wren
Y. = Yellowhammer
YW = Yellow wagtail
Logika GROUP
Figure 3.1b - Indicative breeding bird territories 2023
0 50 100 m

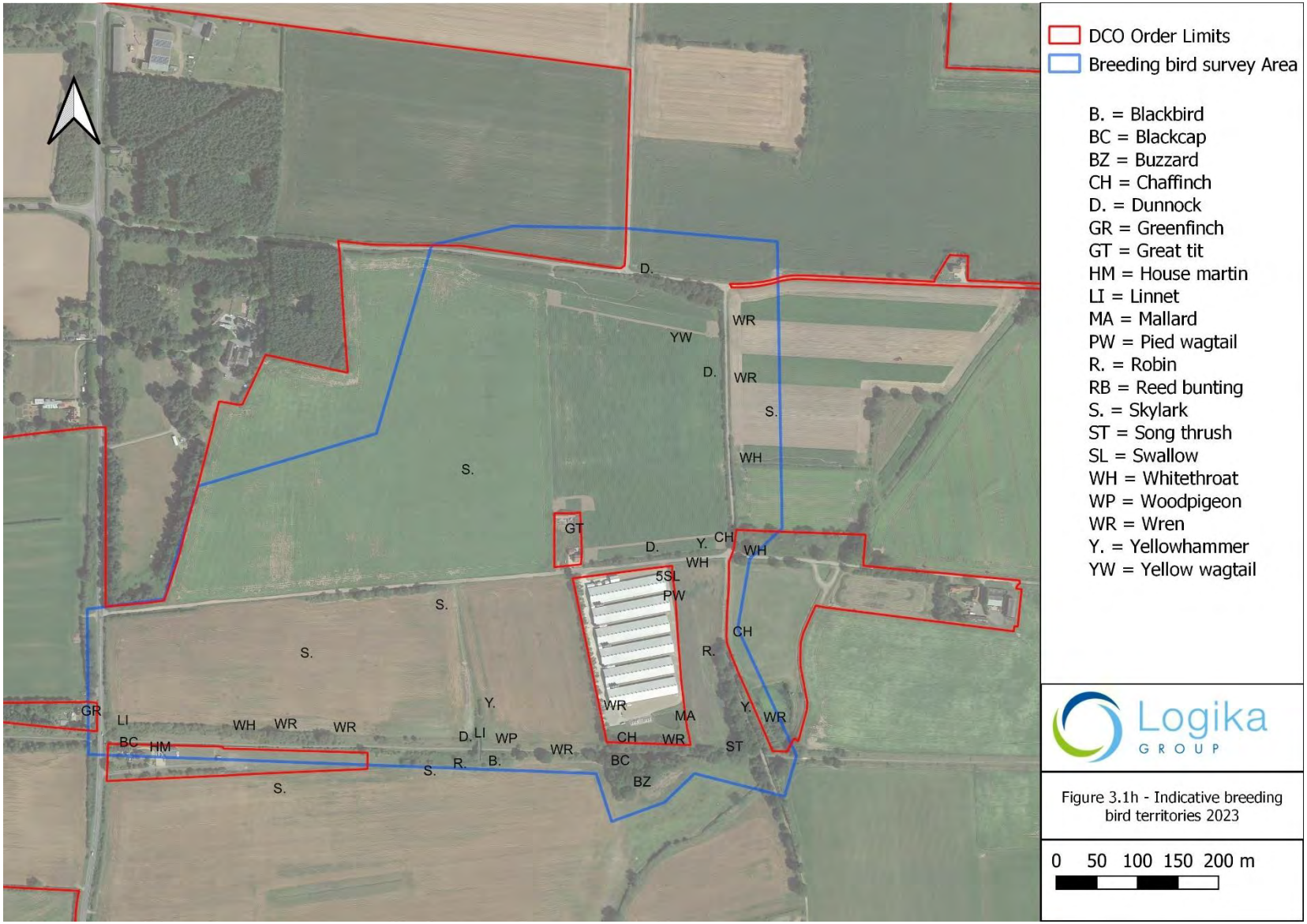

DCO Order Limits
Breeding bird survey Area
B. = Blackbird
CH = Chaffinch
D. = Dunnock
HS = House sparrow
LW = Lesser whitethroat
PW= Pied wagtail
Q.= Quail
RB = Reed bunting
S. = Skylark
SD = Stock dove
WH = Whitethroat
WP = Woodpigeon
WR = Wren
Y. = Yellowhammer
Logika GROUP
Figure 3.1c - Indicative breeding bird territories 2023
0 50 100 150 200 m

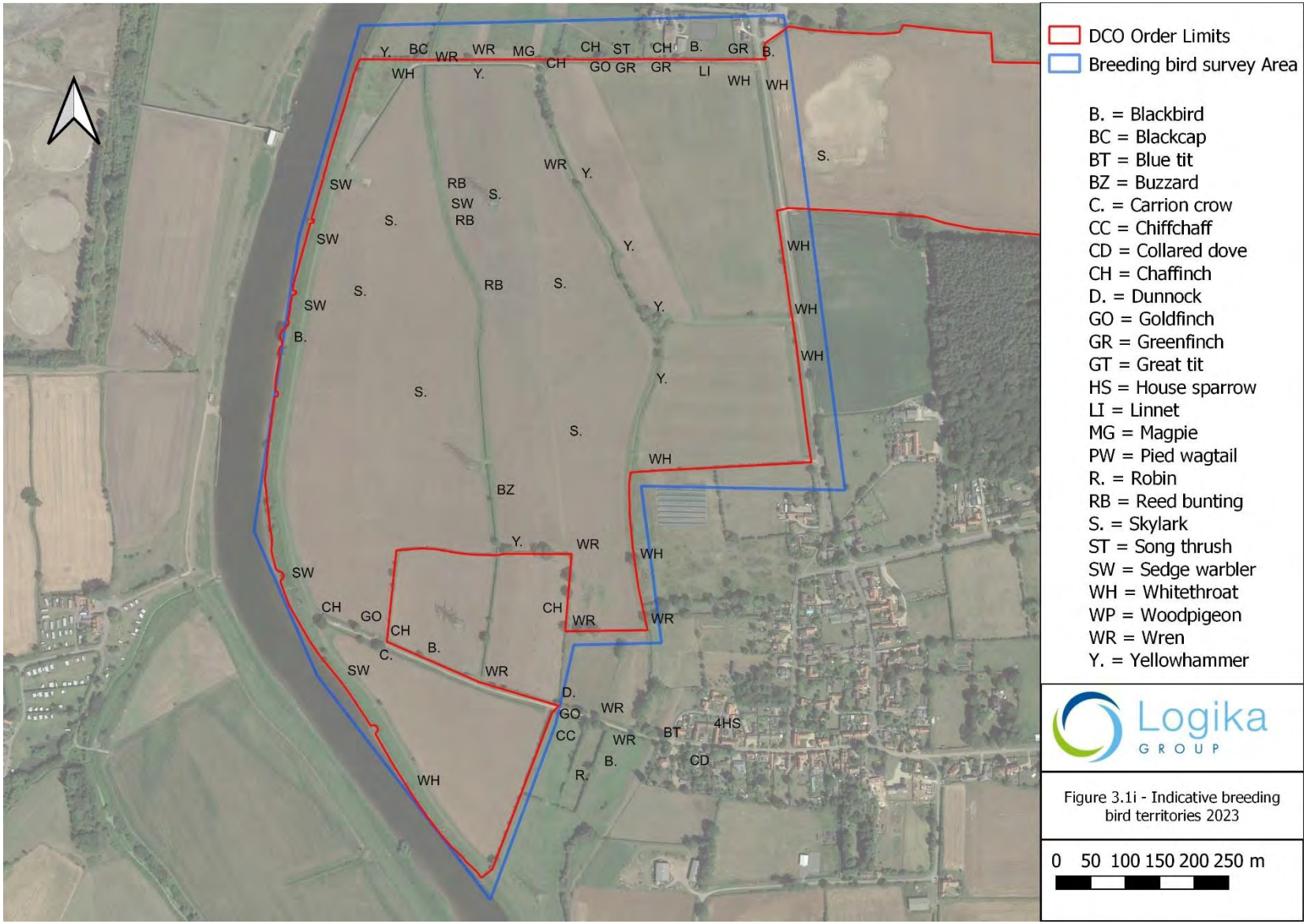

DCO Order Limits
Breeding bird survey Area
B. = Blackbird
CH = Chaffinch
D. = Dunnock
HM = House martin
LI = Linnet
MA= Mallard
P.= Grey partridge
RB = Reed bunting
S. = Skylark
SL = Swallow
WH = Whitethroat
WP = Woodpigeon
WR = Wren
YW = Yellow wagtail
Logika GROUP
Figure 3.1d - Indicative breeding bird territories 2023
0 50 100 150 200 m
2HM
SL
CH
WP
RB
LI
P.
YW
WH
WR
D.
B.
MA

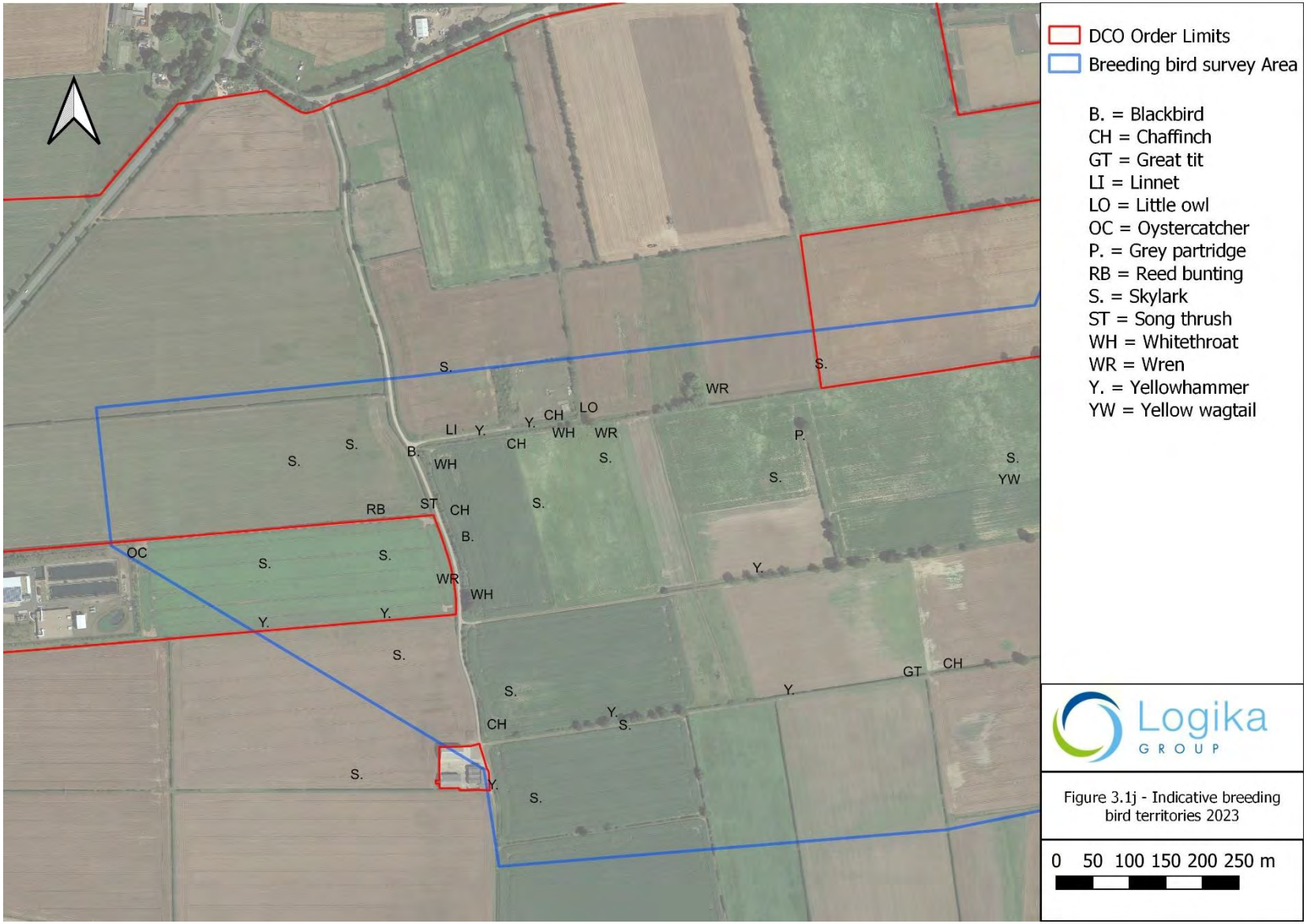

DCO Order Limits
Breeding bird survey Area
B. = Blackbird
BT = Blue tit
CH = Chaffinch
D. = Dunnock
LI = Linnet
MA= Mallard
P.= Grey partridge
RB = Reed bunting
S. = Skylark
WH = Whitethroat
WR = Wren
YW = Yellow wagtail
Logika GROUP
Figure 3.1e - Indicative breeding bird territories 2023
0 50 100 150 m

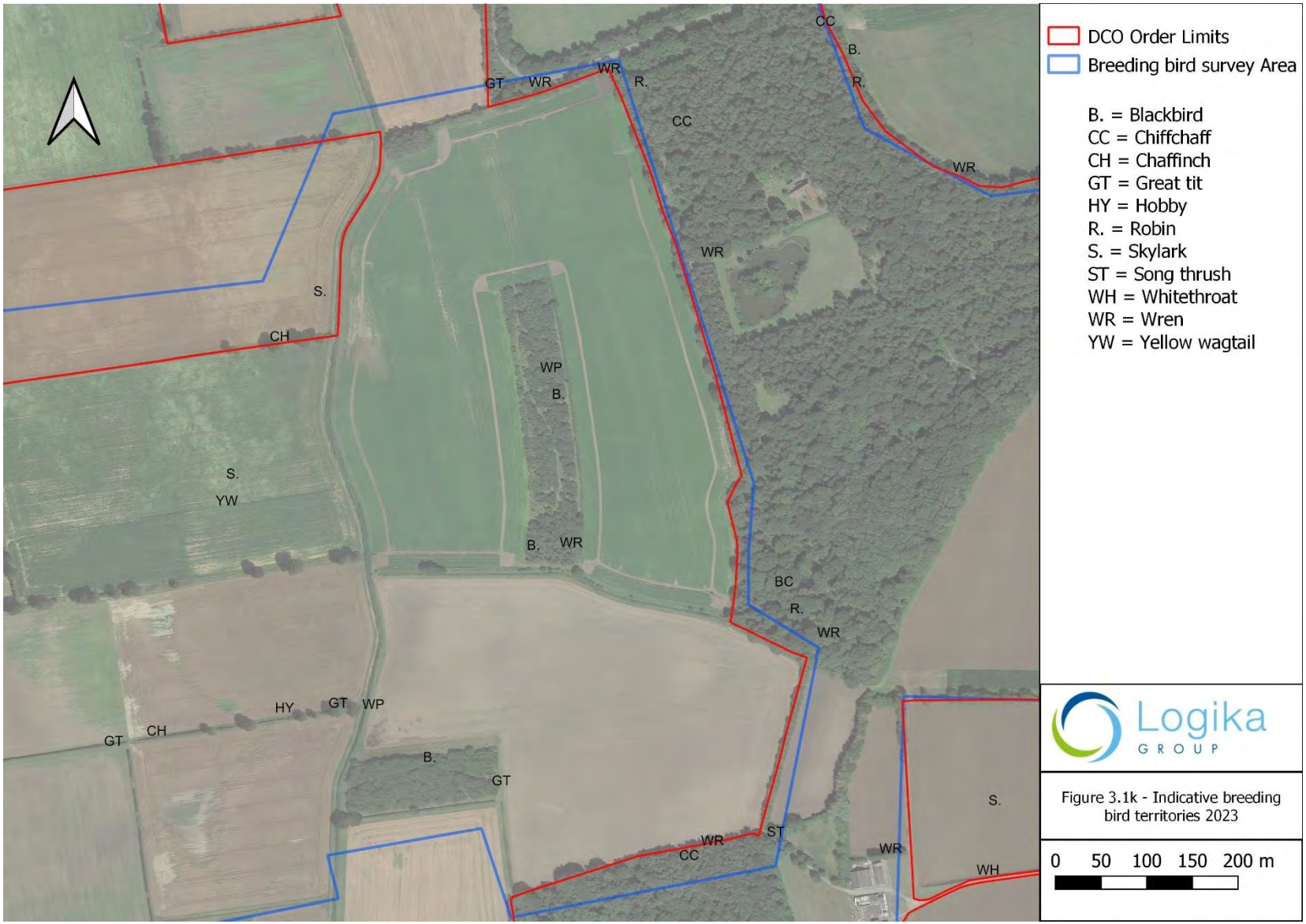

DCO Order Limits
Breeding bird survey Area
B. = Blackbird
BC = Blackcap
BZ = Buzzard
C. = Carrion crow
CC = Chiffchaff
CH = Chaffinch
GT = Great tit
MA = Mallard
OC = Oystercatcher
R. = Robin
RB = Reed bunting
S. = Skylark
ST = Song thrush
SW = Sedge warbler
WH = Whitethroat
WP = Woodpigeon
WR = Wren
Y. = Yellowhammer
Logika GROUP
Figure 3.1f - Indicative breeding bird territories 2023
0 50 100 150 200 250 m

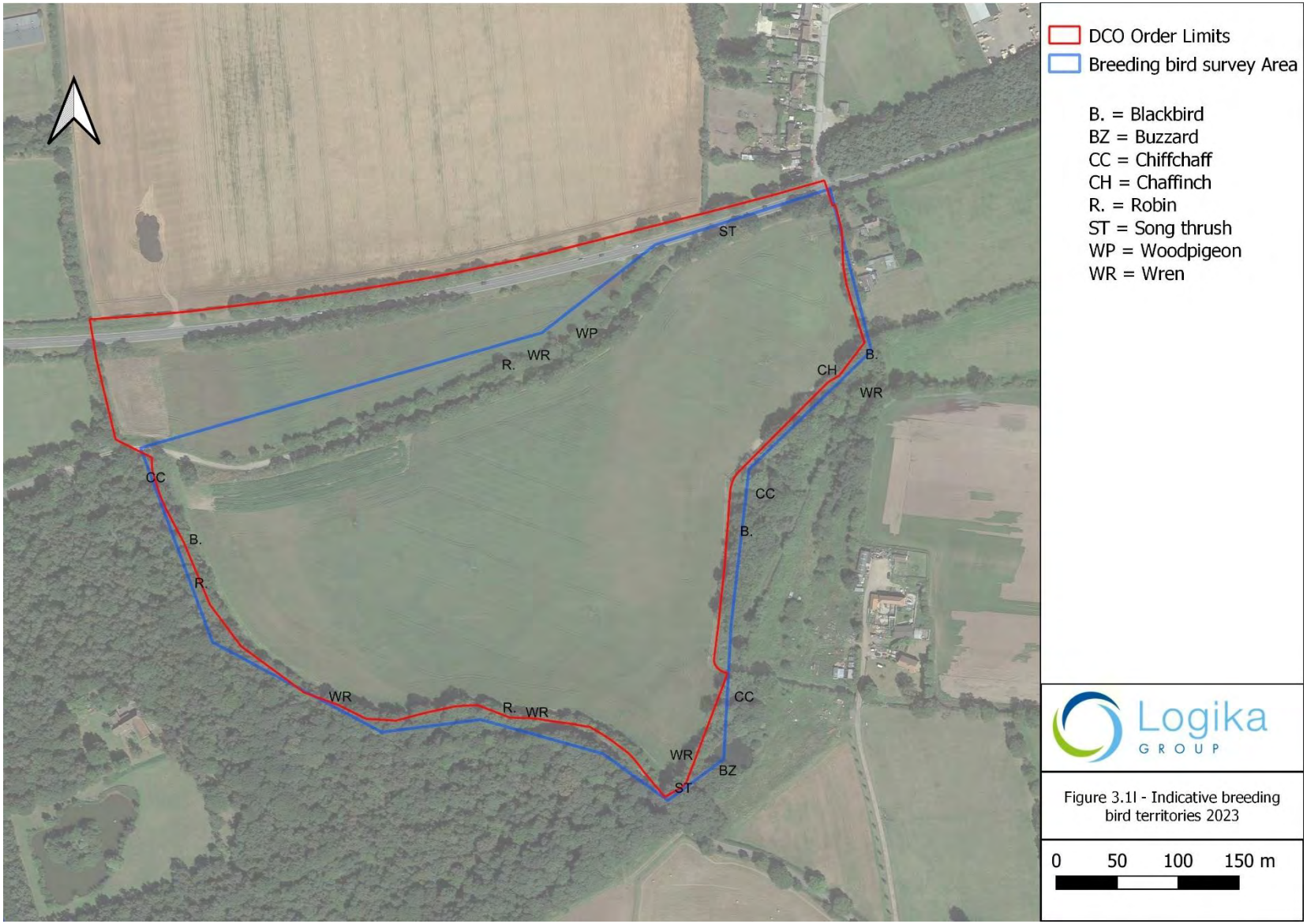

B.
WR
SW
WH
SW
RB
WH
SW
SW
K.
WH
CH
B.
GR
GT
GO
WR
CC
WR
CH
RB
Y.
SW
GO
BO
DCO Order Limits
Breeding bird survey Area
B. = Blackbird
BO = Barn owl
CC = Chiffchaff
CH = Chaffinch
GO = Goldfinch
GR = Greenfinch
GT = Great tit
K.= Kestrel
RB = Reed bunting
SW = Sedge warbler
WH = Whitethroat
WR = Wren
Y. = Yellowhammer
Logika GROUP
Figure 3.1g - Indicative breeding bird territories 2023
0 50 100 150 m

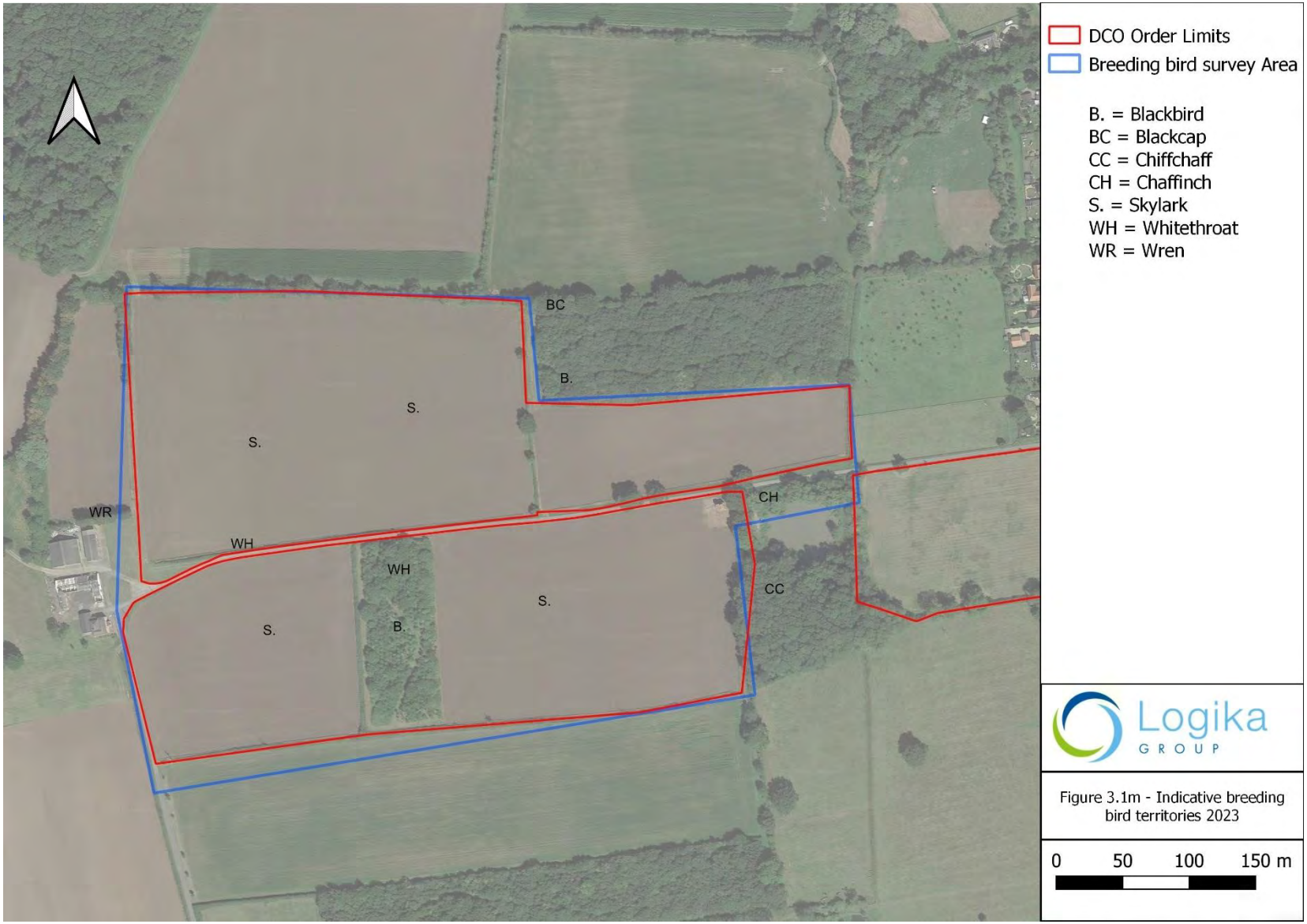

DCO Order Limits
Breeding bird survey Area
B. = Blackbird
BC = Blackcap
BZ = Buzzard
CH = Chaffinch
D. = Dunnock
GR = Greenfinch
GT = Great tit
HM = House martin
LI = Linnet
MA = Mallard
PW = Pied wagtail
R. = Robin
RB = Reed bunting
S. = Skylark
ST = Song thrush
SL = Swallow
WH = Whitethroat
WP = Woodpigeon
WR = Wren
Y. = Yellowhammer
YW = Yellow wagtail
Logika GROUP
Figure 3.1h - Indicative breeding bird territories 2023
0 50 100 150 200 m


DCO Order Limits
Breeding bird survey Area
B. = Blackbird
BC = Blackcap
BT = Blue tit
BZ = Buzzard
C. = Carrion crow
CC = Chiffchaff
CD = Collared dove
CH = Chaffinch
D. = Dunnock
GO = Goldfinch
GR = Greenfinch
GT = Great tit
HS = House sparrow
LI = Linnet
MG = Magpie
PW = Pied wagtail
R. = Robin
RB = Reed bunting
S. = Skylark
ST = Song thrush
SW = Sedge warbler
WH = Whitethroat
WP = Woodpigeon
WR = Wren
Y. = Yellowhammer
Logika GROUP
Figure 3.1i - Indicative breeding bird territories 2023
0 50 100 150 200 250 m


DCO Order Limits
Breeding bird survey Area
B. = Blackbird
CH = Chaffinch
GT = Great tit
LI = Linnet
LO = Little owl
OC = Oystercatcher
P. = Grey partridge
RB = Reed bunting
S. = Skylark
ST = Song thrush
WH = Whitethroat
WR = Wren
Y. = Yellowhammer
YW = Yellow wagtail
Logika GROUP
Figure 3.1j - Indicative breeding bird territories 2023
0 50 100 150 200 250 m


DCO Order Limits
Breeding bird survey Area
B. = Blackbird
CC = Chiffchaff
CH = Chaffinch
GT = Great tit
HY = Hobby
R. = Robin
S. = Skylark
ST = Song thrush
WH = Whitethroat
WR = Wren
YW = Yellow wagtail
Logika GROUP
Figure 3.1k - Indicative breeding bird territories 2023
0 50 100 150 200 m


DCO Order Limits
Breeding bird survey Area
B. = Blackbird
BZ = Buzzard
CC = Chiffchaff
CH = Chaffinch
R. = Robin
ST = Song thrush
WP = Woodpigeon
WR = Wren
ST
WP
WR
R.
B.
CH
WR
CC
B.
CC
B.
R.
WR
R.
WR
CC
WR
BZ
ST
Logika GROUP
Figure 3.1l - Indicative breeding bird territories 2023
0
50
100
150 m


DCO Order Limits
Breeding bird survey Area
B. = Blackbird
BC = Blackcap
CC = Chiffchaff
CH = Chaffinch
S. = Skylark
WH = Whitethroat
WR = Wren
BC
B.
S.
S.
WR
WH
WH
S.
S.
B.
CH
CC
Logika GROUP
Figure 3.1m - Indicative breeding bird territories 2023
0 50 100 150 m

Full species records

Table B-1 – Complete list of species recorded during breeding bird surveys.

Species	Scientific name
Barn owl	*Tyto alba*
Blackbird	*Turdus merula*
Blackcap	*Sylvia atricapilla*
Black-headed gull	*Chroicocephalus ridibundus*
Blue tit	*Cyanistes caeruleus*
Bullfinch	*Pyrrhula pyrrhula*
Buzzard	*Buteo buteo*
Canada goose	*Branta candensis*
Carrion crow	*Corvus corone*
Cetti's warbler	*Cettia cetti cetti*
Chaffinch	*Fringilla coelebs*
Chiffchaff	*Phylloscopus collybita*
Coal tit	*Periparus ater*
Collared dove	*Streptopelia decaocto*
Common tern	*Sterna hirundo*
Coot	*Fulica atra*
Cormorant	*Phalacrocorax carbo*
Corn bunting	*Emberiza calandra*
Cuckoo	*Cuculus canorus*
Dunnock	*Prunella modularis*
Goldcrest	*Regulus regulus*
Goldfinch	*Carduelis carduelis*

Species	Scientific name
Great spotted woodpecker	*Dendrocopos major*
Great tit	*Parus major*
Greenfinch	*Chloris chloris*
Green woodpecker	*Picus viridis*
Grey heron	*Ardea cinerea*
Greylag goose	*Anser anser*
Grey partridge	*Perdix perdix*
Grey wagtail	*Motacilla cinerea*
Herring gull	*Larus argentatus*
Hobby	*Falco subbuteo*
House martin	*Delichon urbicum*
House sparrow	*Passer domesticus*
Jackdaw	*Corvus monedula*
Jay	*Garrulus glandarius*
Kestrel	*Falco tinnunclus*
Lapwing	*Vanellus vanellus*
Lesser black-backed gull	*Larus fuscus*
Lesser whitethroat	*Curruca curruca*
Linnet	*Carduelis cannabina*
Little egret	*Egretta garzetta*
Little owl	*Athene noctua*
Magpie	*Pica pica*
Mallard	*Anas platyrhynchos*
Mandarin	*Aix galericulata*
Meadow pipit	*Anthus pratensis*
Mistle thrush	*Turdus viscivorus*
Moorhen	*Gallinula chloropus*

Species	Scientific name
Mute swan	*Cygnus olor*
Oystercatcher	*Haematopus ostralegus*
Peregrine	*Falco peregrinus*
Pheasant	*Phasianus colchicus*
Pied wagtail	*Motacilla alba yarrellii*
Quail	*Coturnix coturnix*
Red-legged partridge	*Alectoris rufa*
Reed bunting	*Emberiza schoeniclus*
Reeves pheasant	*Syrmaticus reevesii*
Robin	*Erithacus rubecula*
Rook	*Corvus frugilegus*
Sand martin	*Riparia riparia*
Sedge warbler	*Acrocephalus schoenobaenus*
Skylark	*Alauda arvensis*
Song thrush	*Turdus philomelos*
Sparrowhawk	*Accipiter nisus*
Starling	*Sturnus vulgaris*
Stock dove	*Columba oenas*
Swallow	*Hirundo rustica*
Swift	*Apus apus*
Tawny owl	*Strix aluco*
Treecreeper	*Certhia familiaris*
Turtle dove	*Streptopelia turtur*
Whitethroat	*Curruca communis*
Willow warbler	*Phylloscopus trochilus*
Woodpigeon	*Columba palumbus*
Wren	*Troglodytes troglodytes*

Species	Scientific name
Yellowhammer	*Emberiza citrinella*
Yellow wagtail	*Motacilla flava flavissima*

Annex B. – Full survey details

Full survey details of the breeding bird surveys are shown below in **Table C.1.**

Table C-1 Full survey details of breeding bird surveys.

Date	Visit number	Survey Area	Start time	End time	Weather conditions
10/05/2023	1	1,2	06:00	11:15	6/8 Oktas cloud, Beaufort 0 west-northwest, visibility > 3km, precipitation: none, 9°C
11/05/2023	1	2,3	06:00	10:45	5/8 Oktas cloud, Beaufort 2-3 north-west, visibility > 3km, precipitation: none, 9°C
18/05/2023	1	4,5	05:45	10:10	8/8 Oktas cloud, Beaufort 0 southwest, visibility > 3km, precipitation: none, 10°C
19/05/2023	1	5	05:50	09:20	1/8 Oktas cloud, Beaufort 2 west-south-west, visibility > 3km, precipitation: none, 14°C
24/05/2023	2	1			

Date	Visit number	Survey Area	Start time	End time	Weather conditions
24/05/2023	2	1	05:50	7:10	4/8 Oktas cloud, Beaufort 1 north-west, visibility > 3km, precipitation: none, 17°C
25/05/2023	2	2	05:50	09:45	0/8 Oktas cloud, Beaufort 0 north-west, visibility > 3km, precipitation: none, 11°C
01/06/2023	2	4	05:45	09:40	3/8 Oktas cloud, Beaufort 1 north-north-east, visibility > 3km, precipitation: none, 11°C
02/06/2023	2	5	05:45	09:40	1/8 Oktas cloud, Beaufort 1 north-west, visibility > 3km, precipitation: none, 13°C
14/06/2023	3	1,2	05:30	12:00	0/8 Oktas cloud, Beaufort 2 north-east, visibility > 3km, precipitation: none, 22°C
15/06/2023	3	3	06:15	08:20	5/8 Oktas cloud, Beaufort 2 north-east, visibility > 3km, precipitation: none, 12°C
21/06/2023	3	4	06:00	09:10	0/8 Oktas cloud, Beaufort 1 south-west, visibility > 3km, precipitation: none, 18°C

Date	Visit number	Survey Area	Start time	End time	Weather conditions
22/06/2023	3	5	06:00	09:30	5/8 Oktas cloud, Beaufort 1 south-west, visibility > 3km, precipitation: none, 19°C
28/06/2023	4	1,2	06:15	14:45	7/8 Oktas cloud, Beaufort 1 west, visibility 500m-1km, precipitation: none, 20°C
29/06/2023	4	4	06:00	10:20	5/8 Oktas cloud, Beaufort 1 north, visibility > 3km, precipitation: none, 15°C
30/06/2023	4	5	05:45	12:45	8/8 Oktas cloud, Beaufort 0, visibility 500m-3km, precipitation: light rain, 15°C
01/07/2023	4	3	05:45	08:55	6/8 Oktas cloud, Beaufort 1 north-north-west, visibility 500m-3km, precipitation: none, 16°C
06/07/2023	5	1,2	06:25	13:55	4/8 Oktas cloud, Beaufort 2 south, visibility > 3km, precipitation: none, 15°C
07/07/2023	5	3	07:25	10:40	0/8 Oktas cloud, Beaufort 0, visibility > 3km, precipitation: none, 17°C

Date	Visit number	Survey Area	Start time	End time	Weather conditions
11/07/2023	5	4	6:10	10:40	8/8 Oktas cloud, Beaufort 2 north-west, visibility 500m-3km, precipitation: light drizzle, 17°C
12/07/2023	5	5	05:15	11:45	4/8 Oktas cloud, Beaufort 1 north, visibility 500m- 3km, precipitation: none, 15°C
17/07/2023	6	1,2	06:15	13:30	8/8 Oktas cloud, Beaufort 1 south, visibility 500m-3km, precipitation: heavy rain, 15°C
18/07/2023	6	4	10:05	11:50	8/8 Oktas cloud, Beaufort 0, visibility 500m-3km, precipitation: light rain, 15°C
19/07/2023	6	3	05:40	08:55	8/8 Oktas cloud, Beaufort 0, visibility <500m, precipitation: light drizzle, 14°C
20/07/2023	6	5	05:30	11:25	5/8 Oktas cloud, Beaufort 1 south, visibility 500m-3km, precipitation: none, 12°C

Annex C. Territory Mapping Criteria

Territory mapping criteria has been taken from Amar *et al*. (2006). This paper adapted the original methodologies of Marchant, (1983) and Gilbert *et al*. (1998) to focus on how to attribute territories using fewer visits than the original methodology dictates. The paper attributes indicative territory locations based on four CBC visits, whereas during the fieldwork for this project six survey visits were undertaken in order to provide a more robust assessment:

At the end of the fieldwork all the registrations were transferred to 'species maps' on which the letter of the visit (A,B,C,D,E,F) was substituted for the species symbol, the registrations were plotted in exactly the same locations, and using exactly the same activity codes, as those on the original visit maps. The information on these maps was then used to make an assessment of numbers of breeding birds.

In view of the reduction of the number of visits from eight to 10 to six, modified criteria were used for analysing the census maps. The following principles were used to define territory clusters on the species maps:

1. The minimum number of visit registrations (from different visits) used to form a territory was two, although as many registrations as possible were placed into a single territory.

2. Registrations of songbirds alone and in song on two (or more) occasions could stand as a territory.

3. A lone bird alarm-calling or giving other vocalisations thought to have strong territorial significance was acceptable as a territory if there were previous or subsequent sightings within the same approximate area.

4. The presence of a nest in any state, including building, occupied, or recently (within the same season) used nest on just one visit, with no other registrations was acceptable as a territory.

5. A lone songbird not in song could not count as a territory, regardless of whether it was located toward the middle of the plot or near the edges.

6. A territory was not counted where there was just a single registration of a bird in mid-flight.

7. The presence of a family on a single visit (juvenile birds with attendant parents) was not permitted as a territory, since they may have moved into the area from outside the CBC plot. Unless it is apparent that the nest location is within the vicinity i.e. the young are 'branched' or grounded and flightless.

8. A lone pair was permitted as a territory, provided that the birds were not in mid-flight. In instances involving pairs of birds in flight, territories were only permitted when the pair was recorded taking off from a fixed point, e.g., a tree or the ground (but excluded when they had been seen in mid-flight). Such registrations were acceptable even if the sex of the individuals was not known, because this would follow the rationale already widely used and accepted in CBC territory analysis.

9. For species that are semi-colonial, or occur in large groups where it may be hard to define separate individual territories (e.g., house sparrow) the numbers of birds per visit were added up. The maximum count was then divided by two to give the number of territories.

All territories falling at least partly inside the survey area were included in the totals, even if some of the registrations forming the territory cluster fell outside the survey area boundaries.

Appendix 7-5: Great-Crested Newt Baseline

Report

One Earth Solar Farm

Appendix 7-5: Great Crested Newt Survey Report Template

For One Earth Solar Farm Ltd

17 May 2024

Document control

Project Title:	One Earth Solar Farm
Project Number:	14529A
Client:	One Earth Solar Farm Ltd
Document Title:	Appendix 7-5: Great Crested Newt Survey Report Template
Document Number:	14529A
Prepared By:	[redacted]
[redacted]	[redacted]

Revision History

01	16/05/2024

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1 Introduction

1.1 Background

1.2 This Appendix should be read in conjunction with Chapter 7 of the Environmental Information Report (PEIR) which is provided in support of the delivery of an Environmental Impact Assessment (EIA) associated with the One Earth Solar Farm, hereafter referred to as the 'Site'.

1.3 Purpose of this Appendix

1.3.1 This Appendix outlines the methodologies used and summarises the results of the GCN environmental DNA (eDNA) surveys conducted in 2023.

1.3.2 This report does not allude to any requirements for mitigation and/or compensation in respect of GCN, nor does it assess the potential impacts that proposals might have upon the species, as both issues will be covered in detail as part of an ES.

1.4 Structure of this Appendix

1.4.1 The remainder of this Appendix is structured as follows:

- **Section** Error! Reference source not found.**: Methods**
- **Section 0: Results**
- **Section 4: Summary**
- **Section 5: References**
- **Annex A: Details of ponds**
- **Annex B: SureScreen Scientifics GCN eDNA reports**

2 Methodology

2.1 Desk Study

2.1.1 A desk study was undertaken to identify waterbodies withing 250m of the Site using satellite imagery and Multi-Agency Geographic Information for the Countryside (MAGIC) website (an internet-based Geographic Information Systems database provided by the Department for Environment, Foods and Rural Affairs (DEFRA) (Defra, 2024)).

2.1.2 An environmental desk study was undertaken in September 2023 to identify records of GCN within 2km of the Site boundary, from Greater Lincolnshire Nature Partnership (GLNP) and Nottinghamshire Biological and Geological Records Centre (NBGRC) and for English Protected Species Licences (EPSL) from using MAGIC.

2.2 eDNA Sampling

2.2.1 All accessible waterbodies, containing water at the time of visit were surveyed to confirm the presence / likely absence of GCN using eDNA sampling techniques, following methods as set out in Biggs et al., (2014). This method requires one sampling visit by GCN licenced surveyors between 15 April and 30 June inclusive.

2.2.2 The samples were collected on 19th June 2023 by Alexandra Jackson MZool (Hons) (licence ref: 2021-54952-CLS-CLS) and Kelly Jones MSc MCIEEM (licence ref: 2015-18053-CLS-CLS).

2.2.3 All samples collected were sent to a Natural England accredited laboratory[1] for analysis. **Figure 2-1** shows all waterbodies that were surveyed using eDNA sampling.

2.3 Limitations

2.3.1 Not all waterbodies within 250m were surveyed, with only 10 out of 40 being subject to the eDNA sampling. Due to the majority of the ponds within 250m being on private land, only ponds on-Site or adjacent to the Site, were included to be surveyed. This originally identified 17 waterbodies, however due to the following, an additional seven could not be surveyed:

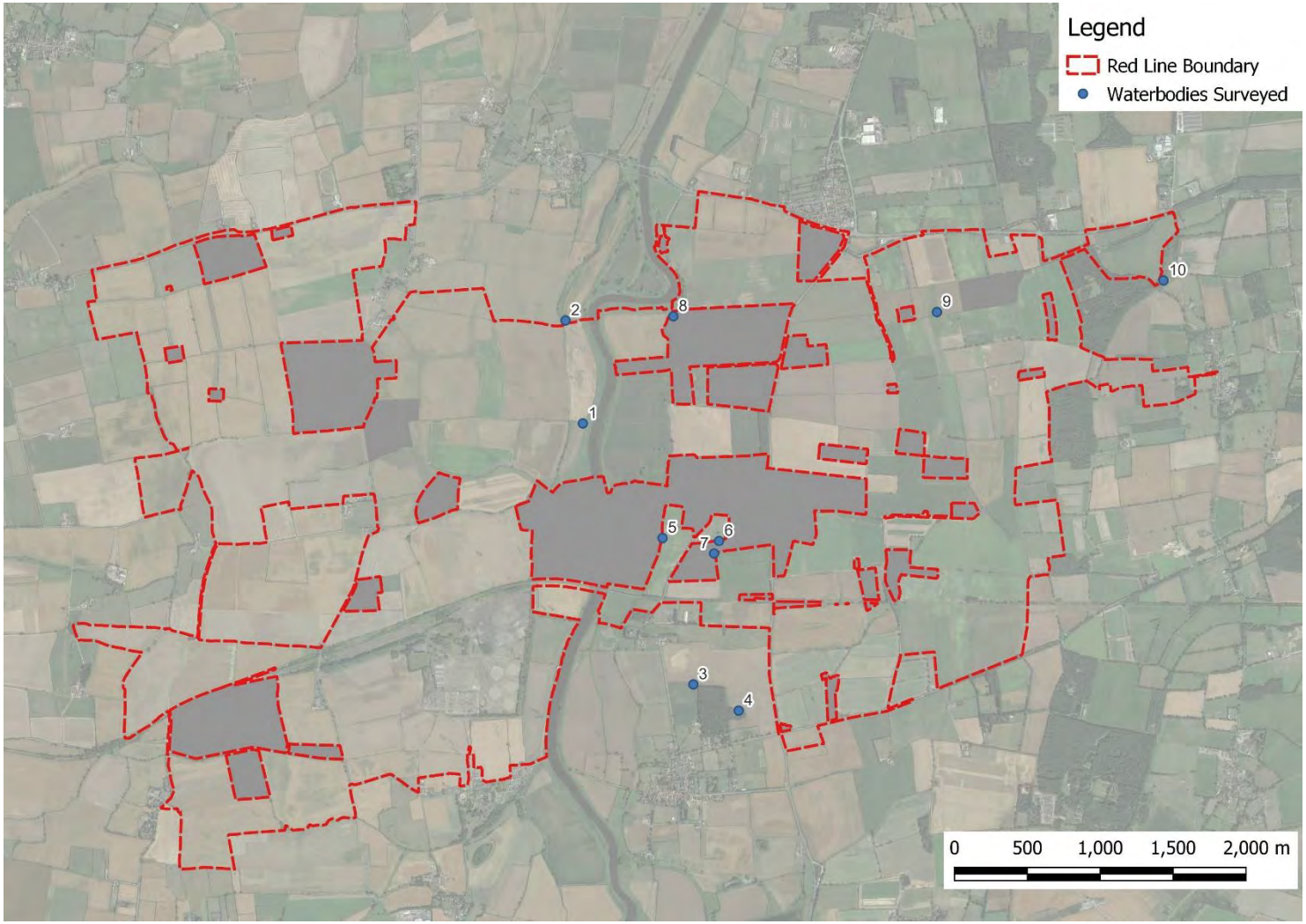
- Two ponds could not be accessed due to dense vegetation and/or steep, unsafe banks.
- One pond was dry at the time of the survey.
- Four ponds were on private land and were not surveyed.

2.3.2 Due to the red line boundary for the Site expanding, five ponds were only identified close to the boundary. As this was outside of the eDNA survey season, they were not surveyed.

2.3.3 Details of these ponds are within **Annex A.**

[1] Nature Metrics, DNA-Based Monitoring and Surescreen Scientific Ltd.

Figure 2-1: Locations of waterbodies surveyed on 19th June 2023



3 Results

3.1 Desk study

3.1.1 Satellite imagery showed that there were 40 waterbodies within 250m of the Site. Due to the size of the Site, only publicly accessible waterbodies on-Site or adjacent to the Site's boundary were included within the GCN eDNA survey. Details of these ponds are within **Annex A.**

3.1.2 The Lincolnshire data search returned a single record of great crested newts (GCN), recorded at 1.82km north-west of the Site boundary in 2014. The data search also returned a single GCN historic record at 1.49 km north to the Site boundary, recorded in 1997.

3.1.3 The Nottinghamshire data search only historic records from 1977 to 2010, which come from an area adjacent to the Site boundary in the east, near Thorney. In 2006, it was recorded that GCN were present within pond 11.

3.1.4 The MAGIC search identified no GCN European Protected Species Licence (EPSL) within 2 km of the Site.

3.2 eDNA Sampling

3.2.1 All 10 ponds surveyed came back with a negative eDNA result from the laboratory. Full results are shown within **Annex B**.

4 Summary

4.1.1 There are a total of four waterbodies on-Site, with a further 36 waterbodies within 250m.

4.1.2 Due to the large size of the Site, only publicly accessible ponds on-Site or adjacent to the Site boundary were included in the eDNA water sampling. Out of the 17 ponds to be surveyed, only 10 had water samples taken due to one pond being dry and access restrictions for the remaining six.

4.1.3 All 10 ponds surveyed came back with a negative GCN eDNA result.

5 References

Biggs J, Ewald N, Valentini A, Gaboriaud C, Griffiths RA, Foster J, Wilkinson J, Arnett A, Williams P and Dunn F (2014). Analytical and methodological development for improved surveillance of the Great Crested Newt. Appendix 5. Technical advice note for field and laboratory sampling of great crested newt (Triturus cristatus) environmental DNA. Freshwater Habitats Trust, Oxford.

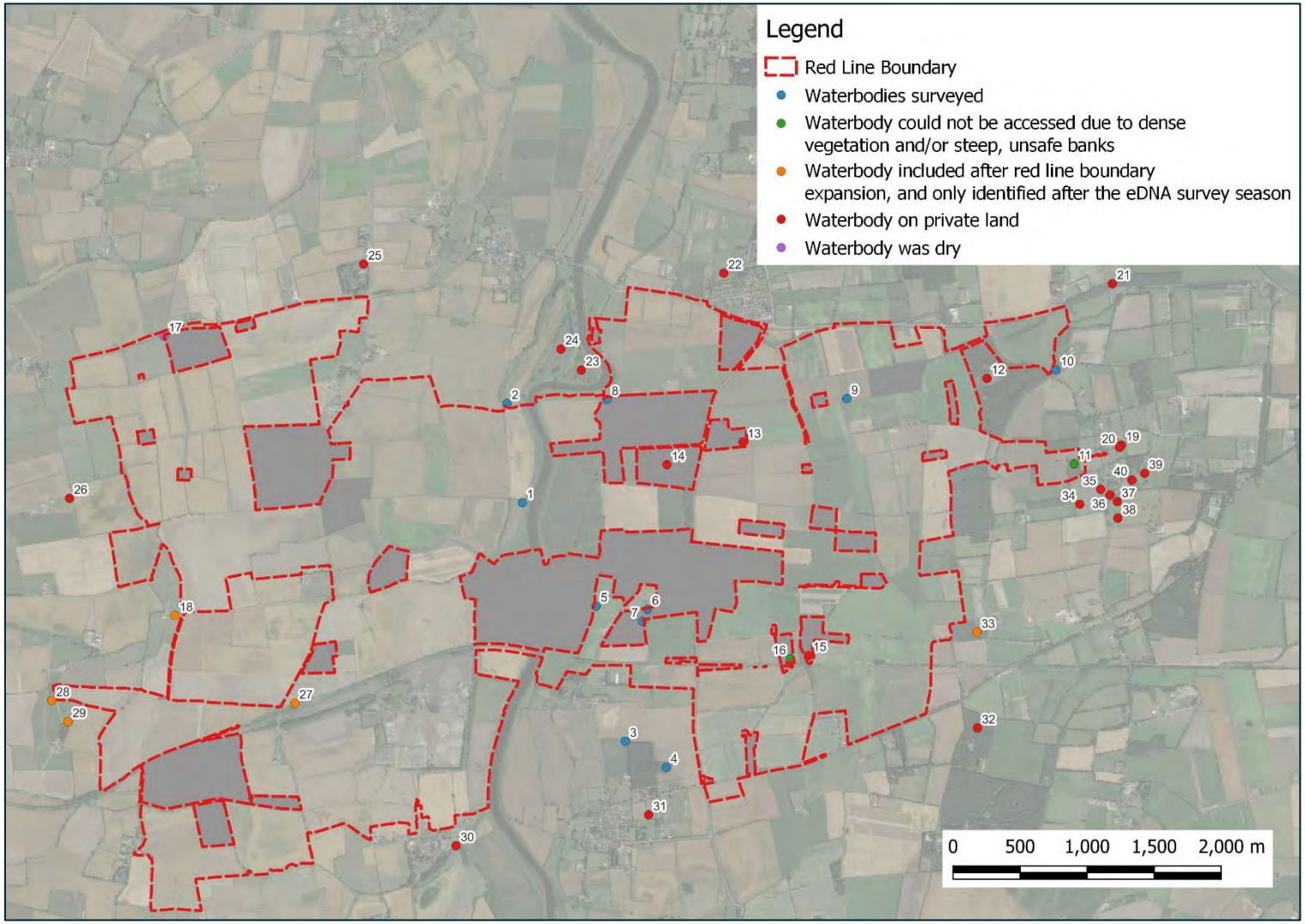
Department for Environment, Food and Rural Affairs (Defra), (n.d.). Multi Agency Geographic Information for the Countryside. [Online] Available at: https://magic.defra.gov.uk/home.htm.

A1 Annex A – Waterbody Details

Table 5-1: Details of waterbodies on-Site and within 250m.

Waterbody ID	Surveyed	Reasons for not surveying
1-10	✓	-
11	×	Dense vegetation so could not access pond.
12, 13, and 16	×	No access as located on private land.
14	×	No access as located on private land. This waterbody is also a reservoir which is unsuitable to support GCN.
15	×	Could not access due to steep banks and dense vegetation.
17	×	Was dry at time of survey.
18, 27, 28, 29 and 33.	×	Red line boundary for the Site expanded and ponds identified outside of the eDNA survey season.
19-26, 30-32 and 34-40	×	No access due to being on private land.

Figure A-5-1: Waterbody details



A2 SureScreen Scientifics GCN eDNA Reports

SureScreen Scientifics

Folio No: E18306
Report No: 1
Purchase Order: LCL2021
Client: Logika
Contact: Alex Jackson

TECHNICAL REPORT

ANALYSIS OF ENVIRONMENTAL DNA IN POND WATER FOR THE DETECTION OF GREAT CRESTED NEWTS (TRITURUS CRISTATUS)

SUMMARY

When great crested newts (GCN), *Triturus cristatus*, inhabit a pond, they continuously release small amounts of their DNA into the environment. By collecting and analysing water samples, we can detect these small traces of environmental DNA (eDNA) to confirm GCN habitation or establish GCN absence.

RESULTS

Date sample received at Laboratory: 26/06/2023
Date Reported: 04/07/2023
Matters Affecting Results: None

Lab Sample No.	Site Name	O/S Reference	SIC	DC	IC	Result	Positive Replicates
5806	Pond 9, One Earth Solar	SK 83954 73461	Pass	Pass	Pass	Negative	0
5807	Pond 8, One Earth Solar	SK 82146 73432	Pass	Pass	Pass	Negative	0
5810	Pond 10, One Earth Solar	SK 85304 73683	Pass	Pass	Pass	Negative	0
5812	Pond 6, One Earth Solar	SK 82459 71891	Pass	Pass	Pass	Negative	0
5813	Pond 7, One Earth Solar	SK 82425 71805	Pass	Pass	Pass	Negative	0
5815	Pond 5, One Earth Solar	SK 82072 71911	Pass	Pass	Pass	Negative	0
5814	Pond 3, One Earth Solar	SK 82283 70907	Pass	Pass	Pass	Negative	0

Forensic Scientists and Consultant Engineers
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Company Registration No. 08950940

Page 2 of

5816	Pond 2, One Earth Solar	SK 81406 73403	Pass	Pass	Pass	Negative	0
5817	Pond 4, One Earth Solar	SK 82594 70727	Pass	Pass	Pass	Negative	0
5818	Pond 1, One Earth Solar	SK 81525 72697	Pass	Pass	Pass	Negative	0

If you have any questions regarding results, please contact us: ForensicEcology@surescreen.com

Reported by: Chris Troth **Approved by:** Chris Troth

METHODOLOGY

The samples detailed above have been analysed for the presence of GCN eDNA following the protocol stated in DEFRA WC1067 'Analytical and methodological development for improved surveillance of the Great Crested Newt, Appendix 5.' (Biggs et al. 2014). Each of the 6 sub-sample tubes are first centrifuged and pooled together into a single sample which then undergoes DNA extraction. The extracted sample is then analysed using real time PCR (qPCR), which uses species-specific molecular markers to amplify GCN DNA within a sample. These markers are unique to GCN DNA, meaning that there should be no detection of closely related species.

If GCN DNA is present, the DNA is amplified up to a detectable level, resulting in positive species detection. If GCN DNA is not present then amplification does not occur, and a negative result is recorded.

Analysis of eDNA requires scrupulous attention to detail to prevent risk of contamination. True positive controls, negative controls and spiked synthetic DNA are included in every analysis and these have to be correct before any result is declared and reported. Stages of the DNA analysis are also conducted in different buildings at our premises for added security.

SureScreen Scientifics Ltd is ISO9001 accredited and participate in Natural England's proficiency testing scheme for GCN eDNA testing. We also carry out regular inter-laboratory checks on accuracy of results as part of our quality control procedures.

INTERPRETATION OF RESULTS

SIC: **Sample Integrity Check** [Pass/Fail]
When samples are received in the laboratory, they are inspected for any tube leakage, suitability of sample (not too much mud or weed etc.) and absence of any factors that could potentially lead to inconclusive results.

DC: **Degradation Check** [Pass/Fail]
Analysis of the spiked DNA marker to see if there has been degradation of the kit or sample between the date it was made to the date of analysis. Degradation of the spiked DNA marker may lead indicate a risk of false negative results.

IC: **Inhibition Check** [Pass/Fail]
The presence of inhibitors within a sample are assessed using a DNA marker. If inhibition is detected,

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samples are purified and re-analysed. Inhibitors cannot always be removed, if the inhibition check fails, the sample should be re-collected.

Result:

Presence of GCN eDNA [Positive/Negative/Inconclusive]
Positive: GCN DNA was identified within the sample, indicative of GCN presence within the sampling location at the time the sample was taken or within the recent past at the sampling location.
Positive Replicates: Number of positive qPCR replicates out of a series of 12. If one or more of these are found to be positive the pond is declared positive for GCN presence. It may be assumed that small fractions of positive analyses suggest low level presence, but this cannot currently be used for population studies. In accordance with Natural England protocol, even a score of 1/12 is declared positive. 0/12 indicates negative GCN presence.
Negative: GCN eDNA was not detected or is below the threshold detection level and the test result should be considered as evidence of GCN absence, however, does not exclude the potential for GCN presence below the limit of detection.

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Appendix 7-6: Badger and Riparian Mammal Baseline

Report

One Earth Solar Farm

Appendix 7-6: Badger and Otter and Water Vole Mammals Survey

For One Earth Solar Farm Ltd

17 May 2024

Document control

Project Title:	One Earth Solar Farm
Project Number:	14529A
Client:	One Earth Solar Farm Ltd
Document Title:	Appendix 7-6: Badger and Otter and Water Vole Mammals Survey
Document Number:	14529A
Prepared By:	[redacted]
[redacted]	[redacted]

Revision History

01	16/05/2024

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1 Introduction

1.1 Background

1.2 This Appendix should be read in conjunction with Chapter 7 of the Preliminary Environmental Information Report (PEIR) which is provided in support of the delivery of an Environmental Impact Assessment (EIA) associated with the One Earth Solar Farm, hereafter referred to as the 'Site'.

1.3 Purpose of this Appendix

1.3.1 The proposed Development Consent Order (DCO) Order Limits include, and are adjacent to, habitats with the potential to support badger *Meles meles*, and riparian mammals, otter *Lutra lutra* and water vole *Arvicola amphibius*.

1.3.2 This Appendix outlines the methodologies used for desk study and field survey, and summarises the results gathered as part of an effort to determine the presence of these species.

1.3.3 This report does not allude to any requirements for mitigation and/or compensation in respect of above species, nor does it assess the potential impacts that proposals might have, as both issues will be covered in detail as part of an ES.

1.4 Structure of this Appendix

1.4.1 This Appendix is structured as follows:

- **Section 2: Methods;**
- **Section** Error! Reference source not found.**: Results;**
- **Section 4: Summary;**
- **Section 5: References;**
- **Appendix 1: Figures**

2 Methods

2.1 Desk study

2.1.1 An environmental desk study was undertaken in September 2023 to identify records of badger, otter and water vole within 2km of the Site boundary, from Greater Lincolnshire Nature Partnership (GLNP) and Nottinghamshire Biological and Geological Records Centre (NBGRC).

2.2 Badger

2.2.1 During the extended Phase 1 habitat survey (detailed in **Appendix 7-3: Extended Phase 1 Habitat Survey report** of the PEIR of the DCO Order Limits, a habitat-based assessment was undertaken to identify the suitability for resident, commuting and foraging badgers. Concurrently, signs of badger activity were searched for in accordance with '*Surveying for Badgers: Good Practice Guidelines*' (Scottish Badgers, 2018).

2.2.2 Where badger setts were identified during the extended Phase 1 habitat survey, these were further classified according to the criteria used in the National Badger Surveys (Cresswell *et al*., 1990 and Wilson *et al*., 1997). The current level of badger activity at each sett entrance hole was also classified.

2.2.3 Other distinctive field signs indicative of badger presence noted were:

- faeces in the form of dung pits or latrines (territorial markers comprising collections of numerous dung pits);
- foraging signs, such as snuffle holes;
- badger hair (hair often found on overhanging vegetation and low barbed wire fences);
- footprints, mammal paths and scratching marks – often on posts at the base of tree trunks; and
- push under, where badgers habitually dig or push under barriers such as fences and lift or displace them (often coinciding with the presence of mammal paths and badger hairs).

2.2.4 An assessment of the suitability of habitats to support badger groups (opportunities for sett formation, the presence of good foraging resources and access and egress for commuting) was also made.

2.3 Riparian mammal (otter and water vole)

2.3.1 The extended Phase 1 habitat survey encompassed potential habitats along watercourses, ponds and ditches and associated terrestrial habitat suitable for otter and water vole within DCO order limits. This area was assessed for suitable aquatic and terrestrial habitat for otter and water vole. The size, type, structure, and connectivity of all watercourses / waterbodies was recorded.

2.3.2 Field signs for otter were recorded during the extended Phase 1 habitat survey and included searching for faeces (spraints), holts, footprints and feeding remains. In addition, any holes in the bank-side (artificial and natural) and well-connected terrestrial habitats, such as scrub or woodland, were examined for otter holts and resting places. Surveys generally followed advice in 'Monitoring the Otter' (Chanin, 2003a).

2.3.3 Field signs for water vole were recorded, such as burrows, latrines, droppings, feeding remains, footprints and runs. In addition, foraging resources and burrowing substrate of waterbodies were also recorded. Surveys and assessments generally followed guidance in 'Water Vole Mitigation

Handbook' (Dean et al., 2016) and 'Water Vole Field Signs and Habitat Assessment' (Dean et al., 2021).

2.3.4 Where watercourses were not accessible, they were surveyed from the closest accessible point for their suitability to support riparian mammals, using binoculars to assist observation where necessary.

2.4 Limitations

2.4.1 Due to the red line boundary for the Site expanding after the extended Phase 1 habitat surveys, some areas have not been surveyed and as such their suitability to support badger, otter and water vole have not been fully assessed.

3 Results

3.1 Desk study

Badger

3.1.1 [redacted]

[redacted]

[redacted]

Otter

3.1.4 GNLP returned five records of otter within 2km of the Site boundary, with no records being recorded on-site. The most recent sighting is from 2019, where a dead otter was recorded 1.6km east of the Site, off Foss Dyke near the village of Drinsey Nook. The other records returned by GLNP are considered to be historic (more than 10 years old), with records ranging from 1995 to 2005. The closest record is approximately 0.2km north of the Site.

3.1.5 NBGRC returned a single record for otter; located 1.6km east of the Site, near the Foss Dyke, Drinsey Nook in 2015.

Water vole

3.1.6 GNLP returned only historic records for water vole, with four records on-site. The most recent records were for an adult and latrine, in 2007, in the northern field, 0.3km to east of the River Trent.

3.1.7 Nottinghamshire have provided multiple records of water vole, with six sightings on-site. These records are from 2012-2017 and are located to the west of the Trent, along the Fledborough beck and associated ditches to the north.

3.2 Badger

3.2.1 Suitable habitat for sett creation, commuting and foraging was recorded throughout the Site. Suitable habitats include woodland, grasslands and arable fields, which dominate.

3.2.2 [redacted]

Table 3-1: Details of badger evidence recorded on-Site

ID	Description
1	[redacted]
[redacted]	[redacted]

ID	Description
	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

3.3 Riparian mammals (Otter and Water Vole)

3.3.1 Suitable foraging, commuting, resting, and holt/burrow habitat for water vole and otter were recorded within the DCO Order Limits, as shown on **Figure A1-2.**

3.3.2 In addition, both GNLP and NGBRC returned records for invasive American mink *Neovison vison*, with two records being recorded on-site in 2017, along the Fleborough beck, 0.35km west of the River Trent. In addition, an adult American mink was recorded in October 2023, near the River Trent, by St Gregory's Church, Fledborough by a surveyor. The presence of American mink in the UK is considered to be a contributing factor to water vole population declines due to direct predation (Aars *et al.*, 2001; Bonesi and Palazon, 2007).

3.3.3 All on-site ditches are associated to four large watercourses: The River Trent, Fledborough beck, the Old Trent, Sewer dyke and an unnamed drainage ditch in the east. A summary of these watercourses is presented below in **Table 3-2.**

Table 3-2: Watercourses suitable for riparian mammals

ID	Type	Shore/ bank	Bank modifications	Bordering land use	Presence of vegetation	Disturbance	Bank profile	Depth	Width	Water	Rat/ mink evidence	Water vole evidence	Otter evidence
River Trent	River	Earth	None	Floodplain grazing marsh	Short grass and scrub (bramble)	Low	Shallow <45°	~0.8-3m	~75m	Permanent – fast flowing	Mink	×	×
Fledborough beck	Ditch	Earth	None	Arable with narrow field margins	Submarginal vegetation (reed beds), Scrub (bramble)	High	Steep >45°	~1.5-5m	~0.5-1m	Permanent – sluggish flow	Mink	×	×
The Old Trent	Ditch	Earth	None	Arable with narrow field margin	Submarginal vegetation (reed beds), Scrub (bramble)	High	Steep >45°	~1.5-4m	~0.5-2m	Permanent – sluggish flow	×	×	×
Sewer dyke	Ditch	Earth	None	Arable with narrow field margins	Submarginal vegetation (reed beds), Scrub (bramble)	High	Steep >45°	~2-4m	~1-2m	Permanent – sluggish flow	×	×	×

ID	Type	Shore/ bank	Bank modifications	Bordering land use	Presence of vegetation	Disturbance	Bank profile	Depth	Width	Water	Rat/ mink evidence	Water vole evidence	Otter evidence
Unnamed drainage ditch	Ditch	Earth	None	Arable with narrow field margins	Submarginal vegetation (reed beds), Scrub (bramble)	High	Steep >45°	~2-3m	~1.5-2m	Permanent – sluggish flow	×	×	×

3.3.4 All five above watercourses are considered suitable foraging, commuting and resting opportunities for otter, although no evidence was found for this species during the surveys.

3.3.5 The Fledborough beck, the Old Trent, Sewer dyke and unnamed ditch are all considered to be optimal habitat for water vole, with the River Trent being considered 'suitable but poor' due to the large variation in water levels where the banks are regularly overtopped. No evidence of water vole was recorded during the surveys; however, an adult mink was recorded running from the Fleborough beck eastwards towards the River Trent.

4 Summary

4.1.1 [redacted]

4.1.2 Suitable foraging, commuting, resting, and holt/burrow habitat for water vole and otter were recorded within on-Site. However no evidence of otter or water vole has been recorded during the ecological fieldwork to date.

5 References

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A1 Figures

Figure A1-1: Location of badger activity

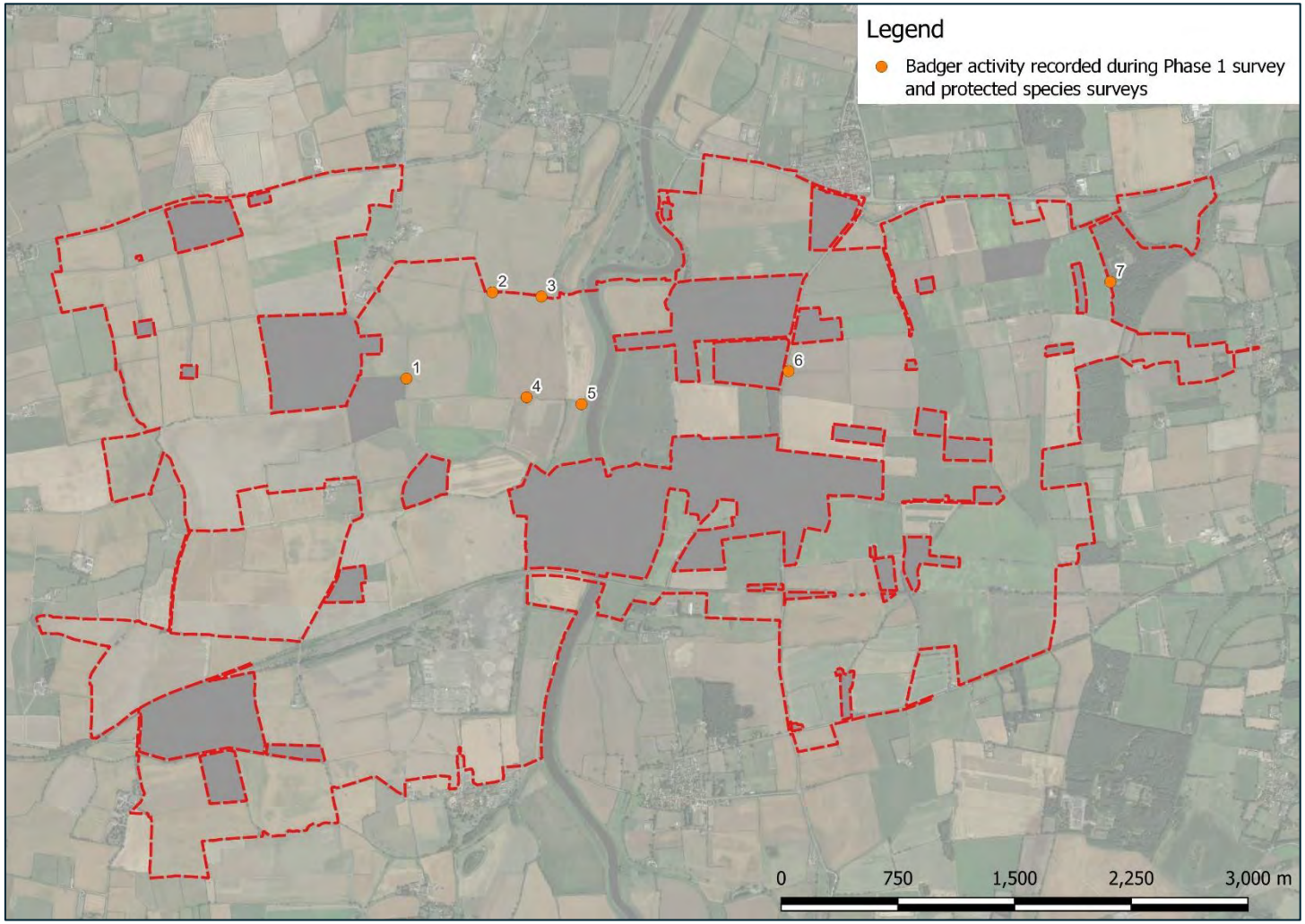
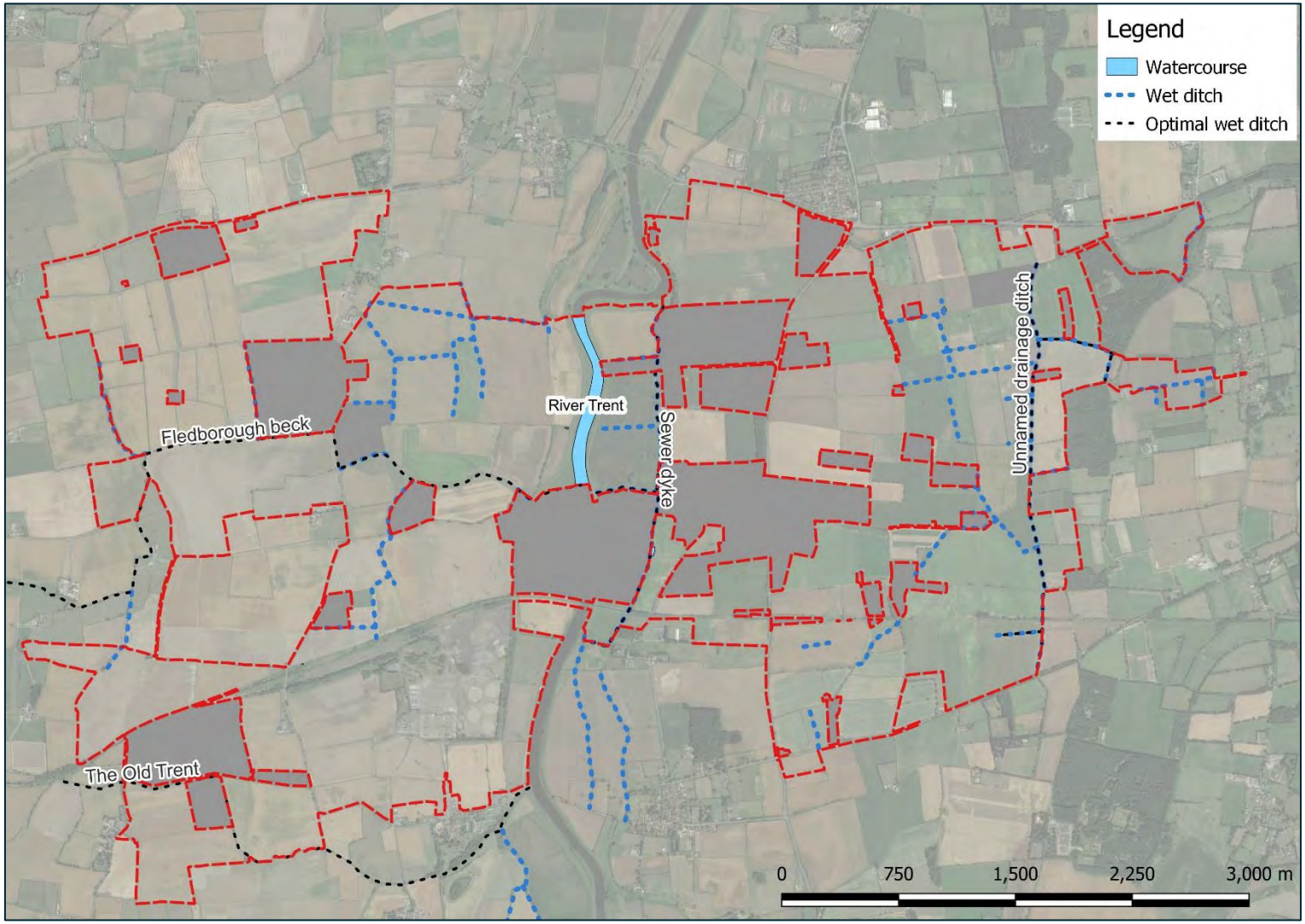


Figure A1-2: Suitable habitat for otter and water vole



Appendix 7-7: Wintering Bird Baseline

Report

One Earth Solar Farm

Appendix 7-7: Winter Bird Baseline

For One Earth Solar Farm Ltd

17 May 2024

Document control

Project Title:	One Earth Solar Farm
Project Number:	14529A
Client:	One Earth Solar Farm Ltd
Document Title:	Appendix 7-7: Winter Bird Baseline
Document Number:	14529A
Prepared By:	[redacted]
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Revision History

01	08/03/2024

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1 Introduction

1.1 Background

1.1.1 This Appendix should be read in conjunction with Chapter 7 of the Preliminary Environmental Information Report (PEIR) associated with the One Earth Solar Farm, hereafter referred to as the 'Proposed Development' or 'One Earth'.

1.1.2 This Appendix described the survey methodologies used and summarised the results of the winter bird surveys undertaken between September 2023 and March 2024 within the proposed DCO Order Limits; with emphasis on open farmland habitats and floodplain grazing marsh within the river Trent corridor that have the potential to support important assemblages of non-breeding (wintering) birds.

1.2 Purpose of this appendix

1.2.1 The purpose of the Appendix is to present the results of the winter bird assessment which was undertaken to identify and assess the assemblage of wintering birds potentially impacted by the Proposed Development.

1.2.2 Surveys were completed between September 2023 and March 2024 (where passage and wintering species are most likely to be encountered) with surveyors following pre-defined transect routes to assess the overall winter bird assemblage within the area.

1.2.3 The winter bird surveys were designed to identify the distribution, density and activities of non-breeding birds within an appropriate sampling area within the DCO Order Limits. This sampling area targeted habitats representative of the DCO Order limits that are likely to support winter bird assemblages.

1.3 Structure of this appendix

1.3.1 This appendix is structured as follows:

- Section 2: Methods;
- Section 3: Results;
- Section 4: References;
- Annex A: Figures;
- Annex B: Species recorded during the breeding bird survey;
- Annex C: Full survey details; and
- Annex D: Territory mapping criteria

2 Methods

2.1 Desk Study

2.1.1 An environmental desk study was undertaken to identify statutory designated sites of international and national importance for ornithology within 10km of the proposed DCO Order Limits, and non-statutory designated sites of ornithological importance within 2km of it. The search for statutory sites was carried out using the Multi-Agency Geographic Information for the Countryside (MAGIC) website (an internet-based Geographic Information Systems database provided by the Department for Environment, Foods and Rural Affairs (DEFRA) (Defra, 2024)) and for non-statutory sites through a data request to Greater Lincolnshire Nature Partnership (GLNP). Information on statutory designated sites was gathered from the websites of Natural England (Natural England, 2024) and the Joint Nature Conservation Committee (JNCC) (JNCC, 2024).

2.1.2 In addition to information on designated sites, species specific data was gathered from GLNP within 2km of the proposed DCO Order Limits.

2.2 Winter bird surveys

2.2.1 Winter bird surveys were undertaken between September 2023 and March 2024 inclusive. The purpose of the winter bird survey was to collect data to confirm the typical distribution and assemblages of species present within the area surveyed (See **Section 3.1**)

Data collection locations

2.2.2 The survey adopted a sampling approach and focused on large areas of accessible land within which the breeding bird assemblage has the potential to be impacted by the proposed development. The survey area covered 633 hectares (ha) of the 1480 ha red-line boundary, at the time of survey. The survey area covered large areas of open farmland, ditch, and hedgerow complexes on both sides of the river Trent, woodland edge habitats (east of the river Trent) and linear features including the river Trent corridor and the embankment of the dismantled railway line that runs east-west through the Site serving as a functional Sustrans Route 647. The survey was undertaken based on the proposed DCO Order Limits, plus a 50m buffer, where the survey areas directly overlapped Order Limits, information was gathered for birds outside of the Order Limits.

2.2.3 For the purposes of the wintering bird surveys, this area was divided into ten transects. The transects were spread throughout to give full coverage on the site. Consideration was also given to include the range of habitats and areas of specific interest for breeding birds such as the floodplain along the river Trent. These survey areas received systematic coverage with surveys undertaken by a single surveyor to avoid duplication of counting or overlap of adjacent area recordings (Figures A1-A9, **Annex A**). Data from all survey areas was combined for reporting purposes.

2.2.4 Transect 1: lies within the northwest of the Site boundary and includes areas of open farmland (with predominantly large rectangular fields), divided in places by narrow hedgerows and ditches. This transect is dominated by winter stubble and bare ground.

2.2.5 Transects 2&3: abuts Transect 1 to the southeast and continues south- and eastwards from the hamlet of Ragnall toward Fledborough. This area consists of a large expanse of agricultural crop fields including examples of the largest agricultural fields within the DCO Order Limits. These large fields were predominantly winter stubble and bare ground with boundary features of hedgerows and overgrown ditches also present. The area includes agricultural land considered as coastal floodplain grassing marsh (on the priority habitat inventory) on the west of the river Trent.

2.2.6 Transect 4: lies to the north of the hamlet of skegby. The area consists of large agricultural fields of winter stubble and bare ground. A small patch of woodland was present just of Crabtree Lane and hedges and treelines separated the fields. The transect crossed over the abandoned railway, which was bordered by trees on both sides.

2.2.7 Transect 5: lies in the north of the site, just to the east of the Trent. The area is 50m about the level of the river and is bordered to the east by a steep bank that runs down to the trent. The fields just south of the A57 were left as winter stubble and bare ground in the winter. The fields closest to the river were grassland that was used sporadically for sheep grazing during the winter. Carefully managed hedges split the field.

2.2.8 Transect 6: lies immediately east of the river Trent on low-lying agricultural land used for crop production. This area includes fields north of Trent Lane between the river corridor escarpment to the east and the river to the west. This land is mostly left as bare earth over the winter and also had a set-aside or sacrificial crop used for game cover. Along the eastern side of these fields there is a large pond and ditch network (the Sewer Dyke) which forms a transitional habitat from low-lying agricultural land into a scrub / wooded escarpment.

2.2.9 Transect 7: Consists of agricultural fields directly east of the river Trent between the villages of South- and North Clifton. These large fields are bordered by linear features including hedgerows and ditches. To the immediate west of the Area is the river Trent, with Church Lane immediately east. These arable fields were made up of winter stubble, bare ground and sports turf during the winter bird survey period.

2.2.10 Transect 8: is located in the northeast of the site. The transect passes alongside patches of plantation woodland with fields of grass used for turf located in between. A large, deep ditch runs along the western edge of the transect.

2.2.11 Transect 9: lies within a large area of agricultural fields. The fields were mostly left as winter stubble and bare ground throughout the winter. Two areas of set-aside used for bird cover are also present within the fields as well as a releasing pen for red legged partridges. Hedges with trees set within are present along most field edges and several farm buildings were also spread around the area.

2.2.12 Transect 10: is located in the southeast of the site. The transect runs through agricultural fields of bare ground and winter stubble. The transect runs along part of the abandoned railway line with a field of beet to the north and grass being grown for turf to the south. A temporary scrape is also present within the fields south of the transect.

2.2.13 Full survey details, including surveyor names, visit dates and times, and weather conditions are available in **Table C-1**, Annex C.

Data collection methods

2.2.14 The surveys followed an adapted method based on the BTO's CBC methodology (Gilbert *et al*., 1998), whereby the observer undertakes a census of all species present. The location of each bird detected (visually and / or aurally) was mapped using the standard two-character BTO codes, and bird activity was recorded using standard behaviour codes (Marchant, 1983).

2.2.15 Survey visits were undertaken between September 2023 and March 2024.

2.2.16 Six survey visits were undertaken during the 2023-24 breeding season: one each month from September 2023 to March 2024.

2.2.17 All surveys were undertaken in favourable conditions, avoiding periods of heavy rain, or strong or cold winds, therefore minimising variation in bird activity levels due to weather conditions.

2.2.18 Visits started occurred during daylight hours within the winter starting at least half an hour after sunrise and finishing at least half an hour before sunset.

2.2.19 The transects were walked in different orders and at different times of day each month to account for a potential range in bird activity throughout the day.

Mapping

2.2.20 On completion of the field survey, results were collated and analysed. Bird records were located using field numbers that were previously finalised. Numbers and locations of target species, waders and waterfowl, were mapped to show distributions of the species.

Deviations, constraints and limitations

2.2.21 Surveys were conducted within a sampling area based on the potential for habitats within the DCO Order Limits to provide winter bird habitat. The sampling area focussed on areas with higher habitat diversity within the DCO Order Limits to assess greater quality habitats for wintering birds and form a baseline (worst case scenario) that can be used to assess the potential impacts of the proposed development. In undertaking these surveys during the early stages of the Scheme, areas subject to survey may no longer fall within the DCO Order Limits at submission, similarly additional areas outside of the current DCO Order Limits may be brought forwards for inclusion with the Scheme. This represents a limitation and constraint to the overall wintering bird assessment of the scheme as potential wintering bird information provided below may no longer be relevant at submission. This limitation, along with the solution to provide a robust assessment will be discussed further within the ES.

2.2.22 Areas that were due to be walked on transects 6 and 7 were flooded in December 2023 and January 2024. As result it was impossible to walk the full length of these transects during these months. The areas within these transects were able to be surveyed from other locations and vantage points such as across the river Trent. This allowed the majority of areas to still be fully surveyed however, it could have limited records of smaller, less conspicuous bird species that may have been located in these areas during December and January. Despite this, it is believed that the winter bird surveys on the transects in other months coupled with the vantage point surveys have given an accurate representation of the wintering bird assemblage in the area throughout the winter.

2.2.23 Despite the deviation, constraints and limitations describe above, the dataset is considered to provide a robust approximation of the wintering bird assemblage within the survey area. This conclusion can be drawn as constraints and limitations faced within the wintering bird assessment were not extensive enough to negatively impact the mapping exercise undertaken following the completion of the surveys. Further the areas sampled as part of this assessment include the areas most likely to present increased species diversity and density therefore using these areas to extrapolate potential impacts on the overall wintering bird assemblage will create a robust baseline. Expansive areas of open arable land which were not subject to wintering bird survey are considered to be of limited importance to wintering birds due to the homogeneity of the habitats and a lack of foraging and roosting habitat.

3 Results

3.1 Statutory designated sites of ornithological importance

3.1.1 There are no nationally or internationally statutory designated sites of ornithological importance within 10km of the DCO Order Limits.

3.2 Non-statutory designated sites of ornithological importance

3.2.1 There are no non-statutory designated sites of ornithological importance within 2km of the DCO Order Limits.

3.3 Species records

3.3.1 As part of the environmental desk study, species data for birds likely to be found within, or in proximity to the DCO Order Limits was gathered from GLNP. Species data was screened to include all records within the winter bird season (here considered to be 1st September – 31st March inclusive) from within the last ten years.

3.3.2 GLNP returned 830 records of 19 species considered to be notable[1] during the wintering season, including:

- Nine Schedule 1 listed species – kingfisher, marsh harrier, whooper swan, brambling, red kite, redwing, fieldfare, barn owl, bewick's swan.
- Seven Species of Principal Importance (SPI) (Natural Environment and Rural Communities Act (NERC), 2006) – bewick's swan, reed bunting, linnet, tree sparrow, bullfinch, starling, lapwing.
- Seven birds of conservation concern[2] (BoCC) Red-listed species – skylark, bewick's swan, linnet, tree sparrow, starling, fieldfare, lapwing.
- Six birds of conservation concern (BoCC) Amber-listed species – greylag goose, marsh harrier, whooper swan, reed bunting, bullfinch, redwing.

3.3.3 There is potential for schedule 1 species including, whooper swan, redwing and bewick's swan to overwinter within or in proximity to the site.

3.3.4 Further details of the GLNP records can be found within Appendix 7-2 (Document Reference: Ecology Desk Study).

[1] GLNP returned records of birds considered notable if listed as local priority species (Listed as UK Biodiversity Action Plan (UK BAP) species), protected by Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) or priority species listed on Birds of Conservation Concern 5 – Red List.
2 BoCC Red list = The background to the establishment of a 'traffic light system' of conservation concern for UK birds is discussed in Gregory et al. (2002). The updated criteria and lists are detailed in Stanbury et al. (2021). Broadly, 'Red-listed' species include those that are globally threatened, have suffered a historical population decline in the UK (between 1800 and 1995) or which have experienced rapid declines in their UK breeding population or contractions in their UK range of more than 50% over the past twenty-five years. Amber-listed' species include any species on the European Red List (Critically Endangered, Endangered or Vulnerable), these are detailed in Stanbury et al. (2021).

3.4 Winter bird survey

3.4.1 A total of forty-four species were recorded during the wintering bird survey (See Table C-1, **Annex C**), of which:

- Nine species listed as SPI: grey partridge, house sparrow, linnet, skylark, song thrush, lesser redpoll, starling, lapwing and yellowhammer.
- Ten species recorded as BoCC red-listed species: grey partridge, lapwing, mistle thrush, starling, house sparrow, lesser redpoll, linnet, skylark, yellowhammer, and fieldfare.

3.4.2 **Table 3.1**, below, presents the records of target species within the survey area, along with any legislative protection or conservation status.

Table 3-1 – Wintering bird records during the 2023-24 wintering bird surveys

BTO code	Species	Number of records	SPI[3]	BoCC[2]
B.	Black-Headed Gull	29		Amber
CM	Common Gull	12		Amber
FF	Fieldfare	18		Red
P.	Grey partridge	3	✓	Red
GP	Golden Plover	6		Green
GJ	Greylag Goose	7		Amber
HS	House sparrow	1	✓	Red
K.	Kestrel	22		Amber
L	Lapwing	11	✓	Red
LB	Lesser-Black Backed Gull	20		Amber
LR	Lesser redpoll	2	✓	Red
LI	Linnet	9	✓	Red
M	Mistle Thrush	3		Red
MA	Mallard	11		Amber
MP	Meadow Pipit	2		Amber
MH	Moorhen	2		Amber

[3] **SPI** = Species "of principal importance for the purpose of conserving biodiversity" covered under Section 41 (England) of the NERC Act (2006).

BTO code	Species	Number of records	SPI[3]	BoCC[2]
OC	Oystercatcher	2		Amber
RO	Rook	25		Amber
S.	Skylark	41	✓	Red
ST	Song thrush	6	✓	Amber
SD	Stock dove	6		Amber
SG	Starling	27	✓	Red
SH	Sparrowhawk	6		Amber
SN	Snipe	5		Amber
WN	Wigeon	4		Amber
WP	Woodpigeon	50		Amber
WR	Wren	4		Amber
WS	Whooper Swan	1		Amber
Y.	Yellowhammer	11	✓	Red

The winter bird assemblage recorded within the survey area is typical of open farmland habitats with limited vegetative cover (aside from seasonal crop). There were noticeable increases in species diversity and abundance within well established marginal features such as those found along the river Trent corridor, the escarpment along the east of the Trent and the woodland and scrub edges within the 50m buffer from the DCO Order Limits.

Waders

Golden Plover were recorded on six occasions during the wintering bird surveys. The maximum number recorded was approximately 400 birds that were flushed from a bare agricultural field in the southwest of the site in November 2023. The majority of records consisted of golden plover flying over the site or being flushed from fields alongside the river trent.

Lapwing were recorded on eleven occasions during the wintering bird surveys. The maximum number recorded was 400 birds that were foraging and loafing alongside a temporary scrape in the southeast of the site in December 2023. A large flock of lapwing was recorded on multiple occasions around the temporary scrape alongside T10 throughout the winter. Lapwing were also recorded in large numbers, roughly 200 individuals, in the flooded agricultural fields alongside the river Trent. Smaller flocks were also recorded commuting around the site on various occasions.

Snipe were recorded on five occasions during the wintering bird surveys. The maximum number recorded was four birds that were flushed from a winter stubble field on T9 in February 2024. All records of snipe were of birds flushed on winter stubble field on T9, the fields remained wet throughout the winter which provided foraging habitat for the snipe.

Oystercatcher were recorded on two occasions; Both sightings were of 3 birds recorded foraging along the banks of the river Trent in February and March 2024 respectively.

Waterfowl

Greylag geese were recorded on seven occasions during the winter bird surveys. The maximum number recorded was 200 birds seen foraging and loafing on the banks of the Trent in February 2024. All but one of the records involved flocks of birds flying over or foraging along the river Trent. The flooded fields to the east of the Trent provided foraging and roosting habitat for the greylags during the winter.

Wigeon were recorded on four occasions during the winter bird surveys. A maximum count of 75 birds was recorded in January 2024 on a flooded field to the east of the river Trent at the northern end of the site. The flock was recorded again the following month foraging and loafing in the flooded fields alongside the river.

Moorhen were recorded on two occasions during the winter bird surveys. A maximum count of 2 was recorded on a small pond within the farmland on T10 in February 2024. The other sighting involved a single moorhen being seen on the sewer dyke present on T6 in October 2023.

Mallard were recorded on eleven occasions during the winter bird surveys. A maximum count of ten birds were recorded on the River Trent in March 2024. All of the sightings involved birds using the river for foraging or loafing.

Whooper swans were recorded on one occasion; seven swans were recorded flying high over the site in January 2024.

Species of Principal Importance

Other than Lapwing which was discussed above, Eight species of principal importance were recorded during winter bird surveys:

- Grey Partridge were recorded on three occasions in the northwest of the site in, with a maximum count of two birds in February 2024.
- House Sparrow were recorded on one occasion in south Clifton, 15 birds were recorded in October 2023.
- Lesser Redpoll were recorded on two occasions in the southwest and southeast of the site, with a maximum count of 28 birds recorded in February 2024.
- Linnet were recorded on nine occasions, mostly in arable farmland in the northeast and centre of the site. A maximum count of 70 linnet was recorded in November 2023.
- Skylark were recorded 41 times spread throughout the site on arable farmland, a maximum count of nine birds was recorded in December 2023.
- Song Thrush were recorded on six occasions, mostly in the northeast and northwest of the site. A maximum count of five birds was recorded in November 2023.
- Starling were recorded on 27 occasions spread throughout the site, with a maximum count of 1000 birds in November 2023.
- Yellowhammer were recorded on eight occasions in areas of arable farmland around the site, with a maximum count of 14 birds in November 2023.

Red listed and large flocks

Other red listed or large flocks of birds:

- Fieldfare were recorded on 18 occasions with a maximum count of 35 in February 2024
- Mistle thrush were recorded on three occasions with a maximum count of 3 in December 2023
- Black-Headed Gull were recorded on 29 occasions with a maximum count of 160 in October 2023
- Common Gull were recorded on 12 occasions with a maximum count of 68 in February 2024
- Goldfinch were recorded on eight occasions with a maximum count of 150 in November 2023
- Stock Dove were recorded on six occasions with a maximum count of 60 in February 2024
- Woodpigeon were recorded on 50 occasions with a maximum count of 65 in January 2024

Other notable Species

Other notable species recorded during winter bird surveys include (with max counts):

- Goshawk (1)
- Kestrel (2)
- Kingfisher (2)
- Hobby (1)
- Sparrowhawk (1)

A full list of species observed during the breeding bird surveys is available in **Annex C.**

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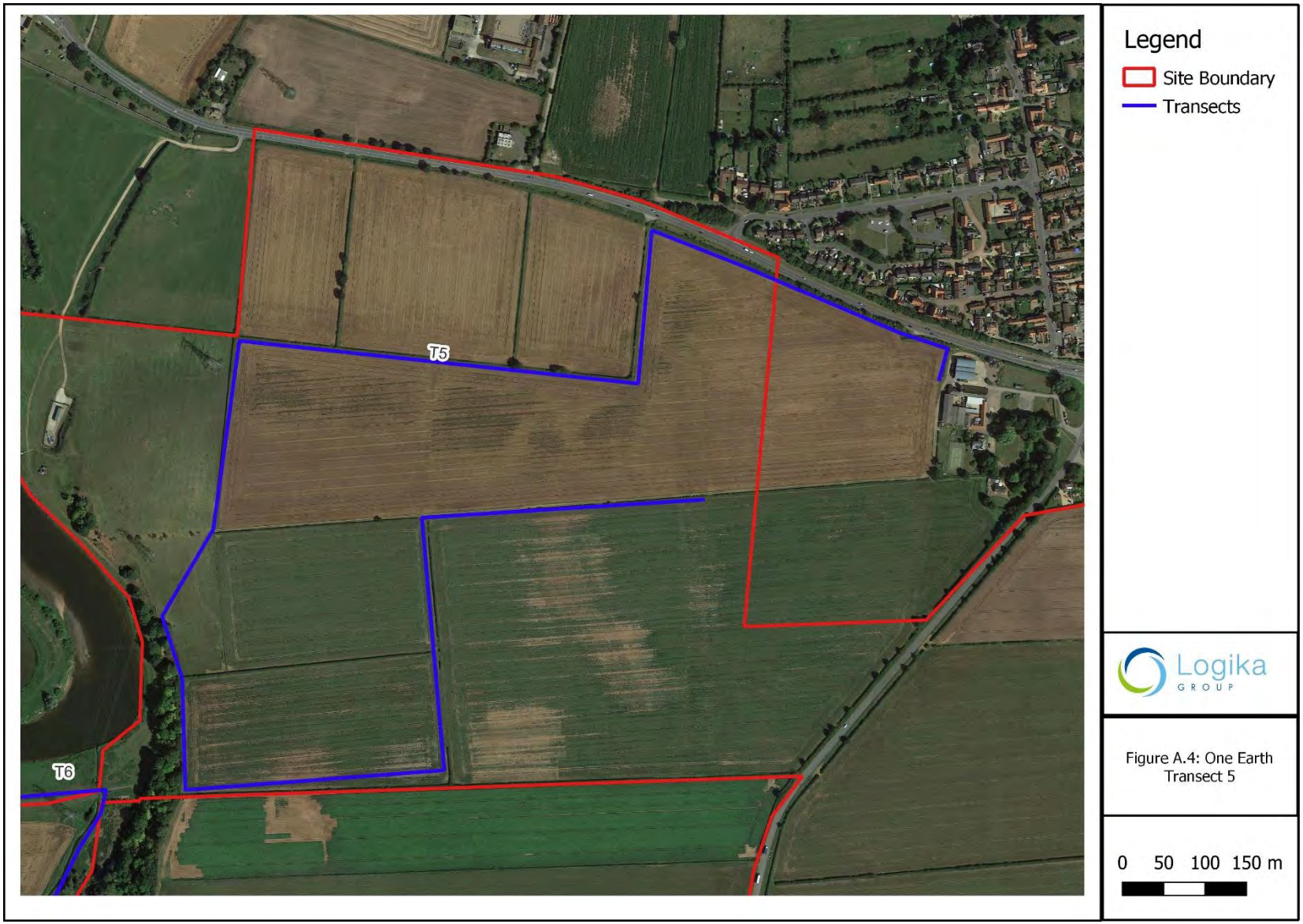
Wildlife and Countryside Act 1981 (as Amended).[Online]. Available at: https://www.legislation.gov.uk/ukpga/1981/69/contents [Accessed 29 February 2024].

Annex A. – Transect Figures


T1
Legend
Site Boundary
Transects
Logika GROUP
Figure A.1: One Earth Transect 1
0 100 200 m


T2&3
T6
Legend
Site Boundary
Transects
Logika GROUP
Figure A.2: One Earth Transect 2&3
0 100 200 m


T4
Legend
Site Boundary
Transects
Logika GROUP
Figure A.3: One Earth Transect 4
0 100 200 m


T5
T6
Legend
Site Boundary
Transects
Logika GROUP
Figure A.4: One Earth Transect 5
0 50 100 150 m


T5
T6
T2&3
Legend
Site Boundary
Transects
Logika GROUP
Figure A.5: One Earth Transect 6
0 100 200 m


T7
Legend
Site Boundary
Transects
Logika GROUP
Figure A.6: One Earth Transect 7
0 100 200 m

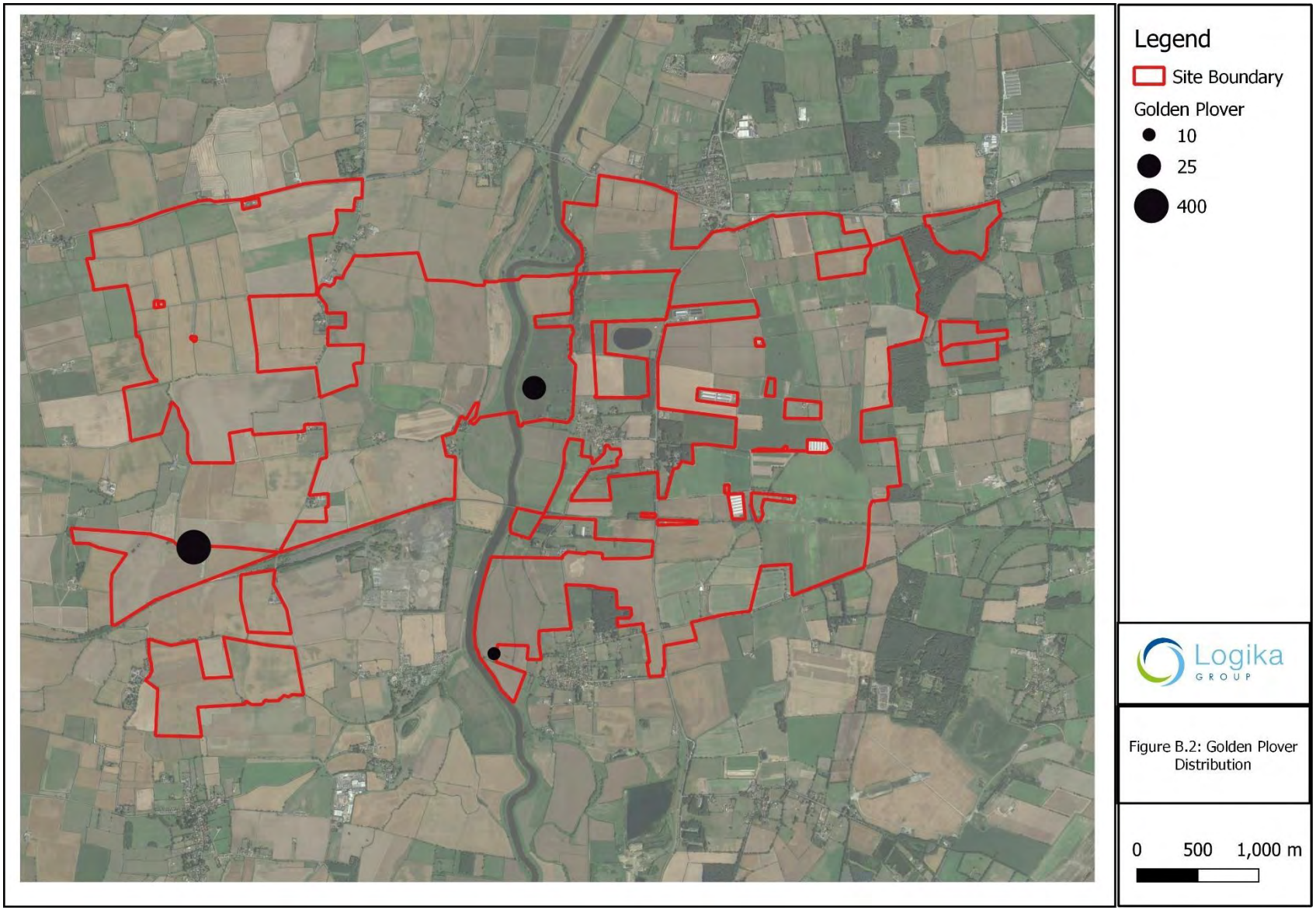

T8
Legend
Site Boundary
Transects
Logika
GROUP
Figure A.7: One Earth Transect 8
0
100
200 m

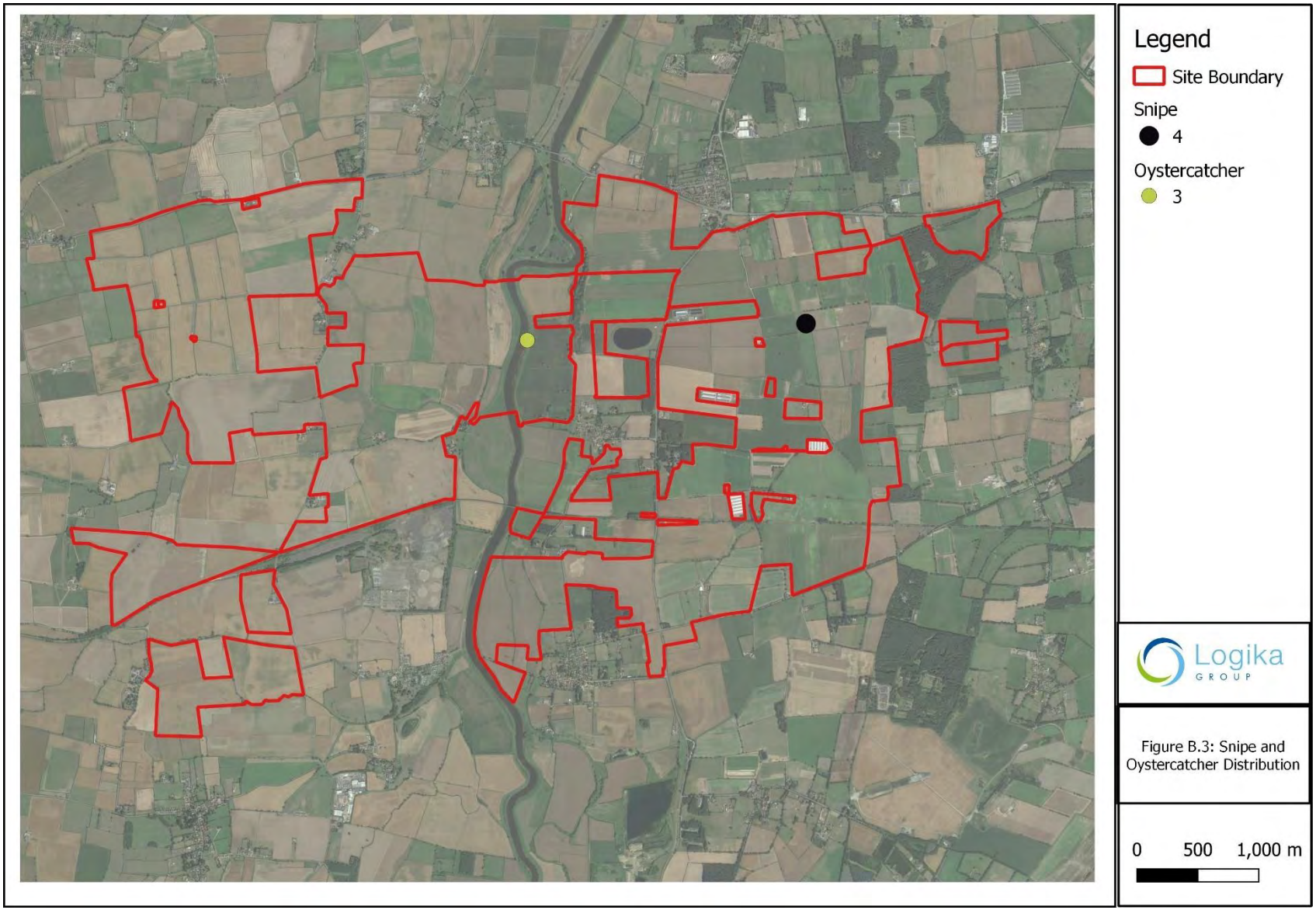

T8
T9
Legend
Site Boundary
Transects
Logika
GROUP
Figure A.8: One Earth Transect 9
0 100 200 m

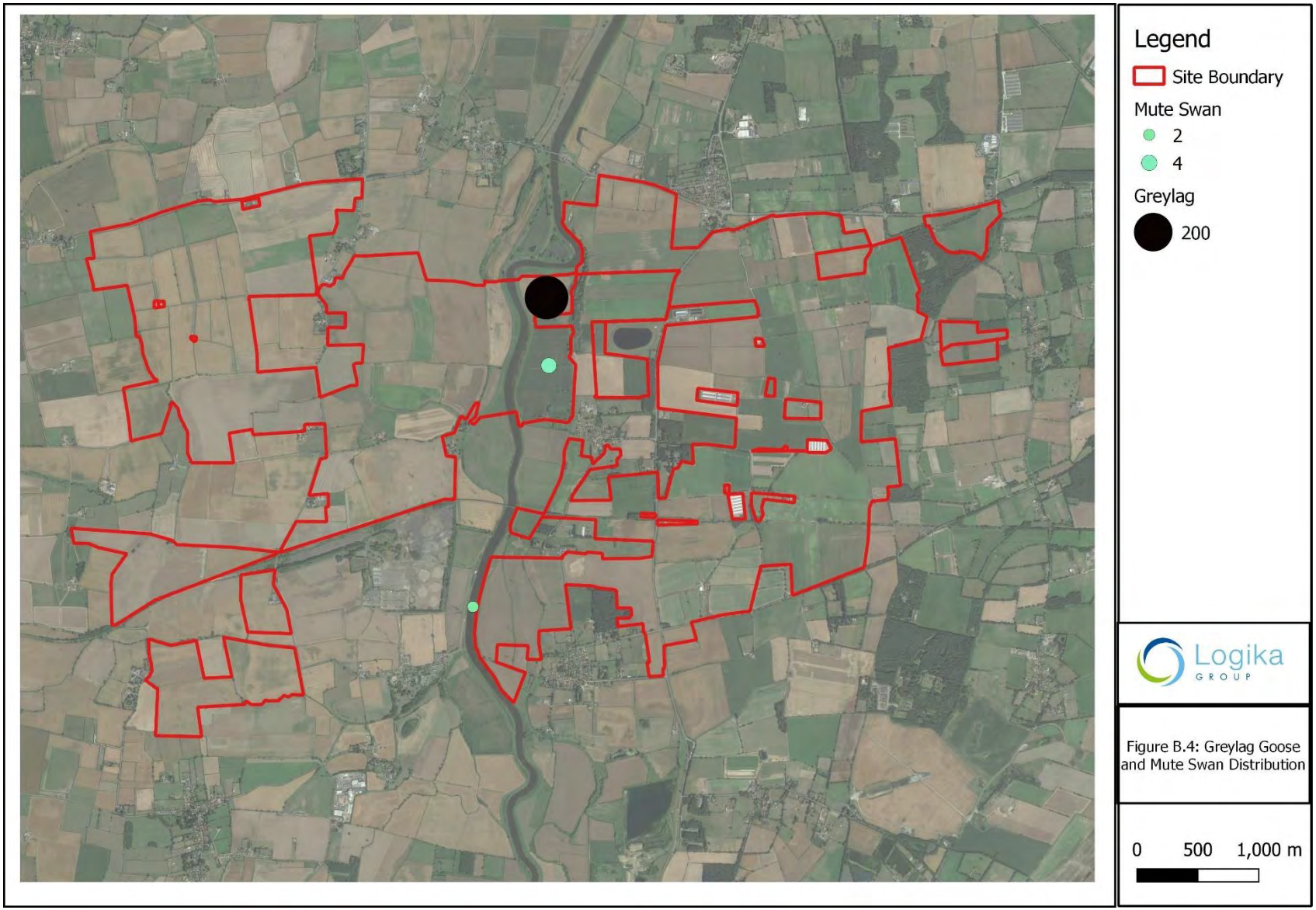

T10
Legend
Site Boundary
Transects
Logika GROUP
Figure A.9: One Earth Transect 10
0 100 200 m

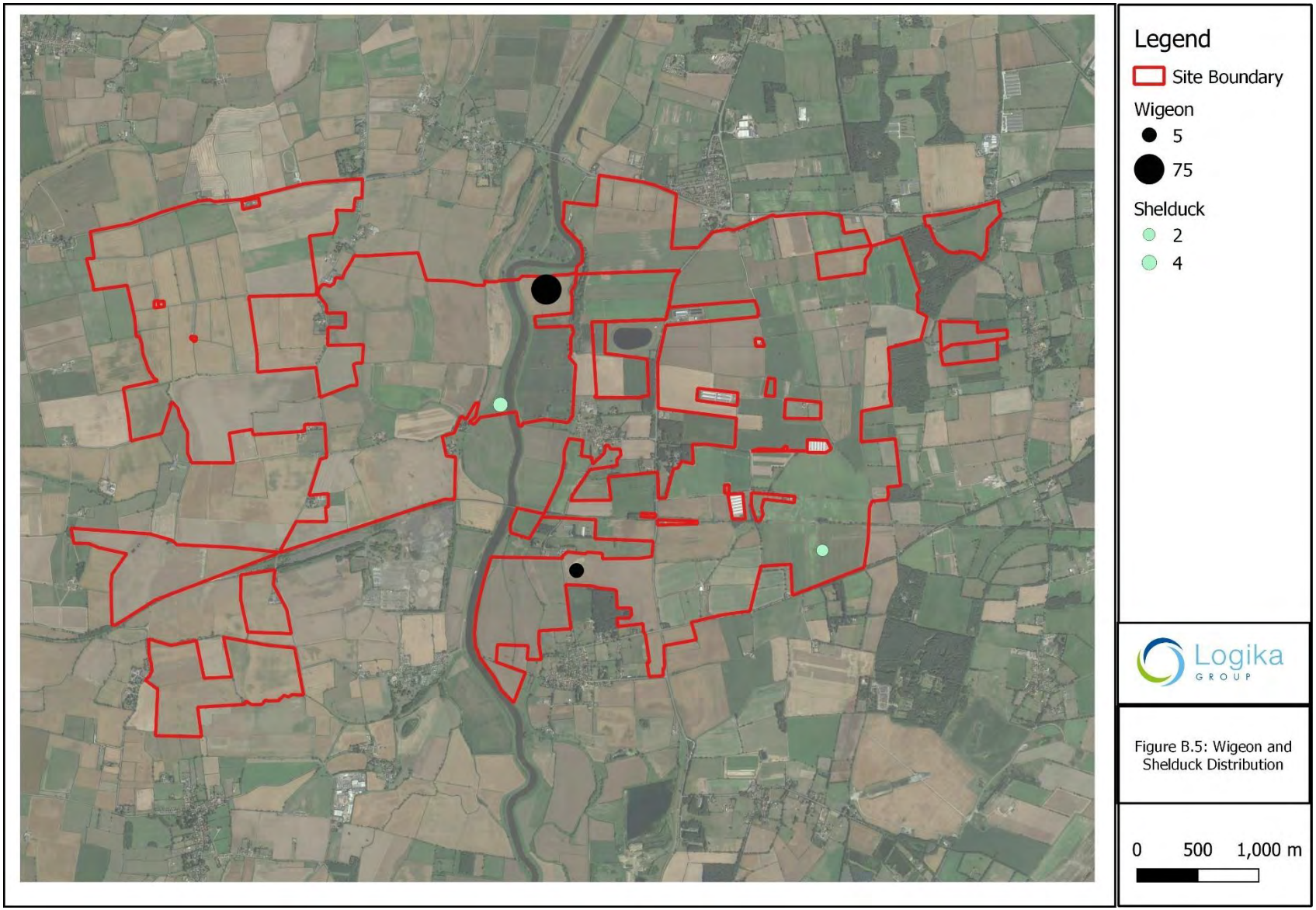
Annex B. – Abundance Figures

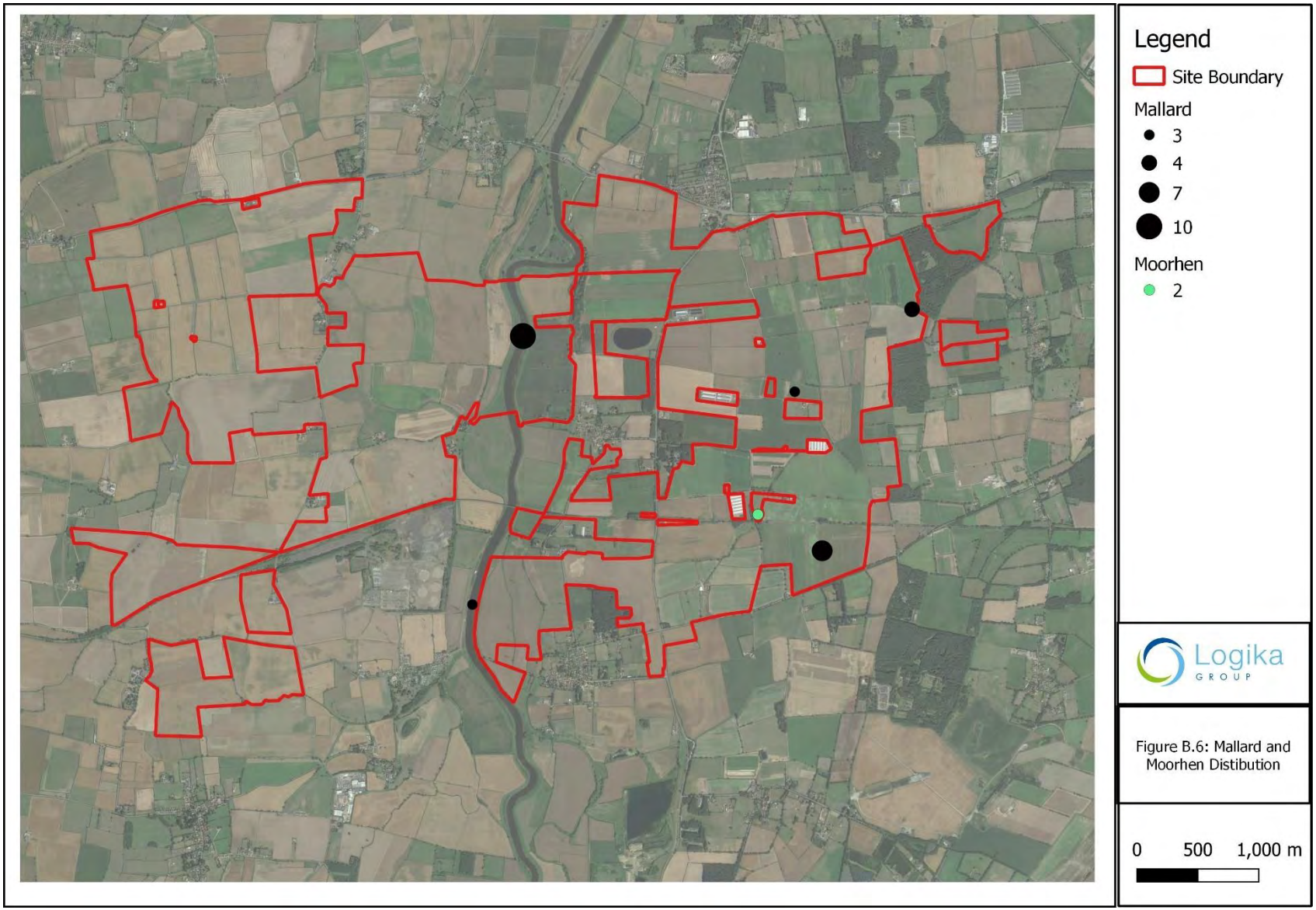

Legend
Site Boundary
Lapwing
50
200
400
Logika GROUP
Figure B.1: Lapwing Distribution
0
500
1,000 m


Legend
Site Boundary
Golden Plover
10
25
400
Logika GROUP
Figure B.2: Golden Plover Distribution
0
500
1,000 m


Legend
Site Boundary
Snipe
4
Oystercatcher
3
Logika GROUP
Figure B.3: Snipe and Oystercatcher Distribution
0
500
1,000 m


Legend
Site Boundary
Mute Swan
2
4
Greylag
200
Logika GROUP
Figure B.4: Greylag Goose and Mute Swan Distribution
0
500
1,000 m


Legend
Site Boundary
Wigeon
5
75
Shelduck
2
4
Logika GROUP
Figure B.5: Wigeon and Shelduck Distribution
0
500
1,000 m


Legend
Site Boundary
Mallard
3
4
7
10
Moorhen
2
Logika GROUP
Figure B.6: Mallard and Moorhen Distibution
0
500
1,000 m

Annex C. Full species records

Table C-1 – Complete list of species recorded during wintering bird surveys.

Species	Scientific name
Black-headed gull	*Chroicocephalus ridibundus*
Buzzard	*Buteo buteo*
Canada goose	*Branta canadensis*
Chaffinch	*Fringilla coelebs*
Common gull	*Larus canus*
Cormorant	*Phalacrocorax carbo*
Egyptian goose	*Alopochen aegyptiaca*
Fieldfare	*Turdus pilaris*
Golden plover	*Pluvialis apricaria*
Goldfinch	*Carduelis carduelis*
Goshawk	*Accipiter gentilis*
Grey heron	*Ardea cinerea*
Grey partridge	*Perdix perdix*
Greylag goose	*Anser anser*
Hobby	*Falco subbuteo*
House sparrow	*Passer domesticus*
Kestrel	*Falco tinnunculus*
Kingfisher	*Alcedo atthis*
Lapwing	*Vanellus vanellus*
Lesser Black-backed gull	*Larus fuscus*
Lesser redpoll	*Acanthis flammea*
Linnet	*Linaria cannabina*
Little egret	*Egretta garzetta*

Species	Scientific name
Mallard	*Anas platyrhynchos*
Meadow pipit	*Anthus pratensis*
Mistle thrush	*Turdus viscivorus*
Moorhen	*Gallinula chloropus*
Mute Swan	*Cygnus olor*
Oystercatcher	*Haematopus ostralegus*
Redwing	*Turdus iliacus*
Rook	*Corvus frugilegus*
Skylark	*Alauda arvensis*
Snipe	*Gallinago gallinago*
Song thrush	*Turdus philomelos*
Sparrowhawk	*Accipiter nisus*
Starling	*Sturnus vulgaris*
Stock dove	*Columba oenas*
Stonechat	*Saxicola rubicola*
Shelduck	*Tadorna tadorna*
Whooper swan	*Cygnus cygnus*
Wigeon	*Mareca penelope*
Woodpigeon	*Columba palumbus*
Wren	*Troglodytes troglodytes*
Yellowhammer	*Emberiza citrinella*

In addition to those species listed in **Table C-1**, the following species noted within the report are given here along with their full scientific name:

- Marsh harrier *Circus aeruginosus*
- Bewick's swan *Cygnus columbianus*
- Reed bunting *Emberiza schoeniclus*

- Brambling *Fringilla montifringilla*
- Red kite *Milvus milvus milvus*
- Tree sparrow *Passer montanus*
- Bullfinch *Pyrrhula pyrrhula*

Annex C. – Full survey details

Full survey details of the winter bird surveys are shown below in **Table C.2.**

Table C-2 Full survey details of winter bird surveys.

Date	*Visit number*	*Transect number*	*Start time*	*End time*	*Weather conditions*
09/10/2023	1	T1	12:52	14:17	0/8 Oktas cloud, Beaufort 1 west, visibility > 3km, precipitation: none, 21°C
09/10/2023	1	T2	14:34	16:05	0/8 Oktas cloud, Beaufort 1 west, visibility > 3km, precipitation: none, 21°C
10/10/2023	1	T9	09:05	10:40	8/8 Oktas cloud, Beaufort 2 west, visibility > 3km, precipitation: none, 16°C
10/10/2023	1	T6	11:02	12:20	4/8 Oktas cloud, Beaufort 2 west, visibility > 3km, precipitation: none, 17°C
10/10/2023	1	T7	12:48	14:27	4/8 Oktas cloud, Beaufort 2 west, visibility > 3km, precipitation: none, 17°C
11/10/2023	1	T8	08:52	10:11	8/8 Oktas cloud, Beaufort 2 south-west, visibility > 3km, precipitation: none,16°C
11/10/2023	1	T5	12:31	14:05	8/8 Oktas cloud, Beaufort 2 south-west, visibility > 3km, precipitation: none, 16°C

Date	*Visit number*	*Transect number*	*Start time*	*End time*	*Weather conditions*
11/10/2023	1	T10	10:32	12:05	8/8 Oktas cloud, Beaufort 2 south-west, visibility > 3km, precipitation: none, 16°C
12/10/2023	1	T3	08:11	09:15	2/8 Oktas cloud, Beaufort 1 south-west, visibility > 3km, precipitation: none, 9°C
12/10/2023	1	T4	09:32	10:53	2/8 Oktas cloud, Beaufort 1 south-west, visibility > 3km, precipitation: none, 11°C
13/11/2023	2	T4	13:29	14:49	1/8 Oktas cloud, Beaufort 4 south-west, visibility > 3km, precipitation: none, 13°C
13/11/2023	2	T1	15:03	16:25	1/8 Oktas cloud, Beaufort 4 south-west, visibility > 3km, precipitation: none, 13°C
14/11/2023	2	T5	12:45	14:03	6/8 Oktas cloud, Beaufort 1 south-west, visibility > 3km, precipitation: none, 11°C
14/11/2023	2	T9	09:25	10:48	6/8 Oktas cloud, Beaufort 1 south-west, visibility > 3km, precipitation: none, 11°C
14/11/2023	2	T6	11:12	12:15	6/8 Oktas cloud, Beaufort 1 south-west, visibility > 3km, precipitation: none, 12°C
15/11/2023	2	T10	11:07	12:28	1/8 Oktas cloud, Beaufort 1 south-west, visibility > 3km, precipitation: none, 8°C
15/11/2023	2	T7	12:55	14:12	1/8 Oktas cloud, Beaufort 1 south-west, visibility > 3km, precipitation: none, 12°C

Date	*Visit number*	*Transect number*	*Start time*	*End time*	*Weather conditions*
15/11/2023	2	T8	09:19	10:34	1/8 Oktas cloud, Beaufort 1 south-west, visibility > 3km, precipitation: none, 8°C
16/11/2023	2	T2&3	08:04	10:23	8/8 Oktas cloud, Beaufort 1 south-west, visibility > 3km, precipitation: none, 5°C
11/12/2023	3	T9	12:48	14:24	8/8 Oktas cloud, Beaufort 1 south-west, visibility > 3km, precipitation: drizzle, 5°C, Drizzle
11/12/2023	3	T6	14:45	15:32	8/8 Oktas cloud, Beaufort 1 south-west, visibility > 3km, precipitation: none, 5°C
12/12/2023	3	T5	09:35	10:56	8/8 Oktas cloud, Beaufort 1 south-west, visibility > 3km, precipitation: light drizzle, 5°C
12/12/2023	3	T7	11:15	12:26	8/8 Oktas cloud, Beaufort 1 south-west, visibility > 3km, precipitation: none, 6°C
13/12/2023	3	T1	09:37	11:08	8/8 Oktas cloud, Beaufort 3 south-west, visibility > 3km, precipitation: drizzle, 2°C
13/12/2023	3	T2&3	11:25	13:23	8/8 Oktas cloud, Beaufort 3 south-west, visibility > 3km, precipitation: drizzle, 2°C
14/12/2023	3	T8	08:11	09:06	8/8 Oktas cloud, Beaufort 1 south-west, visibility > 3km, precipitation: none, 2°C

Date	*Visit number*	*Transect number*	*Start time*	*End time*	*Weather conditions*
14/12/2023	3	T10	09:32	11:13	8/8 Oktas cloud, Beaufort 1 south-west, visibility 500m - 3km, precipitation: drizzle, 2°C
12/12/2023	3	T4	13:05	14:26	8/8 Oktas cloud, Beaufort 1 south-west, visibility > 3km, precipitation: none, 6°C
08/01/2024	4	T4	12:33	13:55	7/8 Oktas cloud, Beaufort 2 north-east, visibility 500m - 3km, precipitation: none, 3°C
08/01/2024	4	T1	14:18	15:38	7/8 Oktas cloud, Beaufort 2 north-east, visibility 500m - 3km, precipitation: none, 3°C
09/01/2024	4	T10	11:46	13:05	1/8 Oktas cloud, Beaufort 2 north-east, visibility 500m - 3km, precipitation: none, 3°C
11/01/2024	4	T2&3	08:13	10:15	8/8 Oktas cloud, Beaufort 1 north-east, visibility 500m - 3km, precipitation: none, 3°C
10/01/2024	4	T7	12:59	14:04	6/8 Oktas cloud, Beaufort 1 north-east, visibility 500m - 3km, precipitation: none, 3°C
10/01/2024	4	T6	12:12	12:38	6/8 Oktas cloud, Beaufort 1 north-east, visibility 500m - 3km, precipitation: none, 3°C

Date	*Visit number*	*Transect number*	*Start time*	*End time*	*Weather conditions*
10/01/2024	4	T9	10:12	11:41	6/8 Oktas cloud, Beaufort 1 north-east, visibility 500m - 3km, precipitation: none, 2°C
09/01/2024	5	T5	13:32	14:57	2/8 Oktas cloud, Beaufort 2 north-east, visibility 500m - 3km, precipitation: none, 2°C
09/01/2024	5	T8	10:03	11:17	1/8 Oktas cloud, Beaufort 2 north-east, visibility 500m - 3km, precipitation: none, 2°C
12/02/2024	5	T9	14:45	16:00	4/8 Oktas cloud, Beaufort 2 west, visibility 500m - 3km, precipitation: none, 8°C
12/02/2024	5	T7	12:50	14:25	4/8 Oktas cloud, Beaufort 2 west, visibility 500m - 3km, precipitation: none, 8°C
13/02/2024	5	T6	13:40	15:15	8/8 Oktas cloud, Beaufort 2 south-west, visibility 500m - 3km, precipitation: none, 8°C
13/02/2024	5	T10	12:00	13:25	8/8 Oktas cloud, Beaufort 2 south-west, visibility 500m - 3km, precipitation: none, 8°C
13/02/2024	5	T1	10:05	11:35	8/8 Oktas cloud, Beaufort 2 south-west, visibility 500m - 3km, precipitation: none, 8°C

Date	*Visit number*	*Transect number*	*Start time*	*End time*	*Weather conditions*
14/02/2024	5	T2&3	11:35	13:55	8/8 Oktas cloud, Beaufort 1 south-west, visibility 500m - 3km, precipitation: none, 8°C
14/02/2024	5	T4	09:45	11:15	7/8 Oktas cloud, Beaufort 1 south-west, visibility 500m - 3km, precipitation: none, 8°C
15/02/2024	5	T8	10:30	11:55	8/8 Oktas cloud, Beaufort 2 south-west, visibility 500m - 3km, precipitation: none, 8°C
15/02/2024	5	T5	08:25	10:05	8/8 Oktas cloud, Beaufort 2 south-west, visibility 500m - 3km, precipitation: none, 8°C
11/03/2024	6	T8	14:35	16:02	8/8 Oktas cloud, Beaufort 2 north, visibility 500m - 3km, precipitation: none, 9°C
11/03/2024	6	T10	12:28	14:05	8/8 Oktas cloud, Beaufort 2 north, visibility 500m - 3km, precipitation: none, 9°C
12/03/2024	6	T1	09:58	11:23	8/8 cloud, Beaufort 2 south-east, visibility 500m - 3km, precipitation: rain showers, 7°C
12/03/2024	6	T2&3	11:54	14:12	8/8 cloud, Beaufort 2 south-east, visibility 500m - 3km, precipitation: rain showers, 7°C

Date	*Visit number*	*Transect number*	*Start time*	*End time*	*Weather conditions*
13/03/2024	6	T4	12:23	14:09	88/8 cloud, Beaufort 2 south-east, visibility 500m - 3km, precipitation: rain showers, 7°C
13/03/2024	6	T5	11:02	12:19	8/8 Oktas cloud, Beaufort 3 south-east, visibility 500m - 3km, precipitation: none, 7°C
13/03/2024	6	T9	08:58	10:35	8/8 Oktas cloud, Beaufort 3 south-east, visibility 500m - 3km, precipitation: none, 7°C
14/03/2024	6	T7	07:56	09:34	8/8 Oktas cloud, Beaufort 1 south-east, visibility 500m - 3km, precipitation: none 10°C
14/03/2024	6	T6	09:58	11:23	8/8 Oktas cloud, Beaufort 1 south-east, visibility 500m - 3km, precipitation: none 10°C

Appendix 7-8: List of Species with Scientific names

Common Name	*Scientific name*
Common pipistrelle	*Pipistrellus pipistrellus*
Leisler's bat	*Nyctalus leisleri*
Myotis	*Myotis spp*
Brown long-eared bat	*Plecotus auritus*
Soprano pipistrelle	*Pipistrellus pygmaeus*
Barbastelle	*Barbastella barbastellus*
Noctule	*Nyctalus noctula*
Whiskered bat	*Myotis mystacinus*
Oak	*Quercus spp*
Ash	*Fraxinus excelsior*
Beech	*Fagus spp*
Willow	*Salix spp*
Poplar	*Populus spp*
Nathusius' pipistrelle	*Pipistrellus nathusii*
Barn owl	*Tyto alba*
Quail	*Coturnix coturnix*
Hobby	*Falco subbuteo*
Skylark	*Alauda arvensis*

Common Name	Scientific name
Yellowhammer	*Emberiza citrinella*
House sparrow	*Passer domesticus*
Yellow wagtail	*Motacilla flava*
Linnet	*Linaria cannabina*
Greenfinch	*Chloris chloris*
Grey patridge	*Perdix perdix*
House martin	*Delichon urbicum*
Turtle dove	*Streptopelia turtur*
Wren	*Troglodytes troglodytes*
Whitethroat	*Sylvia communis*
Reed bunting	*Emberiza schoeniclus*
Woodpigeon	*Columba palumbus*
Sedge warbler	*Acrocephalus schoenobaenus*
Dunnock	*Prunella modularis*
Song thrush	*Turdus philomelos*
Mallard	*Anas platyrhynchos*
Oystercatcher	*Haematopus ostralegus*
Kestrel	*Falco tinnunculus*
Greylag goose	*Anser anser*
Lapwing	*Vanellus vanellus*

Common Name	Scientific name
Black headed gull	*Chroicocephalus ridibundus*
Wigeon	*Anas penelope*
Common gull	*Larus canus*
Starling	*Sturnus vulgaris*
Golden plover	*Pluvialis apricaria*
West European hedgehog	*Erinaceus europaeus*
Brown hare	*Lepus europaeus*
European eel	*Anguila penilla*
rye brome	*Bromus secalinus*
common cudweed	*Filago vulgaris*
frogbit	*Hydrocharis morsus-ranae*
hoary cinquefoil	*Potentilla argentea*
bird cherry	*Prunus padus*
Water fern	*Azolla filiculoides*
Parrot's feather	*Myriophyllum aquaticum*
Himalayan balsam	*Impatiens glandulifera*
Floating pennywort	*Hydrocotyle ranunculoides*
New Zealand pygmyweed	*Crassula helmsii*
Wall cotoneaster	*Cotoneaster horizontalis*
Japanese knotweed	*Reynoutria japonica*

Common Name	Scientific name
Chinese mitten crab	*Eriocheir sinensis*
American mink	*Neovison vison*
Hawthorn	*Crataegus monogyna*
Blackthorn	*Prunus spinosa*
Hazel	*Corylus avellana*
Privet rose	*Ligustrum vulgare*
Guelder-rose	*Viburnum opulus*
Willow scrub	*Baccharis salicifolia*
Bramble	*Rubus fruticosus*
Common reed	*Phragmites australis*
millet	*Panicum miliaceum*
Harvest mouse	*Micromys minutus*
river lamprey	*Lampetra fluviatilis*



one earth

solar farm

One Earth Solar Farm

Preliminary Environmental Information Report [EN010159]

Chapter 8: Hydrology and Hydrogeology

May 2024

One Earth Solar Farm Ltd

Planning Inspectorate Scheme Ref: EN010159

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Appendix 8-1: Hydrology and Hydrogeology Legislation and Policy

8. Hydrology and Hydrogeology

Summary of Preliminary Likely Significant Effects

8.1. This Chapter concludes there are no likely significant environmental effects of our Project on flooding from the River Trent, surface water flooding, water quality or groundwater flow during the construction, operation and decommissioning phases.

Introduction

8.2. This Chapter of the PEIR has been prepared by Logika and presents the preliminary likely significant environmental effects of our Project upon Hydrology and Hydrogeology. The experience of the consultants that have prepared this Chapter, who are competent experts for the purpose of the EIA Regulations, is set out in **Appendix 1-1** in **Chapter 1-6**. It is informed by the environmental information we have collected to date (which is detailed in this Chapter), as well as the current description of our Project, as set out in **Chapter 4: Our Project**.

8.3. This Chapter is supported by the following detailed information:

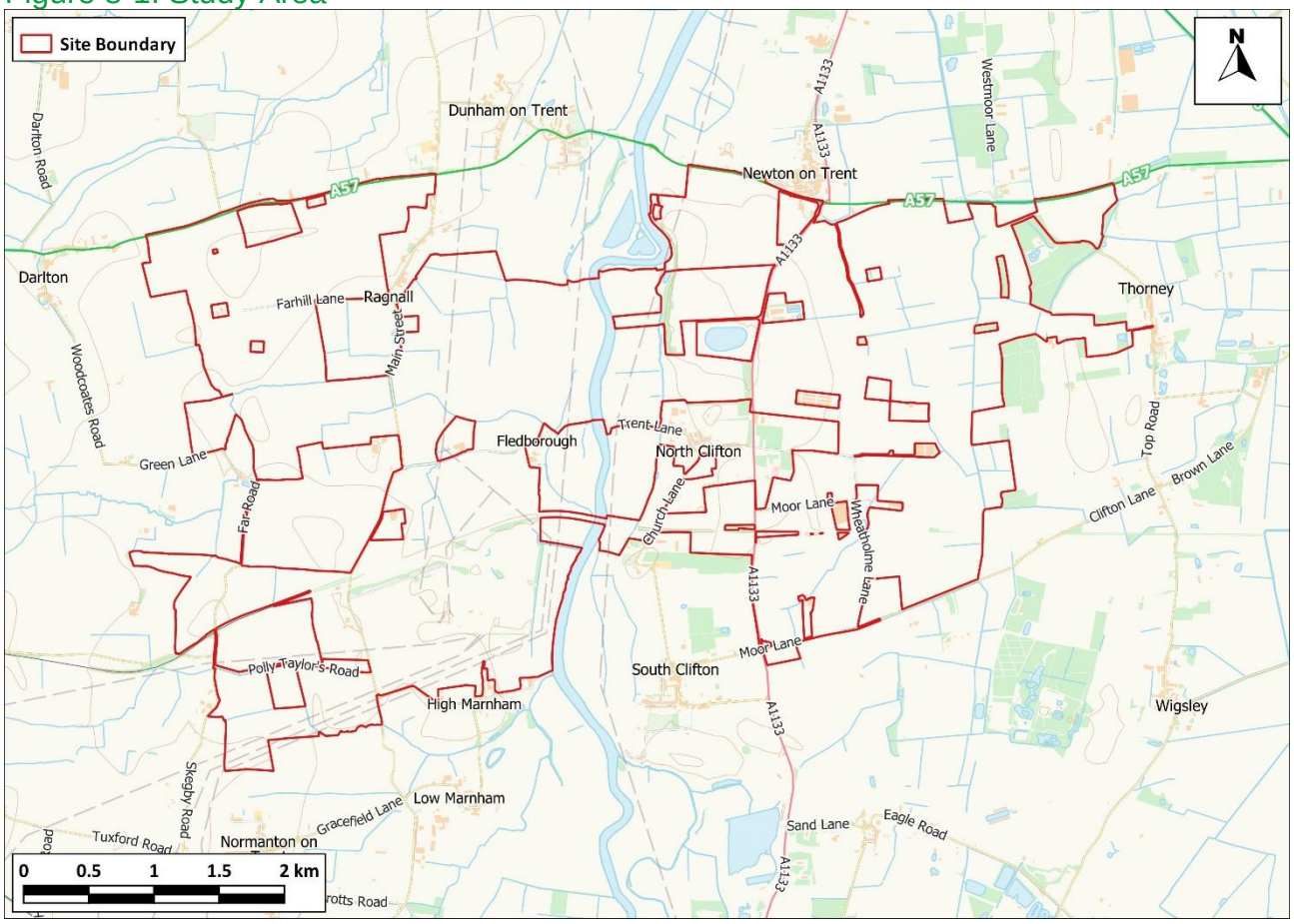
- **Appendix 8-1**: Hydrology and Hydrogeology Specific Legislation and Policy

Current Hydrology and Hydrogeology Conditions

Study Area

8.4. Given the nature of hydrology and hydrogeology (i.e. the flow of water), it is difficult to define a study area with confidence. The assessment of the baseline and proposed conditions therefore focusses on the site of our Project as shown in **Figure 8-1**, but consideration of the impacts that could occur in the wider area has been made (with regards to impacts to flood risk, groundwater and water quality for example).

Figure 8-1: Study Area



Collection of Hydrological and Hydrogeological Data

8.5. The following sources and data sets have been used to assess baseline flood risk and drainage at our Site:

- The Environment Agency (EA) Flood Map for Planning
- EA Long Term Flood Risk Mapping (including surface water and reservoir mapping)
- The EA Hydraulic Model for the River Trent
- British Geological Survey (BGS) Online Geology Mapping and Borehole Records
- BGS Aquifer Designation Data
- EA Groundwater Vulnerability Mapping
- EA Groundwater Source Protection Zone (SPZ) Mapping
- Bassetlaw Level 1 Strategic Flood Risk Assessment (SFRA)

8.6. In addition to the above, consultation and meetings have been held with the EA to discuss baseline flood risk at the Site as well as proposed mitigation.

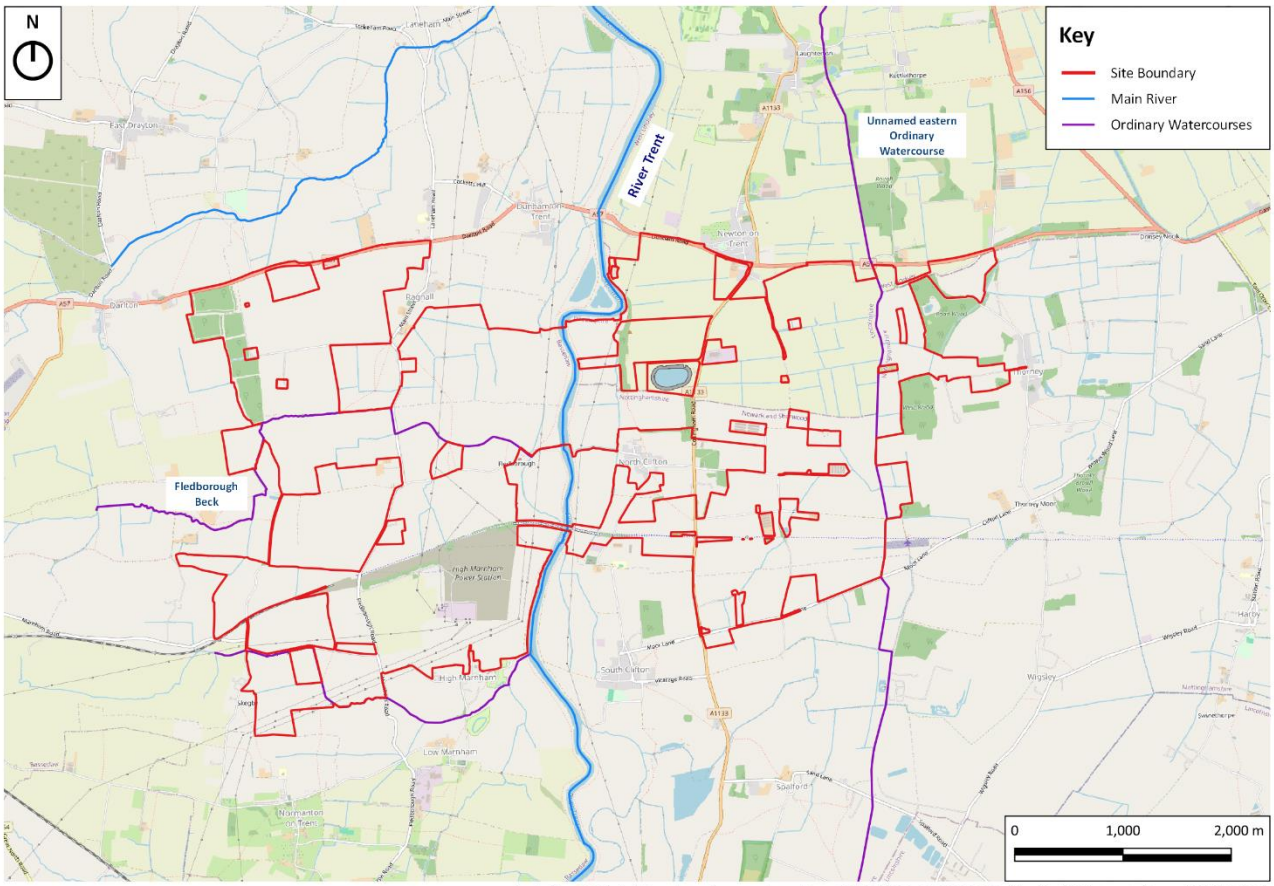
Hydrological and Hydrogeological Baseline Conditions

Existing Watercourses and Drainage Arrangement

8.7. As set out in **Figure 8-2** below, the River Trent flows through the centre of our Site. The River Trent is classified as a Main River[1] by the EA and although there are tidal influences associated with the watercourse, at our Site this is considered to be fluvially dominated i.e. water levels are generally dictated by rainfall within the river catchment rather than tidal fluctuations.

8.8. In addition to the River Trent, there are a number of ordinary watercourses[2] located within the Site boundary as illustrated in **Figure 8-2**.

Figure 8-2: Existing Watercourses



Google Maps (2024). Available at: https://www.google.co.uk/maps/@53.2272889,-0.7682997,6738m/data=!3m1!1e3?entry=ttu (Accessed 05 APRIL 2024)

[1] Main rivers are usually larger rivers and streams. The EA carries out maintenance, improvement or construction work on main rivers to manage flood risk.

[2] Ordinary watercourses are other river and streams that are not considered to be main rivers, these are typically smaller watercourses. The Lead Local Flood Authority, District Council and Internal Drainage Boards carry out flood risk management work on ordinary watercourses.

8.9. The vast majority of our Site is greenfield in nature (this includes the agricultural uses) and therefore is not anticipated to have any formal surface water drainage networks in place. It is anticipated that precipitation at our Site simply infiltrates to the ground with any additional runoff being directed to the existing network of ordinary watercourses and field drains which ultimately discharge to the River Trent.

Ground Conditions

8.10. **Chapter 9: Land and Soils** indicates the following with regards to the underlying geology at our Site:

- Superficial geology is present across much of our Site, although there are areas with no mapped deposits, predominantly in the western part of our Site, and more restricted areas to the east of the River Trent.
- Superficial deposits of Holme Pierrepoint Sand and Gravel member are present around Low Marnham, from Fledborough to Woodcoates, in bands to the west and east of the River Trent and in a more widespread distribution further east.
- Alluvium is present along the route of the River Trent and in more limited extents along more minor watercourses throughout our Site. An area of Devensian Till (mainly clay) is shown in the north west of our Site, between Ragnall and Darlton. To the east of the River Trent, there are some deposits of Blown Sand.
- Bedrock geology is dominated by mudstone from the Mercia Mudstone Group. This comprises mainly red mudstone with some layers of siltstones or halite-bearing units. Thin sandstone beds may be present. A small section of our Site at the far eastern extent is underlain by mudstones from the Penarth Group. These are grey to black mudstones with occasional limestone or sandstone layers.

Hydrogeology

8.11. With regards to aquifer[3] designation, British Geological Survey (BGS) data illustrated within MagicMap indicates the following:

- The bedrock geology of Mercia Mudstone is classified as a secondary B aquifer meaning they may store and yield limited amounts of groundwater.
- The bedrock geology of Penarth Group is classified as secondary undifferentiated, meaning it is not possible to attribute either category A or B to a rock type. In most cases this means the layer has previously been designated as both minor and non-aquifer due to variable characteristics of the rock type.
- Where superficial deposits are present, they are predominantly categorised as Secondary A aquifers meaning that there are permeable layers present that are capable of storing water at a local rather than strategic scale. The only exception to this is a localised area between Ragnall and Darlton where superficial deposits are classified as secondary undifferentiated aquifer.

[3] An aquifer is a body of permeable rock which can contain or transmit groundwater

BGS groundwater vulnerability mapping illustrated on MagicMap indicates the following:

- The bedrock geology is predominantly shown to have a high groundwater vulnerability classification meaning these are high priority groundwater resources that have very limited natural protection. This results in a high overall pollution risk to groundwater from surface activities. Operations or activities in these areas are likely to require additional measures over and above good practice pollution prevention requirements to ensure that groundwater isn't impacted.
- There are localised areas within our Site where a medium groundwater vulnerability classification is noted. This indicates that these are medium priority groundwater resources that have some natural protection resulting in a moderate overall groundwater risk. Activities in these areas should as a minimum follow good practice to ensure they do not cause groundwater pollution.
- The superficial deposits have a medium-high groundwater vulnerability classification indicating these are high priority groundwater resources that have limited natural protection. This results in a medium-high overall pollution risk to groundwater for surface activities. Activities in these areas may require additional measures over and above good practice to ensure that they do not cause groundwater pollution.

8.12. As set out in **Chapter 9: Land and Soils**, there are five groundwater abstraction points located close to the River Trent, east of Ragnall. In terms of SPZs[4], each of these comprises a small central Zone 1 protection area, surrounded by a slightly larger Zone 1 (subsurface activity) area, and then a larger Zone 2 (subsurface activity). One of these inner zones is mainly within the Site boundary, with its associated Zone 2 partly inside and partly outside the Site boundary. Two of the others are close together, with combined Zone 1 areas that are partly within the Site boundary. The associated Zone 2 is also partially within the Site boundary. The inner zones for the other two SPZs are outside the Site boundary, with the Zone 2 just encroaching on the far north western corner of our Site.

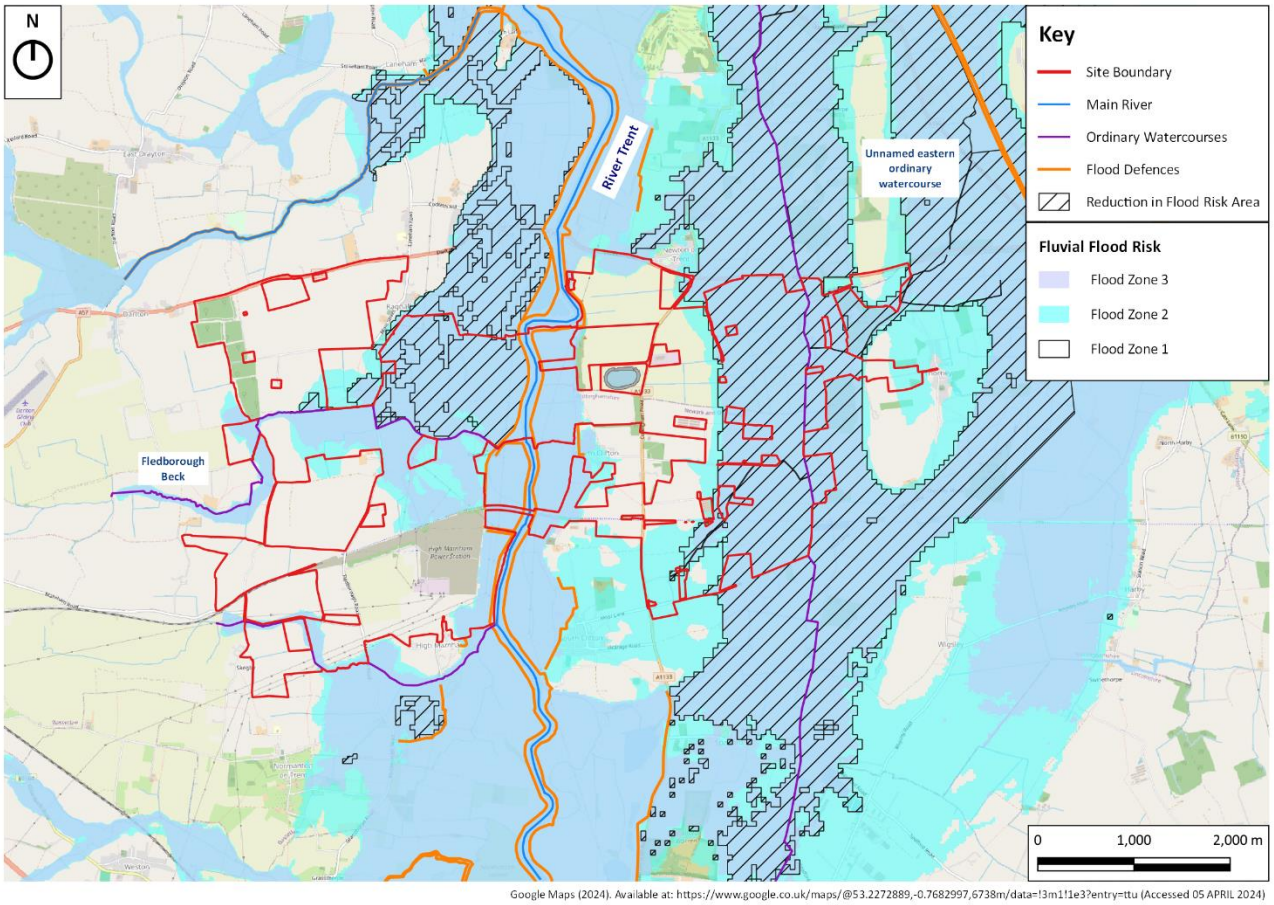
Flood Risk from All Sources

Fluvial and Tidal

8.13. According to the EA's Flood Map for planning (**Figure 8-3**), large areas of our Site are shown to be within Flood Zones 2 and 3, indicating a medium to high probability of flooding from rivers and the sea. This flooding is considered to originate and be predominantly associated with the River Trent which flows through the centre of our Site, however as set out previously, there are a number of ordinary watercourses within our Site which are hydraulically connected to the River Trent.

[4] Groundwater sources represent wells, boreholes and springs which are used to supply drinking water. The Zones show the level of risk to the source from contamination. Zone 1 is defined as an area with a 50 day travel time from pollutant to source. Zone 2 is defined as an area with a 400 day travel time from pollutant to source.

Figure 8-3: Flood Map for Planning



Google Maps (2024). Available at: https://www.google.co.uk/maps/@53.2272889,-0.7682997,6738m/data=!3m1!1e3?entry=ttu (Accessed 05 APRIL 2024)

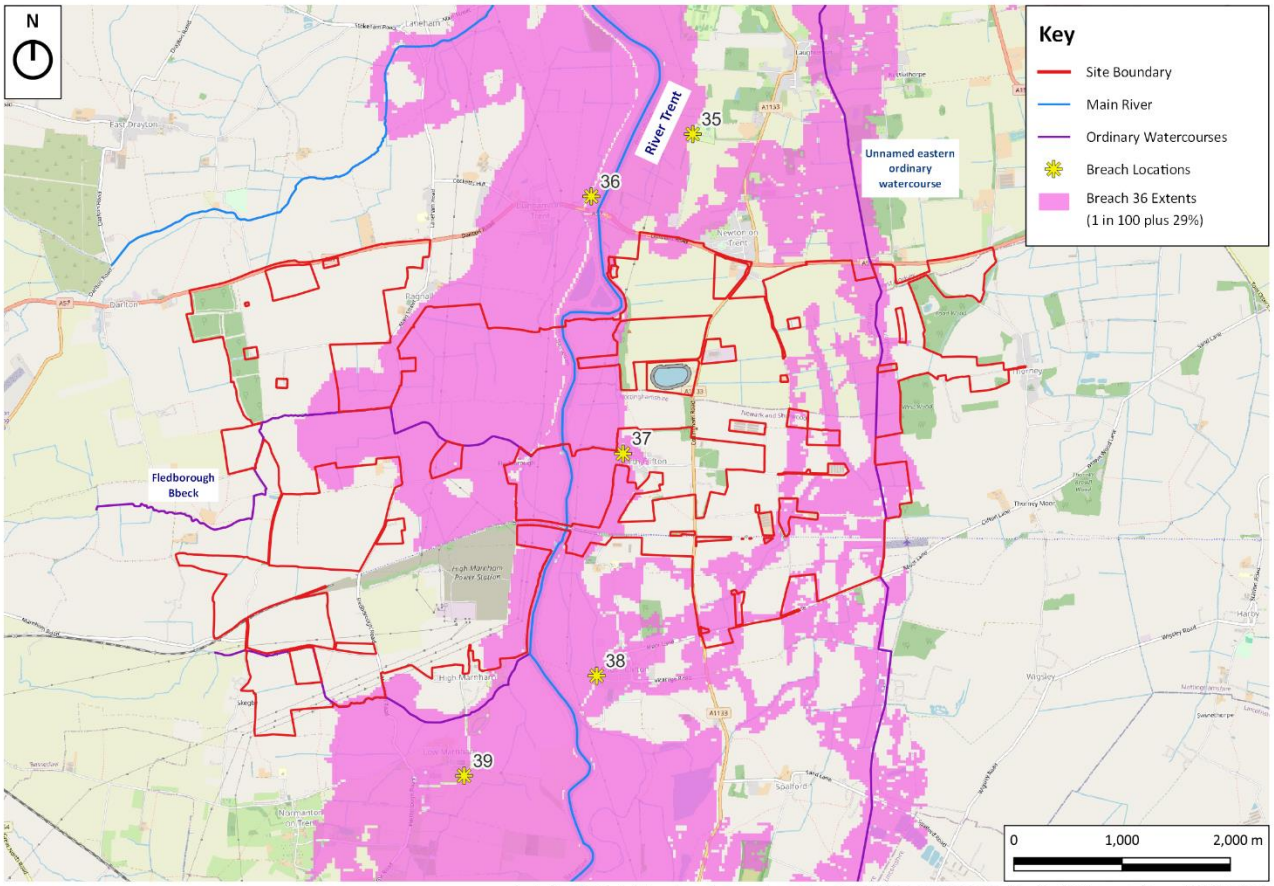
8.14. The EA's Flood Map for Planning shows the presence of flood defences, both on the banks of River Trent and set back from its main channel. The Standard of Protection (SoP) that these defences provide varies along length of the watercourse and is dependent on the water and defence level. A number of areas within our Site therefore benefit from these defences and these areas are illustrated in **Figure 8-3** by the hatch indicating "Reduction in Flood Risk Area".

8.15. Based on an assessment of the hydraulic modelling for the River Trent, it is confirmed that flooding at our Site is fluvially dominated rather than occurring from tidal sources.

8.16. In addition to the Flood Map for Planning, the EA have also modelled a residual event that considers the extent of flooding should there be a breach (failure) of the river defences. A number of breach locations and scenarios are included in the EA modelling, however location 36 is considered to have the largest extent at our Site in 1 in 100 year plus climate change event[5] and this is illustrated in **Figure 8-4**.

[5] Refers to a flood event with a 1 in 100 year probability of occurring in any given year and includes for an increase of 29% in river flows to allow for climate change.

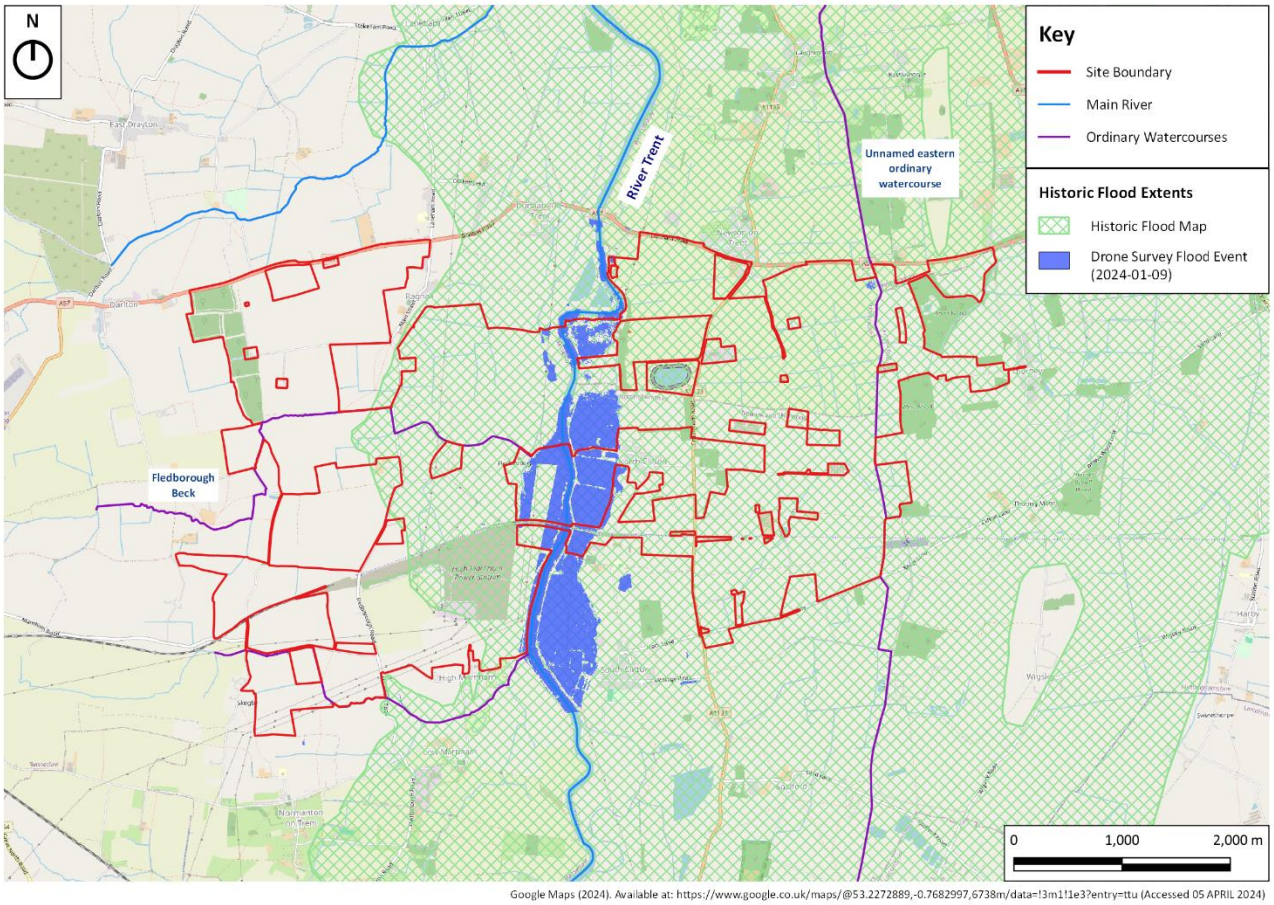
Figure 8-4: Residual (Breach) Flood Extents



Google Maps (2024). Available at: https://www.google.co.uk/maps/@53.2272889,-0.7682997,6738m/data=!3m1!1e3?entry=ttu (Accessed 05 APRIL 2024)

8.17. Historic flood records providing by the EA (**Figure 8-5**) indicate that there are recorded flooding events at the Site. Most recently, flooding at our Site occurred in January 2024 as a result of high water levels within the River Trent and ordinary watercourses, the extent of this flooding was captured via drone survey and is included in **Figure 8-5** below. It is worth noting that the drone survey was undertaken after the peak of the flooding and the extent illustrated may therefore not be the maximum that occurred.

Figure 8-5: Historic Flood Extents



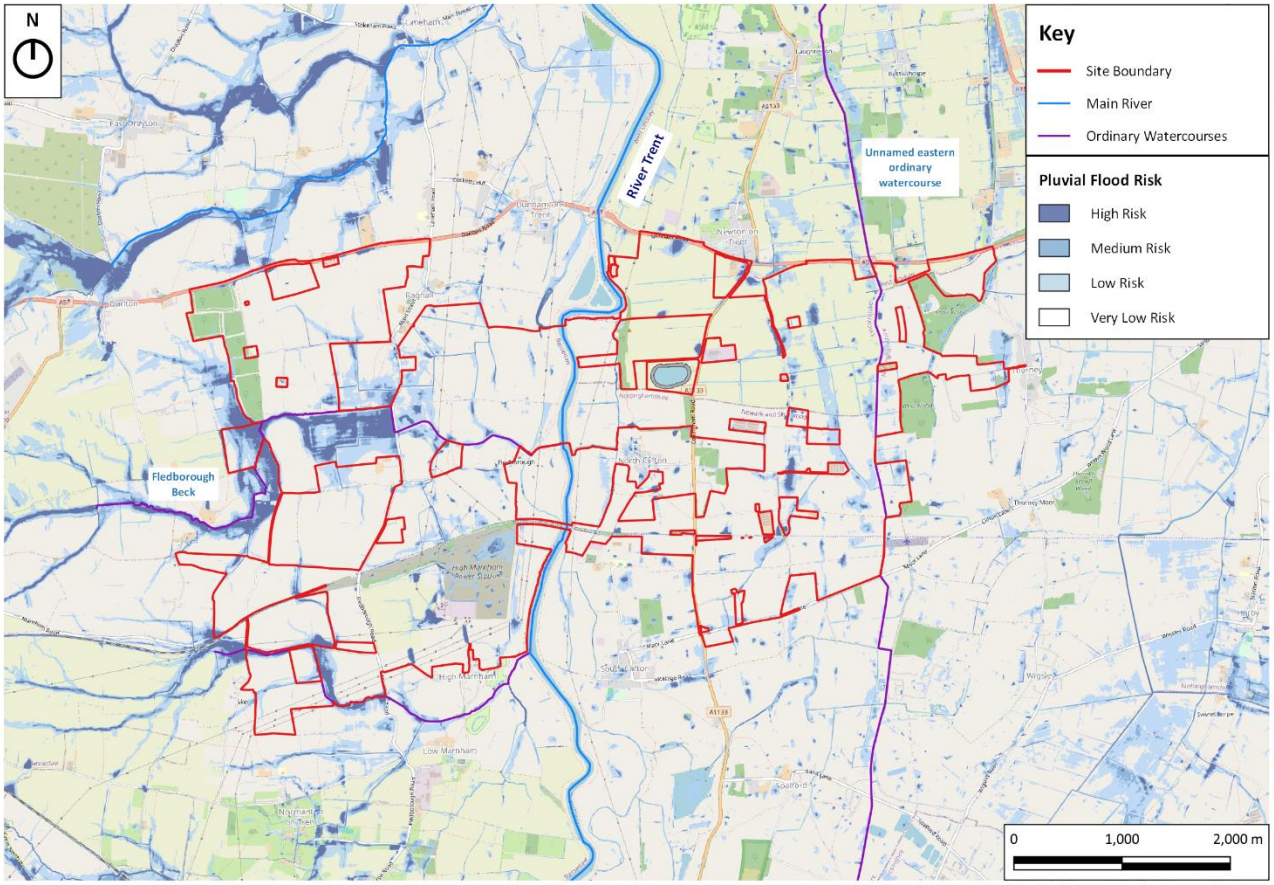
Google Maps (2024). Available at: https://www.google.co.uk/maps/@53.2272889,-0.7682997,6738m/data=!3m1!1e3?entry=ttu (Accessed 05 APRIL 2024)

8.18. The baseline risk of flooding from fluvial sources is therefore considered to be medium to high.

Pluvial

8.19. The EA Flood Risk from Surface Water mapping indicates the majority of our Site is at very low risk of flooding from fluvial sources (see **Figure 8-6**). There are however localised areas within our Site which are shown to be at low, medium and high risk, which are largely associated with the Fledborough Beck in the west and unnamed Ordinary Watercourses in the southwest and east of our Site.

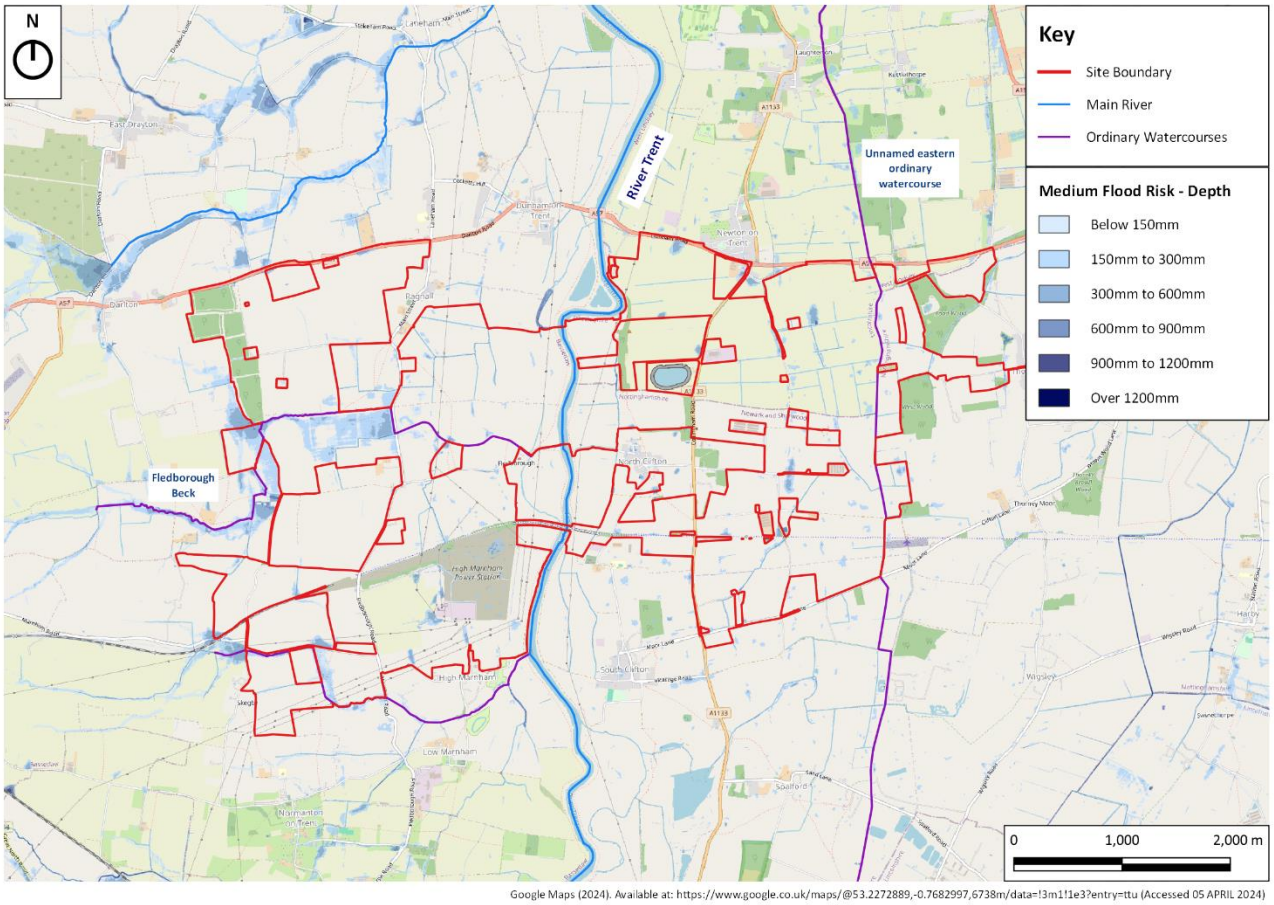
Figure 8-6: Flood Risk from Surface Water



Google Maps (2024). Available at: https://www.google.co.uk/maps/@53.2272889,-0.7682997,6738m/data=!3m1!1e3?entry=ttu (Accessed 05 APRIL 2024)

8.20. Review of the Medium Risk Surface Water Flood depth map shows that flood depths outside of these channels are generally below 300mm, however there are localised areas where flood depths of up to 900mm are experienced (see **Figure 8-7**).

Figure 8-7: Flood Risk Depth from Medium Risk



Google Maps (2024). Available at: https://www.google.co.uk/maps/@53.2272889,-0.7682997,6738m/data=!3m1!1e3?entry=ttu (Accessed 05 APRIL 2024)

The risk of flooding from surface water is therefore in general considered to be low.

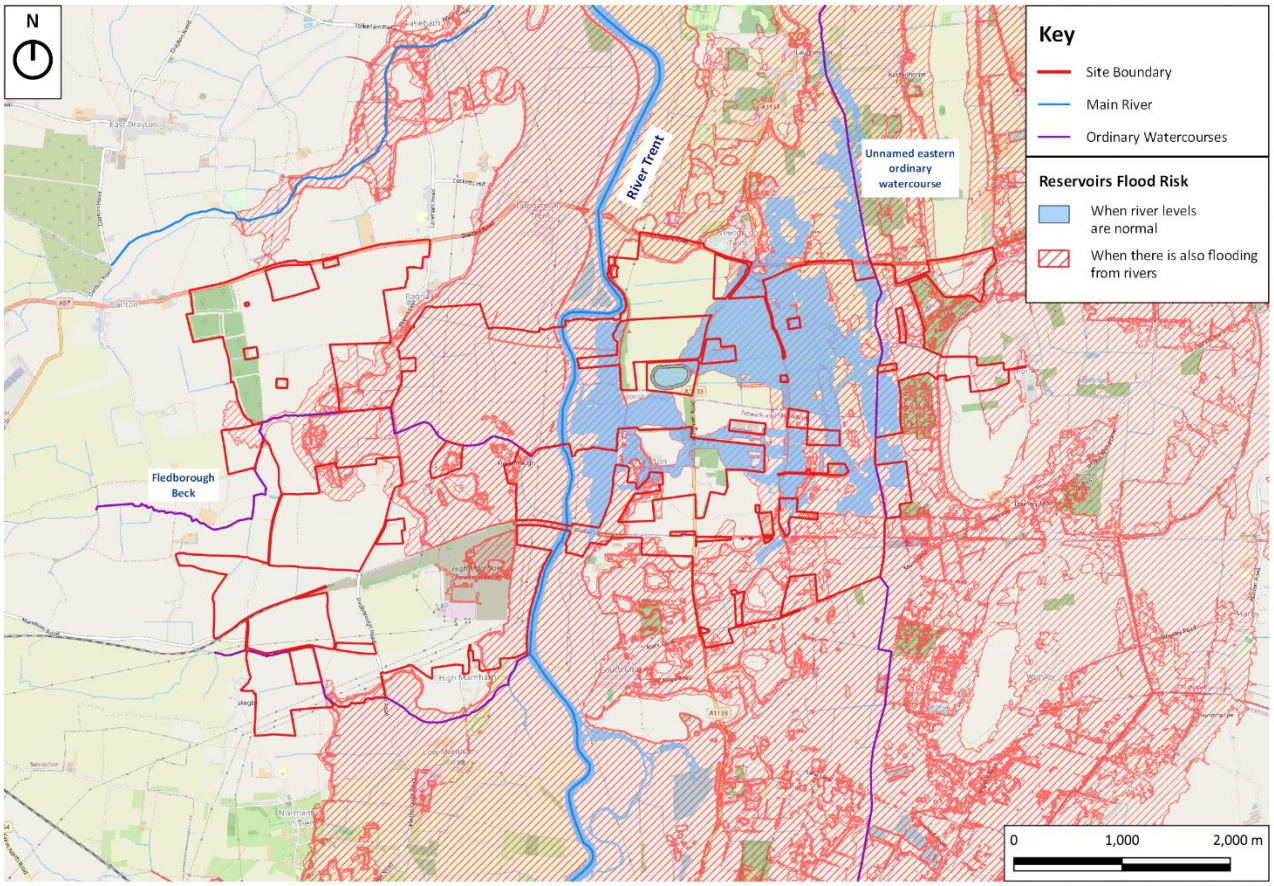
Groundwater

8.21. Mapping from the Bassetlaw Level 1 SFRA shows that the areas of our Site west of the River Trent lie where there is a susceptibility to groundwater flooding ranging from greater than 75% to less than 25%. The areas of highest susceptibility are closest to the Trent's western bank, which is anticipated to be due to the permeable Alluvium superficial deposits.

Artificial Sources

8.22. The EA Flood Risk from Reservoirs mapping indicates that no flooding would be experienced at our Site when river levels are normal. When there is also flooding from rivers however, large areas within the central and eastern areas of our Site are affected by flooding from reservoirs (see **Figure 8-8**). It is worth noting that reservoirs are maintained to a high standard and are inspected regularly, and as such the chance of reservoir failure is considered to be extremely low.

Figure 8-8: Flood Risk from Reservoirs



Google Maps (2024). Available at: https://www.google.co.uk/maps/@53.2272889,-0.7682997,6738m/data=!3m1!1e3?entry=ttu (Accessed 05 APRIL 2024)

Future Hydrological and Hydrogeological Conditions

8.23. It is considered that there would be very minimal changes to our Site in the future baseline scenario. The main implications would occur as a result of climate change impacts on fluvial and surface water flood extents, as well as a natural increase in the greenfield runoff rate as a result of increased rainfall intensity.

8.24. For clarity, the climate change requirements to allow for increases in rainfall intensity and peak river flows are set out below:

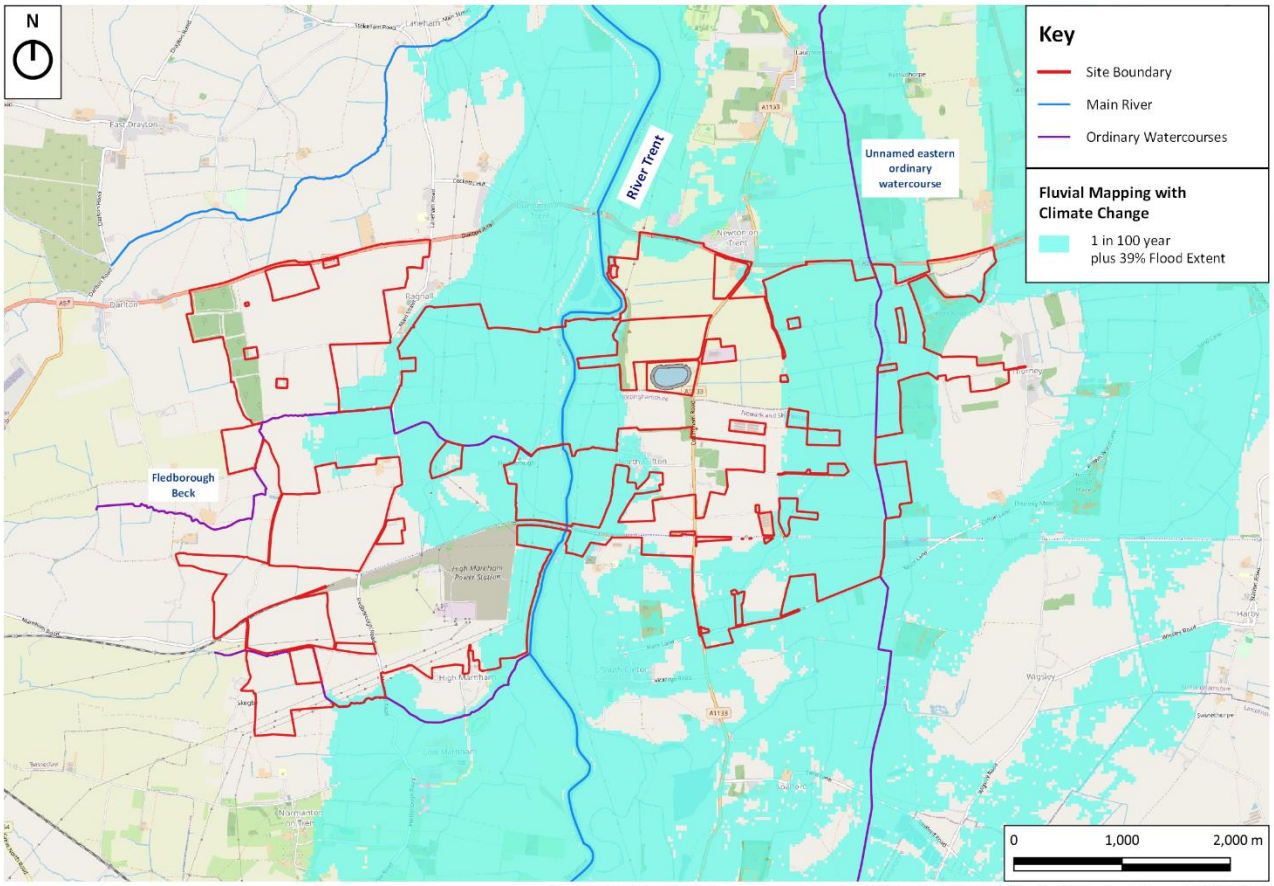
- 40% increase in rainfall intensity when assessing surface water flood risk and drainage systems.
- 39% increase in peak river flows when assessing fluvial flood risk.

8.25. The climate change requirements noted above are both applied to what is referred to as the “design flood event” which for our Project is the 1 in 100 year event.

Future Predicted Results

8.26. The hydraulic modelling from the EA includes results for the 1 in 100 year plus 39% climate change event and the extents in this event are summarised in **Figure 8-9** below.

Figure 8-9: Fluvial Mapping with Climate Change



Google Maps (2024). Available at: https://www.google.co.uk/maps/@53.2272889,-0.7682997,6738m/data=!3m1!1e3?entry=ttu (Accessed 05 APRIL 2024)

8.27. Mapping illustrating the extent of surface water flooding as a result of climate change events are not available as these have not typically been modelled.

Environmental Measures

Embedded Mitigation during Construction and Decommissioning

8.28. An Outline Construction Environment Management Plan (oCEMP) and a Decomissioning Management Plan (DMP) will set out the best practice measures to be followed, and will be adopted to minimise the environmental impacts of the construction and decommissioning works. A more detailed list of mitigation measures is provided in the Construction Environmental Measures Register detailed in **Appendix 4-2** in **Chapter 1-6**, however a high level summary of items that are anticipated to be covered in the oCEMP and oDMP are provided below.

- Any potential changes to the existing fluvial or surface water flow routes will be addressed within the oCEMP and DMP which will outline any temporary measures that would be put in place to control flood flows (such as preventing flows from entering open excavations). No machinery or spoil/materials would be stored within the identified flood extent, to ensure no impact on contractors, or deviation in flow routes due to the proposed works.

- Although there will be some changes to the drainage regime as a result of construction and decommissioning activities on Site (i.e. due to storage areas, facilities, and temporary changes in ground level), these will be addressed within the oCEMP and DMP. The oCEMP and DMP will outline any temporary measures that will be put in place to control surface water runoff (such as through temporary attenuation features) and reduce the risk of polluted surface water from discharging to ground or entering the ordinary watercourses on Site (such as through the use of environmental capture techniques and silt traps).

Embedded Measures for Watercourses

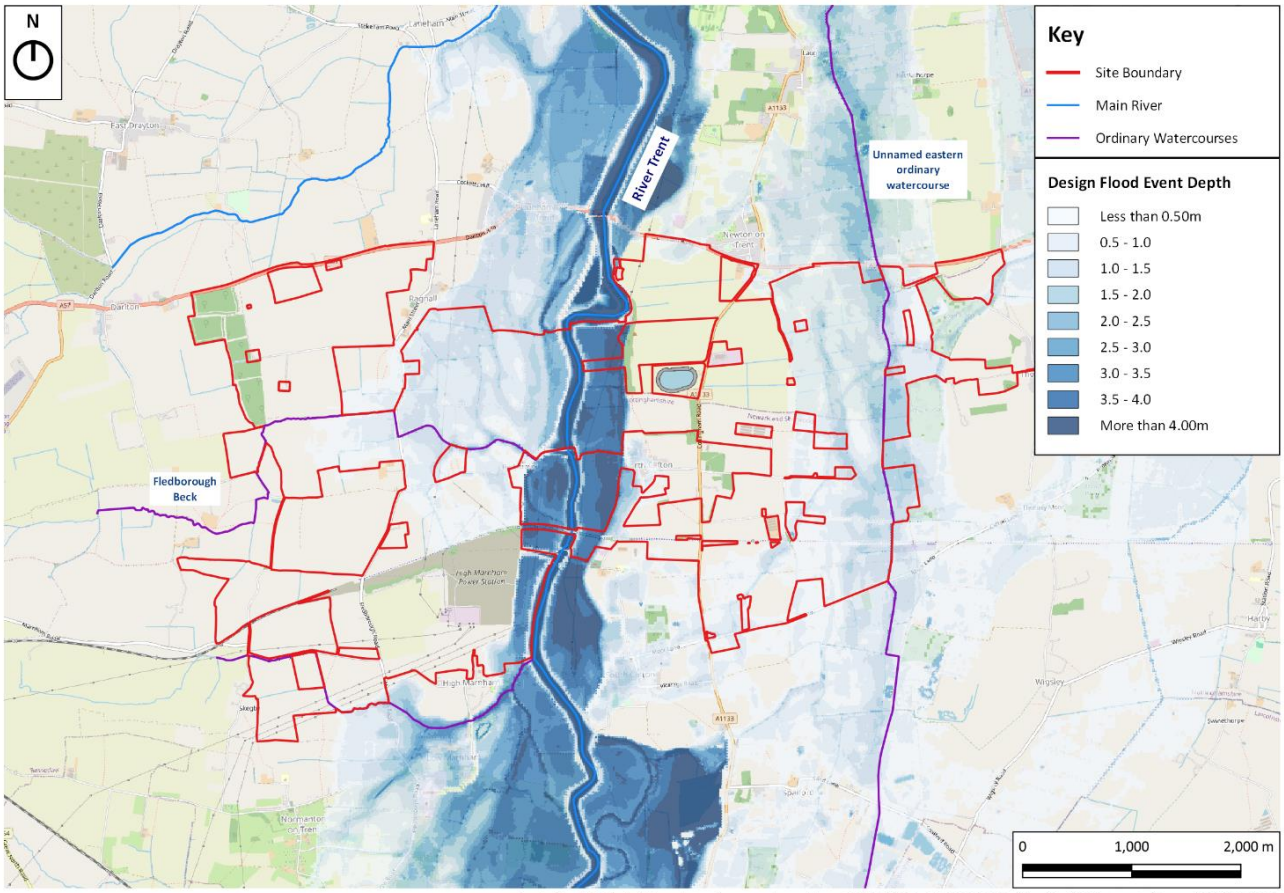
8.29. As detailed in the Design Principles of our Project (which are listed in **Appendix 4-1** in **Chapter 1-6**), it is proposed that suitable offsets (a minimum of 10m from water bodies; 8m from ordinary watercourses such as drains; and 16m from the River Trent) will be provided from the top of bank of all main rivers and ordinary watercourses within our Site to ensure that ecological corridors are maintained and access for maintenance works to the watercourses are provided.

Fluvial Embedded Measures

8.30. As set out previously, the design fluvial flood event for our Site is the 1 in 100 year plus 39% climate change scenario and this has been considered in assessing flood risk and any mitigation required as part of the design.

8.31. The flood depths for this event are summarised in Figure 8-10 below which illustrates that significant depths (greater than 4m) would occur adjacent to the River Trent on the eastern bank and that depths elsewhere generally range from less than 0.5m to 2.0m.

Figure 8-10: Design Flood Event Depth Mapping

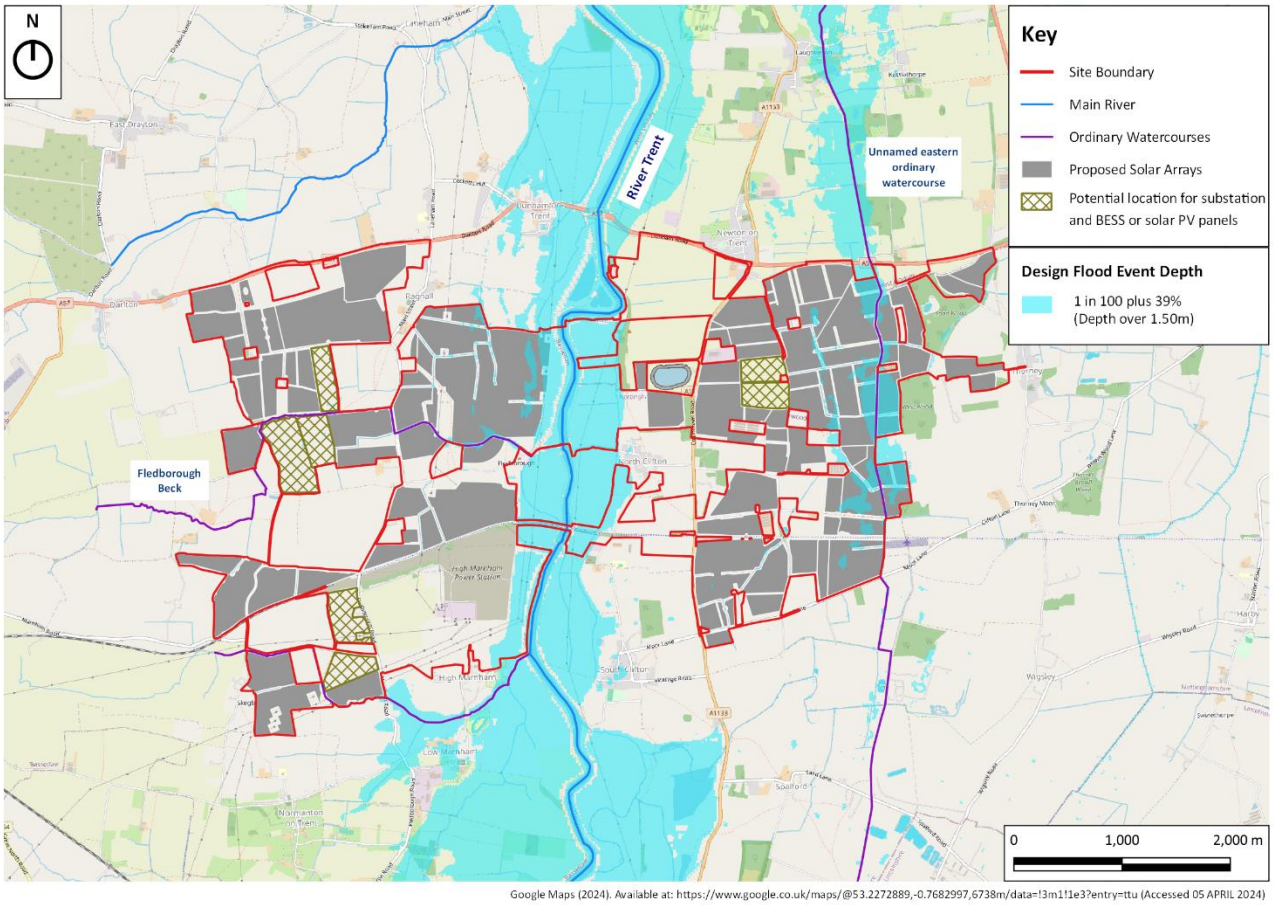


Google Maps (2024). Available at: https://www.google.co.uk/maps/@53.2272889,-0.7682997,6738m/data=!3m1!1e3?entry=ttu (Accessed 05 APRIL 2024)

8.32. Based on discussions with the EA, there is a requirement to raise the solar panels to be above the design flood level and an assessment of what height of raising is feasible has been undertaken, whilst taking into account other technical disciplines such as visual impacts.

8.33. The conclusion of this assessment is that the base of the flood panels can be reasonably raised to be 1.8m above ground level. Taking into account a 300mm freeboard (i.e. gap between the flood level and base of the panels to allow for debris in the event of flood to pass beneath the solar panels), the depth of flooding that has been used to inform where panels can be located is 1.5m and the extent of these depths is shown in **Figure 8-11** below.

Figure 8-11: Design Flood Event Depth Greater than 1.5m



Google Maps (2024). Available at: https://www.google.co.uk/maps/@53.2272889,-0.7682997,6738m/data=!3m1!1e3?entry=ttu (Accessed 05 APRIL 2024)

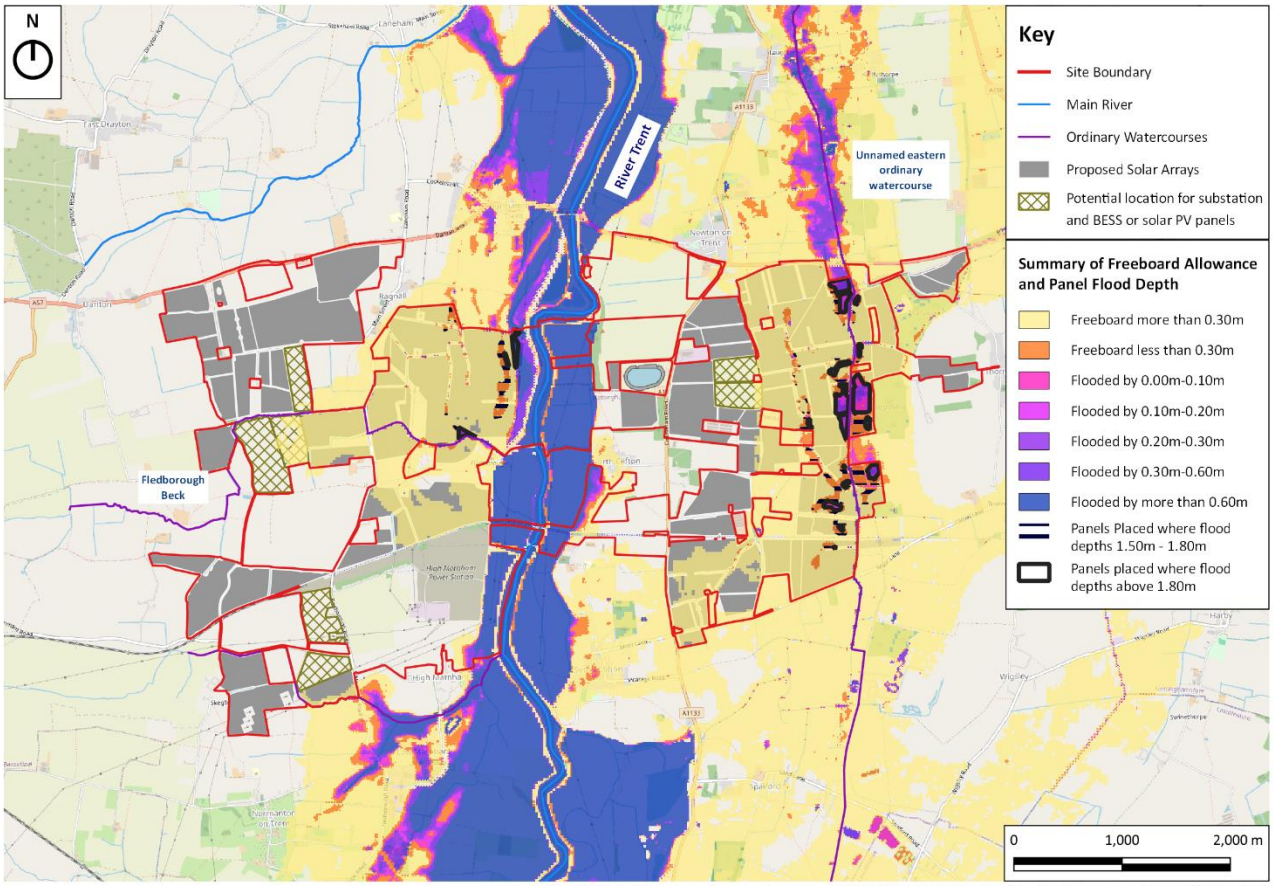
8.34. In general, it is proposed that within our Project solar panels will not be located in areas where flood depths exceed 1.5m to ensure that the solar array will remain operational in flood conditions and the freeboard allowance will ensure there is no significant blockage to flood flows.

8.35. There are however some localised positions within our Project where this is not feasible, namely to the far eastern boundary of our Site and on the western banks of the River Trent. Although in these locations, the depth of flooding will be greater than 1.5m, many of the panels set at 1.8m above ground will still be above the flood level but will have a freeboard of less than 300mm. Only a small portion of the solar panels would experience flooding at their base and the depth of flooding to the panels will be limited, as illustrated in **Figure 8-12**.

8.36. It is worth noting that panels will only be raised to the maximum height of 1.8m above ground level where this is necessary. In locations where flood depths are lower, the panels will be raised accordingly to a lower height above ground level.

8.37. This approach has been discussed and agreed in principle with the EA.

Figure 8-12: Summary of Freeboard Allowance and Panel Flood Depths



Google Maps (2024). Available at: https://www.google.co.uk/maps/@53.2272889,-0.7682997,6738m/data=!3m1!1e3?entry=ttu (Accessed 05 APRIL 2024)

8.38. With regards to the impact in a residual (breach) event (i.e. the flood defence banks along the River Trent failing), a similar assessment of depths greater than 1.5m and freeboard considerations has been undertaken. With regards to the depths greater than 1.5m, within our Project the extent to the east is no worse in the breach scenario when compared to the design flood event, meaning that the conclusions outlined for this area remain. For the areas to the west of the River Trent within our Project, the extent of flooding greater than 1.5m in depth is larger than in the design event however, a freeboard will still be provided for the majority of the area, it is just that this freeboard is less than 300mm. Although there will be a greater portion of solar panels experiencing flooding at their base in the breach scenario, this is considered to be a residual event and the risk of occurrence and impact to our Project is considered to be acceptable. This approach has been discussed and agreed in principle with the EA.

8.39. Wherever possible, within our Project, sensitive equipment (such as BESS and substations) is proposed to be located outside of the flood extents.

8.40. In addition wherever possible, it is proposed that no land raising will be undertaken as part of our Project to ensure that there is no increase in flood risk to our Site or surrounding areas. There may be some limited locations where land raising within the floodplain is required to provide protection to proposed infrastructure (such as inverters) that cannot be located outside the floodplain. To accommodate for these areas and ensure there is no increase in flood risk, level for level floodplain compensation will be provided. This would be assessed within the next stages.

Surface Water Flooding (Pluvial) Embedded Measures

8.41. The impact that surface water flooding will have on our Project has been considered within the parameter plan and Design Principles (see **Appendix 4-1** in **Chapter 1-6**), and where possible the solar infrastructure has been located outside of areas of surface water flooding. It is noted that the above fluvial embedded measures will also provide mitigation to surface water flooding.

Surface Water Drainage Embedded Measures

8.42. For the solar array, it is proposed that rainfall hitting the panels will simply discharge to the retained natural ground beneath, therefore having little to no effect when compared to the greenfield scenario. It is however proposed that Sustainable Drainage Systems (SuDS) will be incorporated wherever practicable to provide multi-functional benefits associated with water quantity, quality and biodiversity. SuDS are designed to mimic natural drainage as closely as possible and include features such as ponds, swales (managed ditches) and filter drains, all of which provide multifunctional benefits.

8.43. For the larger areas of hardstanding (such as the BESS and substation), a quantified drainage strategy will be produced, confirming the attenuation requirements in order to restrict runoff to match the greenfield rates before discharging to the surrounding watercourses. By restricting to the greenfield rate, it will ensure that there are no negative impacts with regards to flood risk and existing watercourses. Again, SuDS features will be incorporated within these areas to provide water quantity, quality and biodiversity benefits.

Stakeholder Consultation

Table 8-1: Overview **of Stakeholder Consultation**

Stakeholder	Date of Consultation	Relevant Considerations for the PEIR
EA	13/09/2023	Embedded mitigation for fluvial flood risk in the design flood event agreed.
EA	27/02/2024	Updates to our Project provided and approach to mitigation/impacts in a breach scenario agreed.
LLFA	02/05/2024	Approach to surface water drainage embedded measures agreed in principle.

Potential Likely Significant Effects Scoped Out

8.44. **Table 8-2** presents the elements which have been scoped out as it is considered no likely significant effects will occur.

Table 8-2: Effects Scoped Out

Effects Scoped Out	Justification
Foul Water	No assessment is proposed of the effect that increased foul flows will have on the capacity of the surrounding Anglian Water and Severn Trent network and wastewater treatment works. Construction impacts will be temporary and using existing foul water infrastructure or more often, would be served by welfare facilities that are unconnected to the mains, thus meaning that there would be only very limited foul flow increases. The potential for increases during operation are also limited with maintenance of our Project being undertaken by a small number of people and comprising only repairs and cleaning of the panels and other infrastructure. As a result, it is proposed to scope out the effect of changes to the foul water network from detailed assessment, which has been agreed by PINs in the scoping opinion (see Volume 3: Scoping Consultation).

Preliminary Environmental Assessment

Construction and Decommissioning Phase

Construction and Decommissioning – Flood Risk and Drainage

8.45. The potential flood and drainage risks associated with the construction and decommissioning are summarised below:

- Increased localised flood risk due to earthworks
- Impacts to water quality due to silts and sediments
- Impacts to water quality due to chemical spillages
- Impacts to water quality due to cement and concrete dust

Approach

8.46. There is no specific quantitative methodology that allows the flood risk and drainage effects to be assessed, however the assessment is based on technical understanding of flood risk at our Site and how runoff will be managed during construction and decommissioning.

8.47. With this in mind, determining the effects of both the construction and decommissioning is based on professional judgement and is qualitative. The experience of the consultants that have prepared this chapter, who are competent experts for the purpose of the EIA Regulations, is set out in **Appendix 1-1** in **Chapter 1-6**.

Receptors and Receptor Sensitivity

8.48. Receptors for any increased flood risk are as follows:

- Users of the Site
- Areas surrounding our Site and residents in these areas

8.49. Receptors relating to water quality are as follows:

- The existing watercourses within and adjacent to Site
- Groundwater

Receptor sensitivity classifications have been determined based on professional experience and are summarised below.

- High - High importance and rarity, national scale, and limited potential for substitution
- Medium - Medium or high importance and rarity, regional scale, limited potential for substitution
- Low - Low or medium importance and rarity, local scale
- Negligible - Very low importance and rarity, local scale

Defining Impacts

8.50. The likely construction and decommissioning effects are based upon understanding of the construction and decommissioning works, including the optionality of the cable crossing the River Trent. A qualitative assessment of likely effects has been carried out.

Preliminary Assessment

8.51. As set out previously, an oCEMP will be adopted to minimise the environmental impacts of the construction and an ODMP will be adopted setting out best practice measures which will be incorporated during the decommissioning works. A detailed list of mitigation measures relating to the construction phase is provided in **Appendix 4-2** in in **Chapter 1-6**.

8.52. Following the implementation of these environmental management plans, there will be no likely significant effects to the receptors during construction or decommissioning.

Operational Phase

Flood Risk Effects on Users of the Site

Approach

8.53. As set out previously, there is no specific quantitative methodology that allows the flood risk and drainage effects to be assessed. Determining the effects of the completed development is therefore based on professional judgement and is qualitative.

Receptors and Receptor Sensitivity

8.54. The receptor for this effect are the users of our Project, such as electrical engineers undertaking works on Site. The sensitivity of this receptor is outlined in **paragraph 8.48** above.

Defining Impacts

8.55. The effects have been defined using professional judgement, by considering numerous factors including the magnitude of impact the operational development could have on flood risk at our Site, taking in to account the environmental measures that will be implemented.

Preliminary Assessment

8.56. A Flood Risk Assessment (FRA) will be submitted as part of our DCO application. This will set out the technical details to ensure that flood risk is not increased as a result of our Project.

8.57. Although our Project is located in an area with medium to high risk of flooding, the embedded mitigation measures noted previously that will be incorporated within the design will ensure there is no increase in flood risk to users of our Site (see **Appendix 4.1** in **Chapter 1-6** relating to the Design Principles of our Project). In addition, an Outline Operational Environmental Management Plan will set out the measures to be undertaken in the event of a flood during the operational phase of our Project.

8.58. Our Project will be implemented in line with the Design Principles and the measures set out in our FRA (which will be submitted as part of the DCO application), and as such, there will be no likely significant effects to the receptors during operation.

Next Steps

8.59. The FRA will be prepared and submitted with the DCO application. The FRA will:

- Assess flood risk in greater detail;
- Outline the specific measures that will be adopted to ensure that flood risk is not increased as a result of our Project;
- Outline the management measures for surface water runoff to ensure there is no increase in flood risk or pollution potential as a result of our Project; and
- Assess the hydrogeology and impact of our Project on groundwater flows in greater detail;

Flood Risk Effects to Areas off Site

Approach

8.60. As set out previously, there is no specific quantitative methodology that allows the flood risk and drainage effects to be assessed. Determining the effects of our Project is therefore based on professional judgement and is qualitative.

Receptors and Receptor Sensitivity

8.61. The receptor for this effect is the areas surrounding our Site and residents in these areas that could be impacted by any changes in flood risk. The sensitivity of this receptor is outlined in **paragraph 8.48** above.

Defining Impacts

8.62. The effects have been defined using professional judgement, by considering numerous factors including the magnitude of impact our Project could have on flood risk at and in the vicinity of our Site, taking in to account the environmental measures that will be implemented.

Preliminary Assessment

8.63. As set out previously, one purpose of the FRA is to ensure that flood risk is not increased as a result of our Project.

8.64. Although our Project is located in an area with medium to high risk of flooding, mitigation measures will be embedded into the design to ensure there is no increase in flood risk to areas off Site (see **Appendix 4.1** in **Chapter 1-6** for further details on the Design Principles).

8.65. This includes raising of solar panels to limit the potential for blockages of flood flows and minimising any raising of land within our Site. As set out previously, should land raising within the floodplain be required, floodplain compensation will be provided to ensure there is no increase in flood risk.

8.66. Our Project will be implemented in line with the Design Principles and the measures set out in our FRA (which will be submitted as part of the DCO application), and as such, there will be no likely significant effects to areas off Site during operation.

Next Steps

8.67. We will be preparing the FRA which will be d submitted as part of the DCO application and will continue to engage with the relevant consultees including the Environment Agency and the host authorities, on the design of our Project relating to flood risk and drainage design.

Effects of Changes in Quality and Quantity of Surface Water Runoff

Approach

8.68. As set out previously, there is no specific quantitative methodology that allows the flood risk and drainage effects to be assessed. Determining the effects of our Project is therefore based on professional judgement and is qualitative.

Receptors and Receptor Sensitivity

8.69. The receptors for this effect are:

- Watercourses within and adjacent to our Site i.e. the River Trent and ordinary watercourses that accommodate surface water runoff from our Site in the operational phase.
- Areas surrounding our Site and residents in these areas that could be impacted by any changes to quantity and rate of discharge as a result of our Project during the operational phase.

8.70. The sensitivity of these receptors are outlined in paragraph 8.48 above.

Defining Impacts

8.71. The effects have been defined using professional judgement, by considering numerous factors including the magnitude of impact the operational development could have on water quality and runoff from our Site, taking in to account the environmental measures that will be implemented.

Preliminary Assessment

8.72. As set out previously mitigation measures will be embedded into the design of our Project to ensure that the quantity and quality surface water runoff is sufficiently managed. This includes the use of SuDS to provide treatment and attenuation where necessary to ensure that runoff rates are restricted to match the natural runoff rate.

8.73. As part of the FRA, the management of surface water runoff will be discussed and outlined in detail to ensure that there is no increase in flood risk or pollution potential as a result of our Project. As above, the FRA will be submitted as part of our DCO application.

8.74. Our Project will be implemented in line with the Design Principles, including the measures set out in our FRA (which will be submitted as part of the DCO application), and as such, there will be no likely significant effects to changes in the quality and quantity of surface water runoff during operation.

Next Steps

8.75. We will be preparing the FRA which will provide further detail on our surface water drainage strategy along with the water treatment. The FRA will be submitted as part of the DCO application.

Hydrogeology and Groundwater Flows

Approach

8.76. There is no specific quantitative methodology that allows the hydrogeology and groundwater effects to be assessed. Determining the effects of our Project is therefore based on professional judgement and is qualitative.

Receptors and Receptor Sensitivity

8.77. The receptor for the effect is groundwater quality and groundwater flood risk to our Site/surrounding area that could be impacted as a result of potential pollution or impacts to groundwater flows.

8.78. The sensitivity of these receptors are outlined in **paragraph 8.48** above.

Defining Impacts

8.79. The effects have been defined using professional judgement, by considering numerous factors including the magnitude of impact our Project could have on groundwater quality and flows, taking in to account the environmental measures that will be implemented.

Preliminary Assessment

8.80. As set out previously, the management of surface water runoff, including treatment will be detailed within the FRA, which will be submitted as part of our DCO application, to ensure that the potential for pollution to groundwater is minimised.

8.81. With regards to groundwater flows, with the exception of foundations (for the solar panels and associated infrastructure such as sub-stations and battery storage) and cable routes, there will be no below ground structures included within our Project. The potential for impacts to groundwater flow is therefore anticipated to be limited however this will be assessed in greater detail within the FRA.

8.82. It is anticipated that there will be no likely significant effects to the receptors during operation.

Next Steps

8.83. The FRA will be prepared – see paragraph 8.59 for further information.

Potable Water Demand[6]

Approach

8.84. As set out previously, there is no specific quantitative methodology that allows potable water effects to be assessed. Determining the effects of our Project is therefore based on professional judgement and is qualitative.

[6] Water taken from the water suppliers which can be used for human consumption

Receptors and Receptor Sensitivity

8.85. The receptor for this effect is the capacity of the Anglian Water and Severn Trent water network.

8.86. The receptor sensitivity classifications are in line with those set out in **paragraph 8.48**.

Defining Impacts

8.87. The effects have been defined using professional judgement, by considering numerous factors including the magnitude of impact the operational development could have on water capacity.

Preliminary Assessment

8.88. All developments have a duty to reduce water consumption and to operate efficiently. This is not however, a matter for EIA, because water consumption is a strategic policy matter and that the overall supply and demand to sustain planned growth, without posing a risk of environmental deterioration is Anglian Water and Severn Trent Water's statutory responsibility under their Water Resource Management Plans (these plans set out the proposals to ensure continued delivery of a secure and reliable supply of water within the regions).

8.89. Given it is the responsibility of Anglian Water and Severn Trent Water to provide water and to ensure that any increase will have no negative impacts on environmental receptors it is anticipated therefore that there will be no likely significant effects during operation.

Next Steps

8.90. We will be providing further details on water consumption because of our Project. Where possible we will quantify the amount of portable water currently used within our Site and the amount of portable water required for our Project. We will also consider any measures to reduce the use of water for our Project (such as rainwater harvesting for any landscaping watering).

8.91. Potable water demand will be quantified and discussions will be held with Anglian Water and Severn Trent Water to determine any capacity concerns.

Conclusions

8.92. **Table 8-3** presents a summary of the preliminary likely significant effects, with further information. It also includes the next steps to be undertaken as part of the Environmental Impact Assessment.

Table 8-3: Summary of Likely Significant Effects

Element	Preliminary Likely Significant Effect	Further Information	Next Steps
Construction and Decommissioning – Flood Risk and Drainage	No likely significant effects	The adoption of a oCEMP and outline Decommissioning Environmental Management Plan will mitigate any significant effects.	
Operational Phase – Flood Risk Effects on Users of our Site	No likely significant effects	Following the principles of the FRA and FEMP will ensure flood risk mitigation is provided.	Flood risk will be quantified in greater detail within the FRA where the embedded mitigation will also be outlined.
Operational Phase – Flood Risk Effects to Areas off Site	No likely significant effects	Following the principles of the FRA and FEMP will ensure flood risk mitigation is provided.	Flood risk will be quantified in greater detail within the FRA where the embedded mitigation will also be outlined.
Operational Phase – Effects of Changes in Quality and Quantity of Surface Water Runoff	No likely significant effects	Following the principles of the FRA and Drainage Strategy will ensure mitigation is provided.	The surface water drainage strategy along with the water treatment will be quantified within the FRA.

Operational Phase – Hydrogeology and Groundwater Flows	No likely significant effects	Following the principles of the FRA and Drainage Strategy will ensure mitigation is provided.	The hydrogeology and impact on groundwater flows will be assessed in greater detail within the FRA.
Operational Phase – Potable Water Demand	No likely significant effects	Environmental assessments and permitting to be undertaken by Anglian Water to ensure increased demand will have no negative impacts on environmental receptors.	Potable water demand will be quantified and discussions will be held with Anglian Water to determine any capacity concerns.

Appendices

Appendix 8-1: Hydrology and Hydrogeology Legislation and Policy

Appendix 8-1: Hydrology and Hydrogeology Legislation and Policy

Review of Policy, Legislation and Relevant Guidance

Legislation, planning policy and guidance relating to hydrology and hydrogeology, and pertinent to our Project comprises:

Legislation

The European Water Framework Directive (WFD) (2000)

The WFD establishes a framework for the protection of inland surface waters, transitional waters, coastal waters, and groundwater. It requires:

- environmental objectives should be set to ensure that good status of groundwater is achieved and that its deterioration is avoided. This includes any upward sustaining trend in the concentration of a pollutant must be identified and reversed;
- a good status of groundwater requires early action and stable long-term planning of protective measures, owing to the natural time lag in its formation and renewal; and
- monitoring programmes should cover monitoring of the chemical and quantitative status of groundwater.

Environmental Protection Act (1990)

Part 2A provides a statutory regime for the identification and remediation of 'Contaminated Land'. It introduces a statutory definition of 'contaminated land' based on significant harm or the likelihood of significant harm or the pollution or likely pollution of controlled waters (all groundwater, inland waters, and estuaries, excluding water perched above the zone of saturation). Local authorities are the primary regulators under the Part 2A regime, with a duty to identify contaminated land in their area.

Water Resources Act (1991) (as amended)

This Act, specifically Part 3 sets controls of pollution of water sources. It contains information about water quality objectives, powers to prevent and control pollution and pollution offences. This Act requires the Environment Agency to giver consent for works in, over, under or adjacent to 'main rivers'. Main rivers are classified watercourses over which the EA has jurisdiction.

Land Drainage Act (1991)

This Act requires that landowners maintain the flow of water in watercourses.

Environment Act (1995)

This Act established the Environment Agency and transferred to it powers over the control of pollution and the conservation and enhancement of natural resources and the environment.

The Groundwater (England and Wales) Regulations (2009)

Under these regulations, rules are set out for the approval/granting of Environment Agency permit, consent to which is under other regulations. Through these regulations, further enforcement powers are given to the Environment Agency, detail penalties and offences, if discharge of a hazardous substance or non-hazardous pollutant into a watercourse occurs without a permit.

The Flood Risk Regulations (2009).

Protecting the community from the risk and impact of flooding is at the centre of the Floods Directive 2007/60/EC. This Directive, implemented via these Regulations in the UK, provides a new approach to managing flood risk on a catchment-wide scale which applies to all sources of flooding (river, lakes, flash floods, urban floods, coastal floods, including storm surges).

National Planning Policy

Overarching National Policy Statement for Energy (EN-1) (2023)

This provides overarching government policy on energy NSIPs, how planning applications relating to energy will be assessed, and the way in which any impacts and mitigation measures will be considered. Part 5, Section 5.8 of this policy statement specifically relates to Flood Risk.

Paragraph 5.8.13 states that *"A site-specific flood risk assessment should be provided for all energy projects in Flood Zones 2 and 3 in England or Zones B and C in Wales. In Flood Zone 1 in England or Zone A in Wales, an assessment should accompany all proposals involving:*

- *sites of 1 hectare or more;*
- *land which has been identified by the EA or NRW as having critical drainage problems*
- *land identified (for example in a local authority strategic flood risk assessment) as being at increased flood risk in future;*
- *land that may be subject to other sources of flooding (for example surface water); and*
- *where the EA or NRW, Lead Local Flood Authority, Internal Drainage Board or other body have indicated that there may be drainage problems."*

National Policy Statement for Renewable Energy Infrastructure (EN-3) (2023)

This provides specific government policy on how renewable energy NSIPs should be assessed an determined, and the way in which any impacts and mitigation measures will be considered. Specific extracts relating to our Project are as follows:

Paragraph 2.10.84 states that *"Where a Flood Risk Assessment has been carried out this must be submitted alongside the applicant's ES. This will need to consider the impact of drainage. As solar PV panels will drain to the existing ground, the impact will not, in general, be significant."*

Paragraph 2.10.154 states that *"Water management is a critical component of site design for ground mount solar plants. Where previous management of our Site has involved intensive agricultural practice, solar sites can deliver significant ecosystem services value in the form of drainage, flood attenuation, natural wetland habitat, and water quality management."*

National Policy Statement for Renewable Energy Infrastructure (EN-5) (2023)

There are no policies that specifically relate to hydrology and hydrogeology.

National Planning Policy Framework (2023)

The National Planning Policy Framework (NPPF) is an overarching document which sets out government planning policy for development outside of the NSIP regime in England, and how this is expected to be applied by local authorities and developers. The NPPF can be an important and relevant consideration for NSIPs as well, but in the event of any conflict, the NPS policy prevails.

Section 14 sets out the Government's over-arching planning policies in relation to meeting the challenge of climate change, flooding and coastal change.

Local Planning Policy

Local planning policy relevant to our Site is set out below. Local policies can be an important and relevant consideration for NSIPs as well, but in the event of any conflict, the NPS policy prevails.

Newark and Sherwood District Council (2023) Local Development Framework, Amended Allocations and Development Management Development Plan Document (AADMDPD), Submission Version, January 2024

This amended local Development Plan Document (DPD) has been compiled to ensure that the wider development framework within Newark and Sherwood District Council sufficiently allocates land for development to meet the needs of the area, up until 2033.

Relevant to our Project is Policy DM5(b) 10. Flood Risk and Water Management, states:

"The Council will, in line with Policy DM5(c)aim to steer new development away from areas at highest risk of flooding. Development proposals within Environment Agency Flood Zones 2 and 3 and areas with critical drainage problems will only be considered where it constitutes appropriate development and it can be demonstrated, by application of the Sequential Test, that there are no reasonably available sites in lower risk Flood Zones.

Where development is necessary within areas at risk of flooding it will also need to satisfy the Exception Test by demonstrating it would be safe for the intended users without increasing flood risk elsewhere and where possible, pursue opportunities to reduce flood risk overall.

All application for new development shall demonstrate that all surface water discharges have been carried out in accordance with the principles laid out within the drainage hierarchy, in such that a discharge to the public sewerage systems are avoided, where possible.

All major developments shall ensure that Sustainable Drainage Systems (SuDS) for the management of surface water run-off are put in place unless demonstrated to be inappropriate.

All schemes for the inclusions of SuDS should demonstrate they have considered all four aspects of good SuDS design, Quantity, Quality, Amenity and Biodiversity, and the SuDS and development will fit into the existing landscape.

The completed SuDS schemes should be accompanied by a maintenance schedule detailing maintenance boundaries, responsible parties and arrangements to ensure that the SuDS are maintained in perpetuity.

Where possible, all non-major development should look to incorporate these same SuDS principles into their designs."

In addition Policy DM5(c) Sequential Test states:

"In-line with Core Policy 10 of the Amended Core Strategy, the Council will follow a sequential approach to development and flood risk, seeking to steer new development away from those areas at highest risk. Development will not be permitted if there are reasonably available sites appropriate for the proposed development in areas at lower risk of flooding.

The area of search within which to undertake the Test will normally be District-wide, unless it is appropriate for this to be further refined having had regard to relevant policy objectives within the Development Plan and/or any valid functional requirements of the proposed use. With specific regard to housing development, the presence of a settlement-level housing needs assessment will not normally justify restricting application of the test to that location, except in the circumstances outlined below.

In order to help maintain the viability and vitality of rural villages below the Principal Village level of the Settlement Hierarchy greater flexibility will be provided, where the presence of large areas in Flood Zones 2 and 3 constrains the availability of suitable land and the proposed development is necessary to sustain the existing community. To demonstrate that housing development is necessary to sustain an existing community, proposals will be expected to be supported by:

- *An up-to-date and appropriately constituted Housing Needs Survey, specific to that community and identifying a form of need which the proposal would contribute towards meeting; and/or*
- *Provision of a robust case that the proposal would make a meaningful contribution towards the sustaining of services and facilities in that community.*

Where a 'made' Neighbourhood Plan provides support for housing development within a defined settlement boundary, or for rural affordable housing adjacent to that boundary under Core Policy 2, then this will provide justification for restriction of the Test to the Neighbourhood Area.

Where the undertaking of the Test is necessary then applicants are encouraged to positively engage with the District Council at an early stage in order to agree appropriate parameters."

Newark & Sherwood District Council, Amended Core Strategy Development Plan (2019)

The Amended Core Strategy for Newark and Sherwood District is part of the Local Development Framework for the area. This strategy outlines the overarching issues and objectives to address over a 20-year period, contextualising this into wider vision, series of objectives and core policies toward delivery.

Core Policy 9 "Sustainable Design" states that *"The District Council will expect new development proposals to demonstrate a high standard of sustainable design that both protects and enhances the natural environment and contributes to and sustains the rich local distinctiveness of the District. Therefore all new development should:*

…

- *Through its design, pro-actively manage surface water including, where feasible, the use of Sustainable Drainage Systems…*

The District Council will prepare an SPD which provides guidance to developers on the sustainable design of development and the consideration of making homes fit for purpose over their lifetime including ensuring adaptability and provision of broadband."

Core Policy 12 "Biodiversity and Green Infrastructure" is relevant to our Project and states that *"The District Council will seek to conserve and enhance the biodiversity and geological diversity of the District by working with partners to implement the aims and proposals of the Nottinghamshire Local Biodiversity Action Plan, the Green Infrastructure Strategy and the Nature Conservation Strategy. The District Council will therefore:*

Expect proposals to take into account the need for continued protection of the District's ecological, biological and geological assets. With particular regard to sites of international, national and local significance, Ancient Woodlands and species and habitats of principal importance identified in Section 41 of the Natural Environment and Rural Communities Act 2006 and in the Nottinghamshire Local Biodiversity Action Plan;

Seek to secure development that maximises the opportunities to conserve, enhance and restore biodiversity and geological diversity and to increase provision of, and access to, green infrastructure within the District;

Promote the appropriate management of features of major importance for wild flora and fauna;

Provide for Suitable Alternative Natural Green Space to reduce visitor pressure on the District's ecological, biological and geological assets, particularly in the Newark area and for 5kms around the Birklands and Bilhaugh Special Area of Conservation;

…."

Central Lincolnshire Local Plan (2023)

The Local Plan for the central Lincolnshire area sets out the approach to planning policy and overarching development allocations to drive growth in the area over a 20-year period. The Local Plan is contextualised into a wider vision, series of objectives and core policies toward delivery.

Specific policies detailed in the Local Plan and are relevant to our Project, as below.

Policy S20 “Resilient and Adaptable Design” states that:

the nature of the development makes it impracticable to incorporate a green roof.

Adaptable design

Applicants should design proposals to be adaptable to future social, economic, technological and environmental requirements in order to make buildings both fit for purpose in the long term and to minimise future resource consumption in the adaptation and redevelopment of buildings in response to future needs. To meet this requirement, applicants should undertake the following, where applicable:

…

8. Is resilient to flood risk, from all forms of flooding (see Policy S21).”

Policy S21 “Flood Risk and Water Resources” states that:

“Flood Risk

All development proposals will be considered against the NPPF, including application of the sequential and, if necessary, the exception test. Through appropriate consultation and option appraisal, development proposals should demonstrate:

> *a) that they are informed by and take account of the best available information from all sources of flood risk and by site specific flood risk assessments where appropriate;*
>
> *b) that the development does not place itself or existing land or buildings at increased risk of flooding;*
>
> *c) that the development will be safe during its lifetime taking into account the impacts of climate change and will be resilient to flood risk from all forms of flooding such that in the event of a flood the development could be quickly brought back into use without significant refurbishment;*
>
> *d) that the development does not affect the integrity of existing flood defences and any necessary flood mitigation measures have been agreed with the relevant bodies, where adoption, ongoing maintenance and management have been considered and any necessary agreements are in place;*
>
> *e) how proposals have taken a positive approach to reducing overall flood risk and have considered the potential to contribute towards solutions for the wider area; and*

f) that they have incorporated Sustainable Drainage Systems (SuDS)/ Integrated Water Management into the proposals unless they can be shown to be inappropriate.

Protecting the Water Environment

Development proposals that are likely to impact on surface or ground water should consider the requirements of the Water Framework Directive. Development proposals should demonstrate:

g) that water is available to support the development proposed;

h) that adequate mains foul water treatment and disposal already exists or can be provided in time to serve the development. Non mains foul sewage disposal solutions should only be considered where it can be shown to the satisfaction of the local planning authority that connection to a public sewer is not feasible;

i) that they meet the Building Regulation water efficiency standard of 110 litres per occupier per day or the highest water efficiency standard that applies at the time of the planning application (see also Policy S12);

j) that water reuse and recycling and rainwater harvesting measures have been incorporated wherever possible in order to reduce demand on mains water supply as part of an integrated approach to water management (see also Policy S11);

k) that they have followed the surface water hierarchy for all proposals:

i. surface water runoff is collected for use;

ii. discharge into the ground via infiltration;

iii. discharge to a watercourse or other surface water body;

iv. discharge to a surface water sewer, highway drain or other drainage system, discharging to a watercourse or other surface water body;

v. discharge to a combined sewer;

l) that no surface water connections are made to the foul system;

m) that surface water connections to the combined or surface water system are only made in exceptional circumstances where it can be demonstrated that there are no feasible alternatives (this applies to new developments and redevelopments) and where there is no detriment to existing users;

n) that no combined sewer overflows are created in areas served by combined sewers, and that foul and surface water flows are separated;

o) that development contributes positively to the water environment and its ecology where possible and does not adversely affect surface and ground water quality in line with the requirements of the Water Framework Directive;

p) that development with the potential to pose a risk to groundwater resources is not located in sensitive locations to meet the requirements of the Water Framework Directive;

q) how Sustainable Drainage Systems (SuDS)/ Integrated Water Management to deliver improvements to water quality, the water environment and to improve amenity and biodiversity net gain wherever possible have been incorporated into the proposal unless they can be shown to be impractical;

r) that relevant site investigations, risk assessments and necessary mitigation measures for source protection zones around boreholes, wells, springs and water courses have been agreed with the relevant bodies (e.g. the Environment Agency and relevant water companies);

s) that suitable access is safeguarded for the maintenance of watercourses, water resources, flood defences and drainage infrastructure; and

t) that adequate provision is made to safeguard the future maintenance of water bodies to which surface water and foul water treated on our Site of the development is discharged, preferably by an appropriate authority (e.g. Environment Agency, Internal Drainage Board, Water Company, the Canal and River Trust or local Council).

In order to allow access for the maintenance of watercourses, development proposals that include or abut a watercourse should ensure no building, structure or immovable landscaping feature is included that will impede access within 8m of a watercourse, or within 16m of a tidal watercourse. Conditions may be included where relevant to ensure this access is maintained in perpetuity and may seek to ensure responsibility for maintenance of the watercourse including land ownership details up to and of the watercourse is clear and included in maintenance arrangements for future occupants."

Bassetlaw District Council (2011) Publication Core Strategy and Development Management Policies.

The Core Strategy for the Bassetlaw District sets out the overarching vision for the area up until 2026, including the policy approach to deliver this.

Policy DM12 "Flood Risk, Sewerage and Drainage" is related to our Project and states:

"A. Flood Risk

Proposals for the development of new units in Flood Zones 2, 3a, and 3b that are not defined by national planning guidance (43) as being suitable for these zones will not be supported while development sites remain available in sequentially superior locations across the District. Reference should be made to the Council's Strategic Flood Risk Assessment when making assessments about likely suitability. Site-specific Flood Risk Assessments will be required for all developments in flood risk areas, even where flood defences exist, as defined on the Proposals Map. Where suitable redevelopment opportunities arise, the Council will require, in liaison with the Environment Agency, the opening up of culverts, notably in Worksop and Retford, in order to reduce the blocking of flood flow routes. Particular support will be given to the Flood Alleviation Scheme for Retford Beck.

B. Sewerage and Drainage

All applications for new development (other than minor extensions) in:

- *Beckingham*
- *Clarborough and Hayton*
- *East Drayton*
- *East Markham*
- *Harworth*
- *Bircotes*
- *North Leverton*
- *North Wheatley*
- *Misterton*
- *South Wheatley*
- *Sturton-le-Steeple*
- *Welham*
- *Walkeringham*

will be required to contain a Surface Water Drainage Assessment, to be produced in discussion with the District Council. This Assessment must show to the Council's satisfaction that the proposed development will not exacerbate existing land drainage and sewerage problems in these areas.

All new development will be required to incorporate Sustainable Drainage Systems (SuDS) and provide details of adoption, ongoing maintenance, and management. Proposals will be required to provide reasoned justification for not using SuDS techniques, where ground conditions and other key factors show them to be technically feasible.

Preference will be given to systems that contribute to the conservation and enhancement of biodiversity and green infrastructure in the District."

Draft Bassetlaw Local Plan 2020-2038: Main Modifications Version, August 2023.

This Local Plan sets out Bassetlaw District's planning and policy framework, development strategy and site allocations to inform effective delivery of the overall vision up until 2038.

Policies set out in the Local Plan relate to our Project are:

Policy ST52 “Flood Risk and Drainage” states that:

“1. Proposals are required to consider and, where necessary, mitigate the impacts of the proposed development on flood risk, on-site and off-site, commensurate with the scale and impact of the development. Proposals, including change of use applications, must be accompanied by a Flood Risk Assessment (where appropriate), which demonstrates that the development, including the access and egress, will be safe for its lifetime, without increasing or exacerbating flood risk elsewhere and where possible will reduce flood risk overall.

2. Where relevant, proposals must demonstrate that they pass the Sequential Test and if necessary the Exceptions Test in Flood Zones 2 and 3 and ensure that where land is required to manage flood risk, it is safeguarded from development.

River Ryton Flood Management Impact Zone

3. All development within the River Ryton Flood Management Impact Zone, as identified on the Policies Map, will need to demonstrate through a Design and Access Statement that they will not prejudice the delivery of a future flood management scheme for the River Ryton catchment through prior agreement with the Environment Agency.

Surface Water Flood Risk

4. All development (where practicable) should incorporate sustainable drainage systems (SuDS) in line with national standards. These should:

> *a) be informed by the Lead Local Flood Authority, sewerage company and relevant drainage board;*
>
> *b) have maintenance arrangements in place to ensure an acceptable standard of operation and management for the development’s lifetime;*
>
> *c) prevent surface water discharge into the sewerage system;*
>
> *d) maximise environmental gain through: enhancing the green/blue infrastructure network, including urban greening measures; contributing to biodiversity net gain where possible; and, securing amenity benefits along with flood storage volumes;*
>
> *e) seek to reduce runoff rates in areas at risk from surface water flooding, and that any surface water is directed to sustainable outfalls.”*

Policy ST53 “Protecting Water Quality and Management” states that:

“1. In line with the objectives of the Water Framework Directive, the quantity and quality of surface and groundwater bodies will be protected and where possible enhanced. Development adjacent to, over or in, a main river or ordinary watercourse will be supported where proposals consider opportunities to improve the river environment and water quality where possible by:

> *a) actively contributing to enhancing the status of the waterbody through positive actions or ongoing projects;*
>
> *b) naturalising watercourse channels;*

c) improving the biodiversity and ecological connectivity of watercourses;

d) safeguarding and enlarging river buffers with appropriate habitat in accordance with Policy ST39; and

e) mitigating diffuse agricultural and urban pollution.

Proposals within a Source Protection Zone will need to demonstrate that any risk to the Sherwood Sandstone Principal Aquifer and its groundwater resources and groundwater quality will be protected throughout the construction and operational phase of development, by demonstrating the satisfactory resolution of all relevant identified impacts.

3. All proposals must ensure that appropriate infrastructure for water supply, sewerage and sewage treatment, is available or can be made available at the right time to meet the needs of the development. Proposals should:

a) utilise the following drainage hierarchy:

i. into the ground (infiltration);

ii. to a surface water body;

iii. to a surface water sewer, highway drain, or another drainage system; to a combined sewer.

b) ensure that foul and surface water flows are separated with foul water being disposed to a public sewer or to a private self-treatment plant and that the design of the waste disposal system will be safe over the lifetime of the development.

c) ensure that development that discharges water into a watercourse incorporates appropriate water pollution control measures;

d) ensure that drainage design take into account an appropriate climate change allowance as agreed with the relevant authority(s);

e) ensure that infiltration-based SuDS incorporate appropriate water pollution control measures;

f) consider use of water recycling, rainwater and storm water harvesting, wherever feasible, to reduce demand on mains water supply.

National Guidance

Planning Practice Guidance (2023) Flood Risk and Coastal Change Planning Practice Guidance (PPG) (updated 2022)

This guidance sets out how practitioners and assessors can account for and address risks associated with flooding and coastal change. Relevantly, it provides commentary on the sequential test, site-specific requirements for flood risk assessment (including a checklist), the role of the EA and local authorities in assessing planning applications, addressing residual risk and sustainable drainage.

DEFRA Non-statutory technical standards for sustainable drainage systems (2015)

This DEFRA guidance focuses on standards for sustainable drainage systems from a non-statutory perspective and should be used by practitioners in tandem with the NPPF and PPG. The standards listed in this report focus on peak control flow, volume control, flood risk within the development, structural integrity, maintenance and construction.

Construction Industry Research and Information Association (CIRIA) Report C753 The SuDS Manual (2015)

This report sets out key guidance for local authorities and developers to assist with the implementation of SuDS within new and existing infrastructure projects. This further covers the cycle of SuDS from design to maintenance. Overarching supporting information also looks at the effectiveness of SuDS to help maximise benefits.

Local Guidance

Bassetlaw District Level 1 Strategic Flood Risk Assessment (SFRA) (2019)

An SFRA is a requirement under Planning Policy Statement 25 on “Development and Flood Risk” and is a tool to account for all sources of flooding and climate change impacts to inform local development outcomes. An SFRA is further used to refine data on specific areas which may flood, which is further contextualised into mapping outputs.

Newark and Sherwood District Level 1 SFRA (2016)

The completed SFRA for Newark and Sherwood District provides an assessment of the overall risk of flooding and associated implications for land use planning and local development outcomes, within the overall District. This is a requirement under Planning Policy Statement 25 on “Development and Flood Risk.”

West Lindsey Level 1 SFRA (2009)

The completed SFRA for West Lindsey provides an assessment of the overall risk of flooding and associated implications for land use planning and local development outcomes, within the overall District. This is a requirement under Planning Policy Statement 25 on “Development and Flood Risk.”

Lincolnshire Sustainable Drainage Design and Evaluation Guide (2018).

This guidance document takes a similar approach to the CIRIA SuDS manual guidance and applies it to a local context. This guide aims to align the design approach to SuDS with the planning process in Lincolnshire. The guidance further details three stages to SuDS design and what it should demonstrate at each stage.



one earth

solar farm

One Earth Solar Farm

Preliminary Environmental Information Report [EN010159]

Chapter 9: Land, Soils and Groundwater

May 2024

One Earth Solar Farm Ltd

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Appendix 9-1: Key Legislation and Policy

Appendix 9-2: Guidance for Assessment of Effects

Appendix 9-3: Environmental Measures

9. Land, Soil and Groundwater

Summary of Preliminary Likely Significant Effects

9.1. This Chapter sets out our preliminary assessment for land, soil and groundwater, which shows that there are no likely significant environmental effects from the construction, operation (including maintenance) and decommissioning of our Project on land or groundwater anticipated based on the assessments undertaken so far. Soil and agricultural land are determined to be potentially at risk of likely significant environmental effects in areas where the highest quality soils are present. For this Project, that is land where there are areas categorised as Agricultural Land Classification grades 2 or 3a, noting that there is no land falling within grade 1 classification within our Site. The preparation for the Environmental Statement (ES) will include undertaking a further review of available baseline data for land, soil and groundwater, which will be used to undertake an assessment of potential effects and to confirm likely significant effects. It should be noted that an Agricultural Land Classification survey has been completed for our Site. The findings will be presented in our ES, to be submitted under the DCO application.

Introduction

9.2. This Chapter of the PEIR has been prepared by RSK Environment Limited and presents the preliminary likely significant environmental effects of our Project upon land, soil and groundwater. The experience of the consultants that have prepared this chapter, who are competent experts for the purpose of the EIA Regulations, is set out in **Appendix 1-1** in **Chapter 1-6**. It is informed by the environmental information we have collected to date (which is detailed in this Chapter), as well as the current description of our Project, as set out in **Chapter 4: Our Project.**

9.3. This Chapter is supported by further detailed information that is contained within:

- **Appendix 9-1**: Land, soil and groundwater specific legislation, policy and guidance
- **Appendix 9-2**: Guidance for assessment of effects
- **Appendix 9-3**: Environmental measures

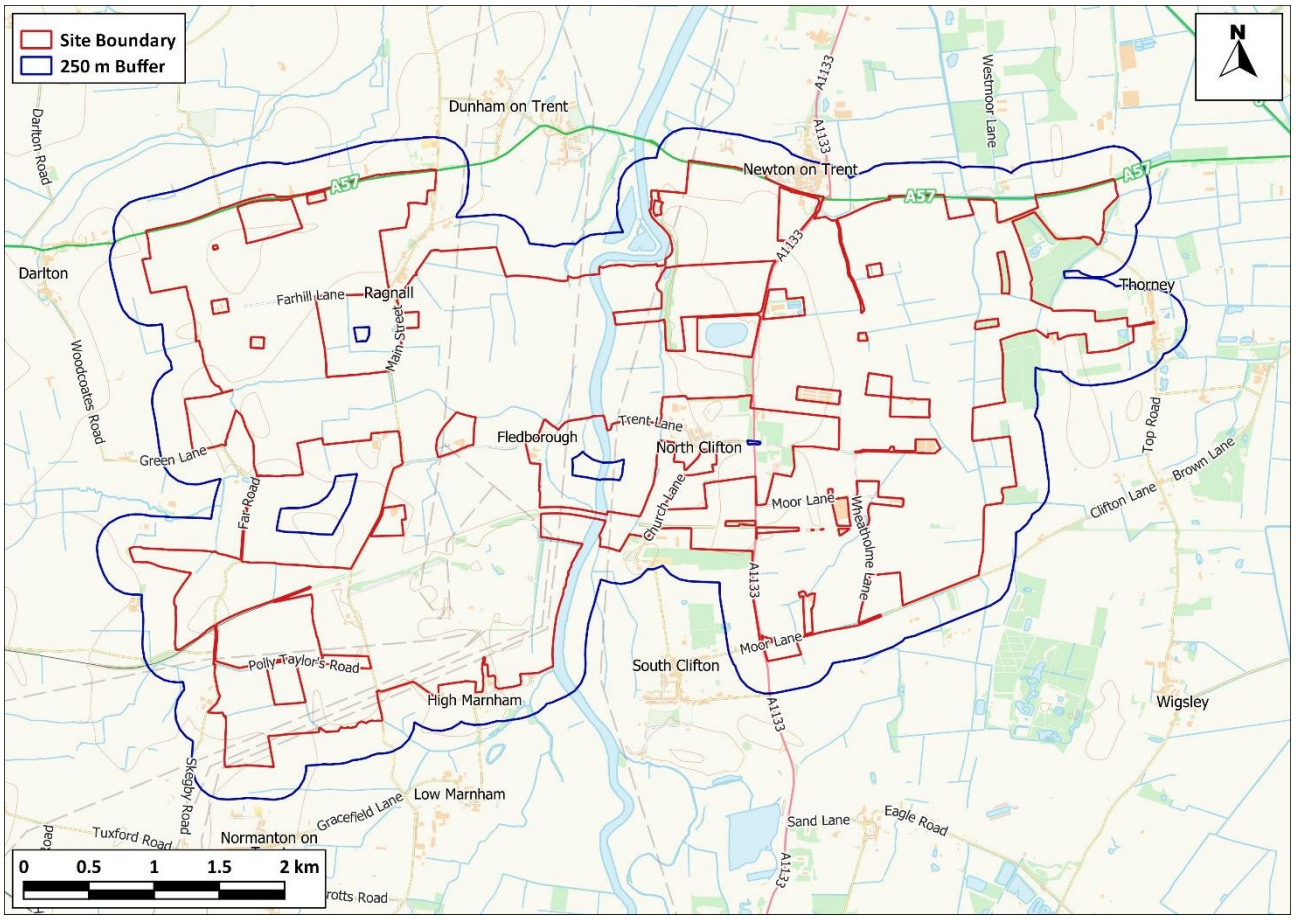
Current Land, Soil and Groundwater Conditions

Study Area

9.4. Our Site plus a 250m buffer has been considered with regard to identifying land, soil and groundwater related receptors that could be impacted by the construction, operation and decommissioning of our Project. The size of the study area is considered appropriate to identify features that may be impacted by our Project and may impact our Project. Issues that could affect sensitive receptors assessed in this section occur by direct contact (for example contamination such as a fuel spillage coming into direct contact with soil, or physical contact from construction plant affecting soil quality) or by movement of contamination through soil, subsoil or groundwater. These types of pathways or contacts are physically restricted by factors such as the geology, topography, groundwater regime and presence of surface water features. Professional judgement is used when considering whether sensitive receptors could be affected by different features or issues, and the 250m is considered sufficiently conservative to identify all relevant issues.

9.5. The study area is illustrated in **Figure 9-1** as the blue line.

Figure 9-1: Study Area



Collection of Land, Soil and Groundwater Data

9.6. The baseline conditions of the study area have been determined using the following sources:

- Geological maps (bedrock and superficial geology) (British Geological Survey (BGS) mapping accessed online[1])
- Hydrogeological and groundwater vulnerability maps (BGS database[2] and MAGIC maps [3])
- Soil survey maps ([4] and [5])
- Site-specific data and historical mapping from an environmental database report[6] (providing details of features on or close to our Site relating to water, waste, hazardous substances, geology and land use)
- Mineral resources information from Lincolnshire Minerals and Waste Local Plan[7] and Nottinghamshire Minerals Local Plan[8].

9.7. Other information sources have been consulted during the preliminary assessment work, including the BGS Onshore GeoIndex[9], Defra's MAGIC maps[10] and publicly available local authority information.

9.8. With respect to soil, a Project-specific soil sampling survey has been undertaken. Reference has also been made to the Provisional Agricultural Land Classification (ALC) map of England[11].

Land, Soil and Groundwater Baseline

Site history

[1] https://mapapps2.bgs.ac.uk/geoindex/home.html

[2] https://mapapps2.bgs.ac.uk/geoindex/home.html

[3] https://magic.defra.gov.uk/MagicMap.aspx

[4] https://magic.defra.gov.uk/MagicMap.aspx

[5] https://publications.naturalengland.org.uk/category/5954148537204736

[6] Set of four Envirocheck reports, to be provided as a technical appendix to the ES (report references 339698695_1_1, 339699668_1_1, 339700353_1_1 and 339700725_1_1, dated 19-03-2024

[7] https://www.lincolnshire.gov.uk/downloads/file/2274/adopted-site-locations-pdfa

[8] https://www.nottinghamshire.gov.uk/media/5079375/adoptedmineralslocalplancompressed.pdf

[9] https://mapapps2.bgs.ac.uk/geoindex/home.html?_ga=2.66027054.1050639966.1674032823-632543622.1674032823

[10] https://magic.defra.gov.uk/MagicMap.aspx

[11] https://magic.defra.gov.uk/MagicMap.aspx

9.9. The earliest historical maps for our Site (from 1884) show the land already in agricultural use, with field boundaries and drainage ditches present, along with tracks, roads, footpaths and some farm buildings. Small ponds are evident in some locations. The River Trent is present crossing through our Site area, with embankments evident in some places, suggesting flood defence systems had been constructed to protect the farmland. Some medieval features are noted on map editions (medieval villages of Whimpton and Woodcoates, both of which are outside our Site boundary). Springs are noted in some locations on-site.

9.10. By the 1900 map edition, a railway is present crossing our Site (roughly running from west to east), including a station and goods shed at Fledborough (on-site) and at Clifton-on-Trent (just outside our Site boundary). A nursery (plants) is apparent in one location on-site, but there are no other notable developments. An area of allotments is shown on-site in 1921. Old sand and gravel pits are noted close to Clifton-on-Trent railway station, which are within our Site boundary.

9.11. Mapping from the 1970s includes overhead power lines crossing some areas of our Site, associated with High Marnham Power Station (coal fired), which was located on-site. This is understood to have operated from 1959 until 2003, with demolition of the cooling towers in 2012. Pumping stations are shown in some locations within our Site boundary, associated with the drainage network.

9.12. The 1980 map edition shows the presence of a sewage treatment works adjacent to High Marnham Power Station (on-site, on the west bank of the River Trent). By this date, some poultry farming operations are apparent (located on land just outside our Site boundary).

9.13. The map from 2000 shows an oil well facility (on land that is excluded from our Site boundary), which was no longer operational by the time of our Site walkover (13 to 15 March 2024). The railway tracks are no longer present by this map edition (the line of the former railway now forms part of the Sustrans cycling route that is present within our Site boundary, and crosses Fledborough Viaduct). Some historical sand and gravel pits within our Site boundary have been infilled.

Site walkover observations

9.14. An overview of our Site was obtained during a Site walkover (March 2024). The land is predominantly used for arable farming, with a smaller fraction used for grazing (approximately 90% arable to 10% grazing). No buildings were observed within our Site boundary. Occasional ponds were observed within fields, with most surface water being present in ditches along field boundaries. In terms of potential contamination sources, some minor areas of waste storage (associated with agricultural land-use) were noted. There was no visible evidence of infilled pits or quarries. An above ground oil pipeline was noted crossing the eastern area of our Site. A former oil well facility is also present (on land that is excluded from our Site boundary, but surrounded by the northeast area of our Site). Pumping stations operate to manage the surface water in some locations. Drainage ditches were deeper in western parts of our Site. Visible discoloration of water was observed in ditches in some locations. In addition, some standing water was affected by algae. Overhead power lines are common across the area.

Animal burial sites

9.15. Historical animal burial sites are not officially recorded, and therefore it is not possible to assess whether there are any of these sites within our Site, this information has been requested from land owners and any further details will be included in the ES. Due to the long-term agricultural site usage, it is a possibility that unrecorded animal burial pits could be present.

Unexploded ordnance

9.16. A review of publicly available unexploded ordnance (UXO) risk maps indicates that the entire Site has low potential for wartime bombs to be present (Zetica, 2024).

Information from environmental database report

9.17. At this preliminary stage of our Project, a full review of environmental data has not been completed. The Preliminary Risk Assessment (PRA) report to be prepared as part of the ES will provide a detailed report of the relevant information. The following key items have been considered when undertaking the assessment to inform this PEIR:

- There are numerous discharge consents within and close to our Site, most of which relate to final effluent discharge.
- There are no active landfills recorded within our Site boundary, or within 250m.
- There is one historical landfill site located within our Site boundary. This is at High Marnham Power Station, where inert and industrial waste were imported from 1978 to 1979.
- There was also a waste management licence at High Marnham Power Station for physical treatment of waste from 2007 until 2013.
- A site located 65m from our Site boundary holds a waste management licence for a household waste transfer station, at Kettlethorpe Lagoons.
- There are three recorded historical mineral sites within our Site (Newton upon Trent clay and shale pit, Station Sand Pit and Station Gravel Pit) and others within 250m of our Site boundary (mainly sand and gravel pits, but also some gypsum and sandstone extraction sites, and clay and shale pits). These are no longer operational and based on evidence from aerial photographs and OS plans they have been backfilled.
- There are areas of potentially in-filled land on-site and within 250m, associated with historical mineral extraction pits.

Site geology

9.18. Superficial geology is present across much of our Site, although there are areas with no mapped deposits, predominantly in the western part of our Site, and more restricted areas to the east of the River Trent.

9.19. The most dominant superficial deposit is the Holme Pierrepoint Sand and Gravel member, which is present around Low Marnham, from Fledborough to Woodcoates, in bands to the west and east of the River Trent and in a more widespread distribution further east.

9.20. Alluvium is present along the route of the River Trent, and in more limited extents along more minor watercourses throughout our Site. An area of Devensian Till (mainly clay) is present in the north west of our Site, between Ragnall and Darlton. To the east of the River Trent, there are some deposits of Blown Sand.

9.21. Bedrock geology is dominated by mudstone from the Mercia Mudstone Group. This comprises mainly red mudstone with some layers of siltstones or halite-bearing units. Thin sandstone beds may be present. A small section of our Site at the far eastern extent is underlain by mudstones from the Penarth Group. These are grey to black mudstones with occasional limestone or sandstone layers.

Sites of geological importance

9.22. No designated sites of geological importance (such as local geological sites, geological conservation review (GCR) sites, geological sites of special scientific interest (SSSIs) or global geoparks) have been identified on-site or within 250m of the boundary.

Geological hazards

Potential risks from geological hazards are categorised as listed below:

- Collapsible ground stability: very low risk or no hazard
- Compressible ground stability: moderate risk or no hazard
- Ground dissolution stability: no hazard
- Landslide ground stability: low risk or very low risk
- Running sand ground stability: no hazard, very low risk or low risk
- Shrinking or swelling clay ground stability: no hazard or very low risk

Mining and mineral extraction

9.23. The entire Site is outside the Coal Authority Development High Risk Area, and is not affected by below ground or opencast coal mining.

9.24. Historical mineral extraction sites are present across our Site, mainly concentrated along the route of the River Trent. This includes extraction pits specifically to extract sand and gravel deposits, which have been infilled.

Mineral safeguarding

9.25. Our Site is located partly within Lincolnshire County Council and partly in Nottinghamshire County Council, who are the relevant Mineral Planning Authorities. The Nottinghamshire Minerals Local Plan[12] includes a mineral safeguarding and preservation area for sand and gravel running roughly along the route of the River Trent. There is one permitted site, located at Girton, for the extraction of sand and gravel. This site is located approximately 350m from our Site boundary, outside the study area. The site has permission until 2036.

[12] https://www.nottinghamshire.gov.uk/media/5079375/adoptedmineralslocalplancompressed.pdf

9.26. The Lincolnshire County Council Minerals and Waste Plan[13] does not show any mineral sites within our Site boundary or the study area.

9.27. A Minerals Assessment, to demonstrate how impacts to Mineral Safeguarding Areas have been addressed, does not form part of this preliminary assessment, but will be reported within the ES once further baseline information has been obtained and further engagement with the relevant regulatory authorities has been undertaken.

Soil

9.28. The National Soils Map, published at 1:250,000 scale, maps seven different soil associations within our Site. Land to the east of our Site mainly belongs to the Blackwood soil association. Fladbury 2 association is recorded in land adjacent to both sides of the River Trent. The south-western corner of our Site is mapped as Whimple 3 association, with land to the north-west mapped as a mix of Compton, Brockhurst 2, Worcester, Blackwood and Dunnington Heath associations. Dunnington Heath association is also mapped between Fladbury 2 and Blackwood association soils to the east of the River Trent.

- Blackwood association is typically dominated by deep permeable sandy and coarse loamy soils in glaciofluvial drift, which can be variable in stone content and frequently overlies glaciolacustrine clay or till at depth.
- Dunnington Heath association soils are typically reddish coarse and fine loamy over clayey soils with slowly permeable subsoils and slight seasonal waterlogging.
- Fladbury 2 soil are generally stoneless clayey soils variably affected by groundwater with some sandy subsoils.
- Worcester association soils are typically slowly permeable reddish clayey soils over mudstone.
- Brockhurst 2 soils are slowly permeable seasonally waterlogged reddish fine loamy over clayey and clayey soils. Heavy texture and soil wetness impose considerable limitations upon the use of these soils and cropping is mainly limited to grass and cereal growing, even with adequate underdrainage.
- Compton soils are typically stoneless mostly reddish clayey soils affected by groundwater, often at risk of flooding.
- Whimple 3 association are reddish fine loamy or fine silty over clayey soils with slowly permeable subsoils and slight seasonal waterlogging.
- Evesham 2 soils are typically slowly permeable calcareous clayey soils.
- Peat soils have not been identified on-site.

Agricultural Land Classifications

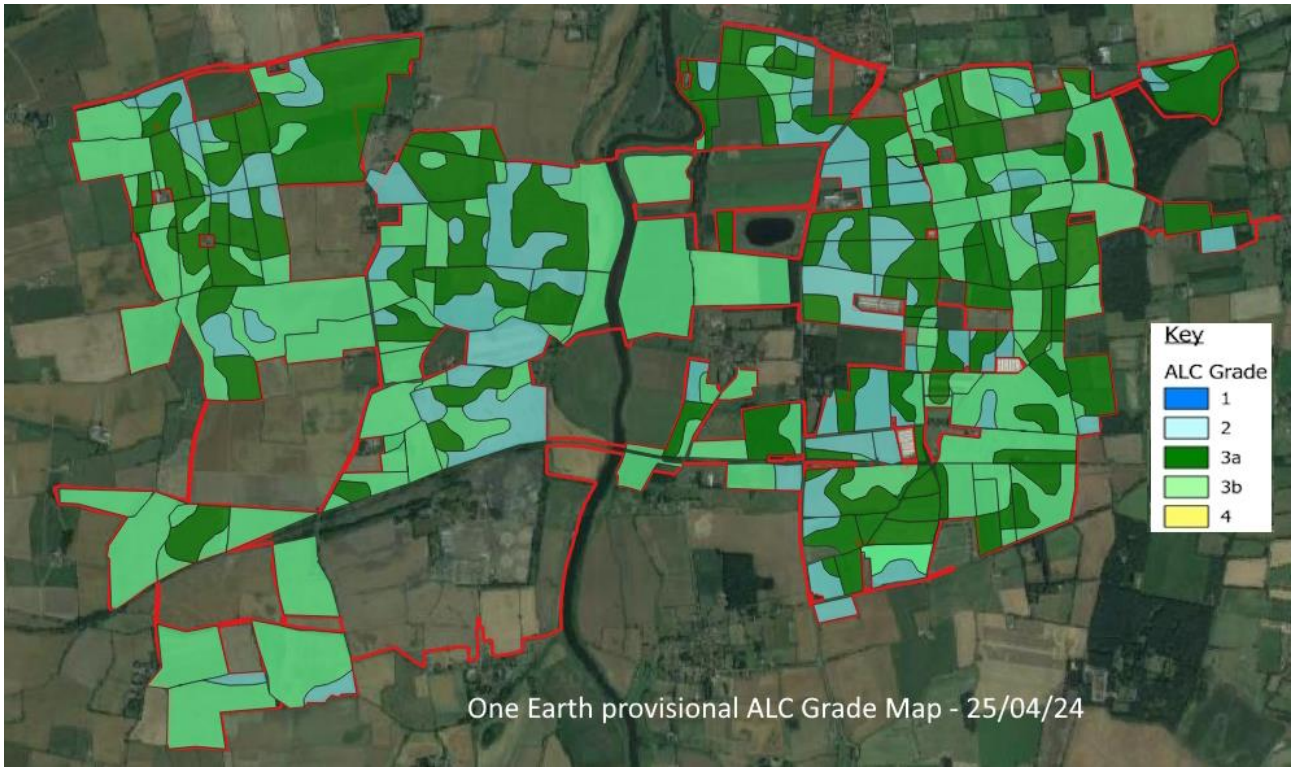
[13] https://www.lincolnshire.gov.uk/downloads/file/2274/adopted-site-locations-pdfa

9.29. The Agricultural Land Classification system (ALC) is a method of classifying the quality of land used for agricultural purposes, based on the possible limitations on agricultural use due to physical or chemical properties. The three main factors affecting ALC are climate, site and soil.

9.30. An ALC survey of our Site has been undertaken, with results awaited from a small number of locations due to access restrictions (anticipated to be available by the end of June 2024). The survey work involved using an auger to assess soil types (topsoil and subsoil) to depths up to 1.2m (approximately one sample per hectare), with some additional larger trial holes (also to 1.2m depth).The ALC survey covers the main Site area, but was not undertaken in areas that are only assigned as potential cable route options. Preliminary results for the soil within our Site boundary indicate the following ALCs, within a total land area of 1,263 Ha surveyed to date:

- Grade 1: none present
- Grade 2: 19.2% (243 Ha)
- Grade 3a: 36.0% (455 Ha)
- Grade 3b: 44.8% (565.9 Ha)
- Grade 4: none present.

Figure 9-2: Preliminary ALC Survey Results



9.31. Soil pit data are used to refine and confirm soil auger results and continuous wet conditions over winter 2023-24 have hampered progress. The soil survey field work is due to be completed in late June 2024 and confirmed land gradings will be available to inform the ES.

9.32. No detailed post-1988 agricultural land classification is publicly available for our Site. The Provisional ALC map of England, published at 1:250,000 scale, records the land as almost entirely grade 3 quality[14]. This dataset does not differentiate between 3a and 3b land, so cannot be used to determine proportions of best and most versatile agricultural land (BMV). It is also inaccurate on a field scale. As noted above, preliminary site-specific ALC results suggest that significant areas of grade 2 are found at our Site which are not mapped at the 1:250,000 scale.

Hydrogeology

9.33. The Mercia Mudstone Group bedrock units are classified as a secondary B aquifer, with the Penarth Group classified as a secondary undifferentiated aquifer. Where superficial units are present, these are categorised as secondary A aquifers. There is a small area of secondary undifferentiated aquifer where till deposits are present between Ragnall and Darlton.

9.34. There are five groundwater abstraction points located close to the River Trent, east of Ragnall. In terms of groundwater protection areas, each of these comprises a small central Zone 1 protection area, surrounded by a slightly larger Zone 1 (subsurface activity) area, and then a larger Zone 2 (subsurface activity). One of these inner zones is mainly within our Site boundary, with its associated Zone 2 partly inside and partly outside our Site boundary. Two of the others are close together, with combined Zone 1 areas that are partly within our Site boundary. The associated Zone 2 is also partially within our Site boundary. The inner zones for the other two SPZs are outside our Site boundary, with the Zone 2 just encroaching on the far north western corner of our Site.

Hydrology

9.35. The surface water environment within our Site is dominated by the presence of the River Trent, which crosses our Site area roughly from north to south (flowing northwards). Other watercourses are typically drainage features, present along field boundaries. These are as deep as 4m or 5m in places, some with embankments. Full details relating to surface water features are presented in **Chapter 8: Hydrology and Hydrogeology**.

Sensitive Land Uses

9.36. No sensitive land uses[15] for the purposes of the land, soil and groundwater assessment have been identified within our Site or within 250m of our Site boundary.

Further Data Collection

[14] Defra, 2023. *Interactive map of Great Britain*. Online resource: https://magic.defra.gov.uk/MagicMap.aspx

[15] Sensitive land uses covered by this search included: International designations – Ramsar wetland, Special Area of Conservation (SAC), Special Protection Area (SPA); National designations – Site of Special Scientific Interest (SSSI), National Nature Reserve (NNR), ancient woodland; Local designations – Local Nature Reserve, Site of Importance for Nature Conservation.

9.37. Additional site-specific data will be collected to inform our ES, which will include the preparation of a detailed preliminary risk assessment relating to land, soil and groundwater. This will assess potential risks from contamination to sensitive receptors (human health, groundwater or ecological receptors).

9.38. The remaining locations not yet accessed by the ALC survey will be completed when access has been agreed for the survey works (anticipated to be by the end of June 2024). The full Site soil classifications present across our Site will be detailed in our ES.

Future Land, Soil and Groundwater Conditions

Collection of Future Land, Soil and Groundwater Data

9.39. The baseline conditions that might occur if our Project is not progressed are assessed as part of the impact assessment process.

9.40. If our Project is not progressed, the baseline conditions with respect to land, soil and groundwater would be expected to remain broadly unchanged, therefore no further assessment against the future baseline is considered necessary.

Environmental Measures

9.41. Our Project incorporates the adoption of an outline Soil Management Plan (oSMP) (see **Appendix 9-3** for further details), an outline Construction Environmental Management Plan (oCEMP), outline Operational Environmental Management Plan (oEMP) and Decommissioning Environmental Management Plan (DEMP) to minimise emissions and sources of land, soil or groundwater pollution during the construction and decommissioning works (see **Chapter 4: Our Project** for details relating to these management plans and **Appendix 4-2** in **Chapter 1-6** for environmental measures to be included in the oCEMP). These documents will include good design and best practice measures to ensure that adverse impacts to land, soil and groundwater are avoided, reduced or mitigated. These environmental measures are considered to be embedded mitigation, therefore will be applied to any potential environmental effects prior to the technical assessment.

Potential Likely Significant Effects Scoped Out

9.42. **Table 9-1** presents the matters that we have scoped out as it is considered no likely significant effects will occur. This has been accepted by PINs as set out in the EIA Scoping Opinion.

Table 9-1: Effects Scoped Out

Matters Scoped Out	Justification
Physical damage to soil resources- Operational phase	The scoping opinion agreed to scope this out due to limited disturbance of soil, as long as details are provided in the ES relating to type and number of vehicles required for on-site maintenance, (including potential replacement of panels).

Land and groundwater contamination- Operational phase	The scoping opinion agreed to scope out this matter. It was indicated that the ES should describe any measures in place to reduce the potential for contamination during operation.

Preliminary Environmental Assessment Construction and Decommissioning Phase

Construction and Decommissioning: Land

9.43. The main potential concerns related to the construction and decommissioning activities of our Project are:

- the accidental spillage of fuels or chemicals being used during works, or
- the spreading of existing contamination due to construction or decommissioning activities.

Approach

9.44. The approach to the assessment undertaken for land and soils receptors is provided in **Appendix 9-2**.

9.45. The potential impacts from existing contamination will be assessed by the preliminary risk assessment report (to be completed and reported on as part of the ES). However, a preliminary review is presented here which uses the same assessment criteria as the ES.

Receptors and Receptor Sensitivity

9.46. **Table 1** in **Appendix 9-2** provides a guide to the criteria for determining the sensitivity of receptors associated with land. Sensitive receptors that relate to land include the following (based on guidance provided by IEMA[16]), with expected sensitivities provided for each receptor:

- Geological units (superficial and bedrock units), sensitivity 'low' for our Project based on the geological units that are present;
- Designated geological sites, sensitivity 'low', as none are present on-site or within the study area;
- Mineral extraction sites, sensitivity 'low', as no current sites are present on-site or within the study area; and
- Mineral safeguarding sites, sensitivity 'low', as there no sites within our Project boundary or study area.

[16] Institute of Environmental Management & Assessment (IEMA) Guide: A New Perspective on Land and Soil in Environmental Impact Assessment (2022). Available online: IEMA publishes new land and soils guidance - IEMA

Defining Effects

9.47. The magnitude of effects is determined based on the criteria provided in **Table 3** of **Appendix 9-2**. The significance of the effect is then determined from **Table 5** of **Appendix 9-2** (based on guidance from IEMA[17]).

9.48. The effects that have been considered for construction and decommissioning phases include the following:

- Localised contamination of soils from accidental spillages of fuel or chemicals during construction works; and
- Mobilisation of existing unknown contamination within soil or groundwater.

9.49. The magnitude of impact on land receptors would be expected to be negligible, based on the criteria provided in **Table 3** of **Appendix 9-2.**

9.50. Effects on the land receptors listed above, from construction or decommissioning activities, will normally be neutral or slight, which would be reported as 'not significant' (when environmental measures have been implemented), as determined by referring to **Table 5** of **Appendix 9-2**.

Preliminary Assessment

As stated above, a oSMP, oCEMP and Decommissioning Environmental Management Plan will be adopted to minimise the environmental impacts of the construction and decommissioning works, and a set of best-practice measures will be incorporated into the specification for the works. Further information is provided in **Chapter 4: Our Project**.

9.51. These preliminary measures include the following:

- Procedures to mitigate against erosion
- Procedures to deal with unexpected contamination
- Emergency procedures to manage accidental spillages and leaks
- Independent auditing and monitoring of contractors.

9.52. Further details will be presented in the outline management plans.

9.53. If general pollution control measures are followed, there should be no likely significant effects on land as a result of the activities undertaken during the construction and decommissioning phases.

Construction and Decommissioning: Groundwater

9.54. Risks to groundwater relating to the construction and decommissioning activities include:

- the accidental spillage of fuels or chemicals
- the spreading of existing contamination

[17] Institute of Environmental Management & Assessment (IEMA) Guide: A New Perspective on Land and Soil in Environmental Impact Assessment (2022). Available online: IEMA publishes new land and soils guidance - IEMA

- impacts from piling, excavations or earthworks (which could result in spreading contamination or reducing the quality of aquifers)
- damage to existing drainage systems, or
- release of contaminated run-off from Site areas.

Approach

9.55. The preliminary risk assessment will consider how likely contamination is to affect sensitive receptors. This PEIR identifies potential significant effects on groundwater based on the available information. The EIA process will then provide further assessment of any identified potential effects.

Receptors and Receptor Sensitivity

9.56. **Table 2** in **Appendix 9-2** provides a guide to the criteria for determining the sensitivity of groundwater receptors. See **Appendix 9-2** for the assessment criteria. Sensitive receptors that relate to groundwater include the following (based on guidance provided by IEMA[18]), with expected sensitivities provided for each receptor:

- The majority of our Site is underlain by secondary aquifers (in both bedrock and superficial geological units) with 'low' sensitivity because they are not connected to groundwater source protection zones (SPZs);
- SPZs near Ragnall would be classified as an area of 'medium' sensitivity for groundwater, which is partially within our Site boundary; and
- Groundwater abstraction points are present across our Site, mainly used for spray irrigation for farming. These would also be categorised as being of 'medium' sensitivity.

Defining Effects

9.57. The magnitude of effects is determined based on the criteria provided in **Table 4** of **Appendix 9-2**. The significance of the effect is then determined from **Table 5** of **Appendix 9-2** (based on guidance from IEMA[(19)]).

9.58. Based on categories in **Table 4** of **Appendix 9-2**, the magnitude of impact is considered to be likely to be low for groundwater receptors across our Site. Referring to **Table 6** of **Appendix 9-2**, the significance would therefore be either minor or negligible, which would be reported as 'not significant'.

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[18] Institute of Environmental Management & Assessment (IEMA) Guide: A New Perspective on Land and Soil in Environmental Impact Assessment (2022). Available online: IEMA publishes new land and soils guidance - IEMA

[19] Institute of Environmental Management & Assessment (IEMA) Guide: A New Perspective on Land and Soil in Environmental Impact Assessment (2022). Available online: IEMA publishes new land and soils guidance - IEMA

Preliminary Assessment

9.59. A oSMP, oCEMP and Decommissioning Environmental Management Plan will be adopted to minimise the environmental impacts of the construction and decommissioning works, and a set of good practice measures will be incorporated into the specification for the works. These preliminary measures include the following:

- Procedures to mitigate against erosion
- Procedures to deal with unexpected contamination
- Emergency procedures to manage accidental spillages and leaks
- Independent auditing and monitoring of contractors.

9.60. Further details will be presented in the outline management plans.

9.61. If general pollution control measures are followed, there should be no likely significant effects on groundwater as a result of the activities undertaken during the construction and decommissioning phases.

Construction and Decommissioning: Soil and Agricultural Land

9.62. Likely effects during construction could include:

- Compaction and deterioration of soils and agricultural land (access tracks within our Site are likely to be most susceptible to deterioration through erosion).
- Damage to soils during handling (some soils are more susceptible to damage when handled. There will be limited handling and moving of soils during the construction of our Project and handling will be avoided where practical).

9.63. Where possible the design layout has minimised the use of BMV land. Preliminary surveys have shown that there are no ALC grade 1 areas on-site.

Approach

9.64. A detailed ALC survey of our Site will be completed when access to the remaining land parcels is possible (expected to be by the end of June 2024) and will inform the assessment in the ES that will be part of the DCO application. This will provide information on the location of soil classes across our Site areas. However, a preliminary review of the sensitivity of soils has been presented in this PEIR based on the available data, using the assessment criteria that will be applied within the ES.

Receptors and Receptor Sensitivity

9.65. **Table 1** in **Appendix 9-2** provides a guide to the criteria for determining the sensitivity of soil receptors. Soils are categorised in accordance with the ALC. Soils of ALC grades 1, 2 and 3a are considered to be BMV land. These would be deemed to be ‘very high’ (grade 1 or 2) or ‘high’ (grade 3a) sensitivity. Preliminary baseline data available for our Site indicates that soils are mainly grades 2, 3a or 3b. However, these rankings may be amended as more detailed data becomes available as the ALC survey works are completed.

9.66. Based on the preliminary information:

- 19.2% of soils are classified as grade 2and would have 'very high' sensitivity
- 36.0% of soils are classified as grade 3a and would have 'high' sensitivity
- 44.8% of soils, classified as grade 3b, would have 'medium' sensitivity and
- There are no areas where the soils would be classified as being of 'low' sensitivity (grade 4 or 5, or urban soils).

Defining Effects

9.67. The magnitude of effects is determined based on the criteria provided in **Table 3** of **Appendix 9-2**. The significance of the effect is then determined from **Table 6** of **Appendix 9-2** (based on guidance from IEMA[20]).

9.68. The magnitude of impact on soils could range from moderate to negligible, based on the descriptions provided in **Table 3** of **Appendix 9-2**.

9.69. Effects on soil from construction or decommissioning activities will potentially be 'significant' where grade 2 or grade 3a land is affected ('very high' and 'high' sensitivity, with potentially moderate magnitude of impact), but are expected to be 'not significant' for grade 3b or grade 4 land ('medium' and 'low' sensitivity, with potentially minor magnitude of impact). Adherence to a robust oSMP will be of importance in minimising negative effects on soil and agricultural land quality.

Preliminary Assessment

A oSMP, oCEMP and Decommissioning Environmental Management Plan will be adopted to minimise the environmental impacts of the construction and decommissioning works, and a set of best-practice measures will be incorporated into the specification for the works. These preliminary measures include:

- Identifying those areas within our Site which may be more susceptible to damage, for example, the temporary access tracks, construction compounds and steep slopes;
- Presenting guidelines as to when soil handling should be avoided (for example when it is wet or after periods of heavy rainfall or high winds)
- Providing guidelines as to when soils are suitable for being handled or trafficked.
- Providing soil management guidelines (for example relating to topsoil stripping, construction and storage of topsoil and subsoil in stockpiles, stockpile management)
- Providing guidelines to maintain the physical properties of the soil
- Independent auditing and monitoring of the contractor.

9.70. Further details will be presented in the outline management plans.

[20] Institute of Environmental Management & Assessment (IEMA) Guide: A New Perspective on Land and Soil in Environmental Impact Assessment (2022). Available online: IEMA publishes new land and soils guidance - IEMA

9.71. Based on the information available, whilst our Site contains grade 2 and grade 3a land, taking account of the management plans which will minimise negative effects on soil and agricultural land quality, there would be expected to be no likely significant effects.

Next Steps

9.72. To ensure the final list of measures included in the oSMP, oCEMP and Decommissioning Environmental Management Plan are appropriate, a more detailed risk assessment (based on the latest description for our Project) will be conducted in the form of a preliminary risk assessment, and will be presented in our ES. ALC survey works will be completed when access to remaining areas of land is possible to provide more detailed information on the soils located across our Site.

Operational Phase

Operational Phase: Land, Soil and Groundwater

9.73. The scoping opinion confirmed that land, soil and groundwater impacts could be scoped out of the EIA process for the operational phase, as long as appropriate environmental measures would be integrated into the relevant management plans. Details of the management plans and the environmental measures to be included are detailed within **Chapter 4: Our Project** and **Appendix 4-1**. Further details on the oSMP is included in **Appendix 9-3**.

9.74. Our Project will lead to temporary impacts to soil and agricultural land for the duration of the operational phase (assumed to be 60 years), in particular, the areas in which the BESS and substations will be located. The area of land underneath the Solar PV panels and within the field margins will be used for ecological mitigation and enhancements, which will include planting of grassland and wildflowers. This planting will help to reduce soil degradation and erosion during the operational phase which could lead to potential benefits to the soil quality.

Next Steps

9.75. Industry good practice measures for the protection of land, soil and groundwater will be included in the oSMP and Outline Operational Environmental Management Plan. Further information on the amount of ALC land to be used for solar infrastructure and ecological enhancement will be presented within the DCO application.

Conclusions

9.76. **Table 9-2** presents a summary of the preliminary likely significant effects, with the further information that will be collected also outlined. It also details the next steps that will be undertaken to inform our ES.

Table 9-2: Summary of Preliminary Likely Significant Effects

Matter	Result of review of preliminary environmental information	Further Information	Next Steps
Construction and decommissioning: land	No likely significant effects	With the adoption of an oSMP, oCEMP and	A preliminary risk assessment will be completed for

Matter	Result of review of preliminary environmental information	Further Information	Next Steps
		Decommissioning Environmental Management Plan and a set of best-practice measures to control pollution, no significant effects are likely.	our Site to provide a contamination assessment, which will provide a more detailed baseline for assessment as part of the EIA process. Assessment of likely significant effects will be completed as part of the EIA.
Construction and decommissioning: groundwater	No likely significant effects	With the adoption of an oSMP, oCEMP and Decommissioning Environmental Management Plan and a set of best-practice measures to control pollution, no significant effects are likely.	The preliminary risk assessment will cover potential risks to groundwater and provide more details for undertaking the assessment within the EIA. Assessment of likely significant effects will be completed as part of the EIA.
Construction and decommissioning: soil and agricultural land	No likely significant effects	An oSMP, oCEMP and Decommissioning Environmental Management Plan and a set of best-practice soil management techniques will minimise effects on soil.	A detailed ALC survey is underway, and results will be available in time to provide a more detailed baseline for assessment as part of the EIA process. Assessment of likely significant effects will be

Matter	Result of review of preliminary environmental information	Further Information	Next Steps
			completed as part of the EIA.
Operational phase: land, groundwater, soil and ALC	No likely significant effects	With the adoption of an oSMP, Operational Environmental Management Plan and a set of best-practice measures to control pollution, no significant effects are likely.	Preparation of management plans to submit as part of the DCO application.

Appendices

Appendix 9-1: Key Legislation and Policy

Appendix 9-2: Guidance for Assessment of Effects

Appendix 9-3: Environmental Measures

Appendix 9-1: Key Legislation and Policy

Review of Policy, Legislation and Relevant Guidance

Legislation, planning policy and guidance relating to land and soils, and pertinent to our Project comprises:

Legislation

Environmental Protection Act (1990)

Part 2A provides a statutory regime for the identification and remediation of 'Contaminated Land'. It introduces a statutory definition of 'contaminated land' based on significant harm or the likelihood of significant harm or the pollution or likely pollution of controlled waters (all groundwater, inland waters, and estuaries, excluding water perched above the zone of saturation). Local authorities are the primary regulators under the Part 2A regime, with a duty to identify contaminated land in their area.

Control of Pollution Act (1974)

This Act preceded the EPA 1990 and makes provisions for the control of pollution across waste, water, noise, and public health.

Environmental Permitting Regulations (2016) (as amended)

These regulation act as an overarching permitting structure for activities which may have the potential cause harm to human health and the environment. By setting out a permitting system, they aim to reduce the number of obligations for operators, whilst still retaining robust protections, best practice and legislative implementation.

National Planning Policy

Overarching National Policy Statement for Energy (EN-1) (2023)

This provides overarching government policy on energy NSIPs, how planning applications relating to energy will be assessed, and the way in which any impacts and mitigation measures will be considered. Part 5, Section 5.8 of this policy statement specifically relates to Land Use.

Paragraph 5.11.8 states that *"The ES… should identify existing and proposed land uses near the project, any effects of replacing an existing development or use of the site with the proposed project or preventing a development or use on a neighbouring site from continuing. Applicants should also assess any effects of precluding a new development or use proposed in the development plan. The assessment should be proportionate to the scale of the preferred scheme and its likely impacts on such receptors. For developments on previously developed land, the applicant should ensure that they have considered the risk posed by land contamination and how it is proposed to address this."*

Paragraphs 5.11.12 to 5.11.15, 5.11.23 and 5.11.34 are all directly relevant to soil and agricultural land:

"5.11.12 Applicants should seek to minimise impacts on the best and most versatile agricultural land (defined as land in grades 1, 2 and 3a of the Agricultural Land Classification) and preferably use land in areas of poorer quality (grades 3b, 4 and 5).

5.11.13 Applicants should also identify any effects and seek to minimise impacts on soil health and protect and improve soil quality taking into account any mitigation measures proposed.

5.11.14 Applicants are encouraged to develop and implement a Soil Management Plan which could help minimise potential land contamination. The sustainable reuse of soils needs to be carefully considered in line with good practice guidance where large quantities of soils are surplus to requirements or are affected by contamination.

5.11.15 Developments should contribute to and enhance the natural and local environment by preventing new and existing developments from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability.

5.11.23 Although in the case of most energy infrastructure there may be little that can be done to mitigate the direct effects of an energy project on the existing use of the proposed site (assuming that some of that use can still be retained post project construction) applicants should nevertheless seek to minimise these effects and the effects on existing or planned uses near the site by the application of good design principles, including the layout of the project and the protection of soils during construction.

5.11.34 The Secretary of State should ensure that applicants do not site their scheme on the best and most versatile agricultural land without justification. Where schemes are to be sited on best and most versatile agricultural land the Secretary of State should take into account the economic and other benefits of that land. Where development of agricultural land is demonstrated to be necessary, areas of poorer quality land should be preferred to those of a higher quality."

National Policy Statement for Renewable Energy Infrastructure (EN-3) (2023)

This policy acts forms a key document that a range of stakeholders use to understand government policy on NSIPs, how planning applications relating to energy infrastructure will be assessed, and the way in which any impacts and mitigation measures will be considered. Specific extracts relating to this Project are as follows:

Paragraphs 2.10.28 to 2.10.34 state that *"Solar is a highly flexible technology and as such can be deployed on a wide variety of land types.*

While land type should not be a predominating factor in determining the suitability of the site location applicants should, where possible, utilise suitable previously developed land, brownfield land, contaminated land and industrial land. Where the proposed use of any agricultural land has been shown to be necessary, poorer quality land should be preferred to higher quality land avoiding the use of "Best and Most Versatile" agricultural land where possible. 'Best and Most Versatile agricultural land is defined as land in grades 1, 2 and 3a of the Agricultural Land Classification.

Whilst the development of ground mounted solar arrays is not prohibited on Best and Most Versatile agricultural land, or sites designated for their natural beauty, or recognised for ecological or archaeological importance, the impacts of such are expected to be considered and are discussed under paragraphs 2.10.73 – 92 and 2.10.107 – 2.10.126.

It is recognised that at this scale, it is likely that applicants' developments will use some agricultural land. Applicants should explain their choice of site, noting the preference for development to be on suitable brownfield, industrial and low and medium grade agricultural land.

Where sited on agricultural land, consideration may be given as to whether the proposal allows for continued agricultural use and/or can be co-located with other functions (for example, onshore wind generation, storage, hydrogen electrolysers) to maximise the efficiency of land use.

The Agricultural Land Classification (ALC) is the only approved system for grading agricultural quality in England and Wales and, if necessary, field surveys should be used to establish the ALC grades in accordance with the current, or any successor to it, grading criteria86 and identify the soil types to inform soil management at the construction, operation, and decommissioning phases in line with the Defra Construction Code.

Applicants are encouraged to develop and implement a Soil Resources and Management Plan which could help to use and manage soils sustainably and minimise adverse impacts on soil health and potential land contamination. This should be in line with the ambition set out in the Environmental Improvement Plan to bring at least 40% of England's agricultural soils into sustainable management by 2028 and increase this up to 60% by 2030."

Paragraph 2.10.127 states that *"The Defra Construction code of practice for the sustainable use of soils on construction sites provides guidance on ensuring that damage to soil during construction is mitigated and minimised. Mitigation measures focus on minimising damage to soil that remains in place, and minimising damage to soil being excavated and stockpiled. The measures aim to preserve soil health and soil structure to minimise soil carbon loss and maintain water infiltration and soil biodiversity. Mitigation measures for agricultural soils include use of green cover, multispecies cover crops - especially during the winter- minimising compaction and adding soil organic matter."*

Paragraph 2.10.145 states that *"The Secretary of State should take into account the economic and other benefits of the best and most versatile agricultural land. The Secretary of State should ensure that the applicant has put forward appropriate mitigation measures to minimise impacts on soils or soil resources."*

The National Planning Policy Framework, 2023

The National Planning Policy Framework (NPPF) is an overarching document which sets out government planning policy for England, and how this is expected to be applied by local authorities and developers. The NPPF provides a framework for local sustainable development via local plans.

Regarding proposals affecting the Green Belt, paragraph 153 states that *"When considering any planning application, local planning authorities should ensure that substantial weight is given to any harm to the Green Belt. 'Very special circumstances' will not exist unless the potential harm to the Green Belt by reason of inappropriateness, and any other harm resulting from the proposal, is clearly outweighed by other considerations."*

In addition, Section 15 "Conserving and enhancing the natural environment" includes the following statements:

"Planning policies and decisions should contribute to and enhance the natural and local environment by:

a) protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan);

b) recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland" and

"e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;"

Further information relevant to the Project can be found within paragraphs 153-158 and pages 45 to 46 of the NPPF.

Environmental Improvement Plan 2023

This plan forms the first review of the government's 25 Year Environment Plan, providing the plan for the delivery of the framework. The framework sets out the Government's vision for the environment in England and identifies the need to explore improvements across a wide range of disciplines, including an approach to land use that aims to account for the environment in the first instance. Proposals within the 25-year plan also address minimising waste and improving soil health. The Plan includes a series of long term targets, with associated interim targets, such as the following which relates to agricultural chemical use:

"Long term target: Reduce nitrogen, phosphorus and sediment pollution from agriculture into the water environment by 40% by 31 December 2038, compared to a 2018 baseline.

Interim target 1: Reduce nitrogen, phosphorus and sediment pollution from agriculture to the water environment by 10% by 31 January 2028

Interim target 2: Reduce nitrogen, phosphorus and sediment pollution from agriculture to the water environment by 15% in catchments containing protected sites in unfavourable condition due to nutrient pollution by 31 January 2028."

The following commitment relates to waste:

"Long term target: By 31 December 2042, the total mass of residual waste excluding major mineral wastes in a calendar year does not exceed 287 kg per capita.

Interim target 1: By 31 January 2028, the total mass of residual waste excluding major mineral wastes in the most recent full calendar year does not exceed 437 kg per capita."

Local Planning Policy

Local planning policy relevant to our Site is set out below. Local policies can be an important and relevant consideration for NSIPs as well, but in the event of any conflict, the NPS policy prevails.

Newark and Sherwood District Council (2023) Local Development Framework, Amended Allocations and Development Management Development Plan Document (AADMDPD). Submission Version, January 2024.

This amended local Development Plan Document (DPD) has been compiled to ensure that the wider development framework within Newark and Sherwood District Council sufficiently allocates land for development to meet the needs of the area, up until 2033. The document includes *"new and amended Housing and Affordable Housing Policies which replace those included in the Amended Core Strategy and new Gypsy Roma Traveller policies and allocations. The document also sets out amendments to urban boundaries and village envelopes, retail boundaries as well as sites requiring continued protection from development (open space and green infrastructure designations). It also includes a suite of Development Management policies to provide greater direction, help deliver specific allocations and assist in the day-to-day assessment of planning applications."* This DPD is currently under examination via the Secretary of State with an independent planning inspector.

Specific policies within the AADMDPD relevant to our Project include Policy DM8 "*Development in the Open Countryside*" which states that *"In accordance with the requirements of Spatial Policy 3 of the Amended Core Strategy, development away from villages or settlements, in the open countryside, will be strictly controlled and limited to the following types of development:*

Agricultural and Forestry Development Requiring Planning Permission;

New and Replacement Rural Workers Dwellings, the Extension of Existing Rural Workers Dwellings, and the Removal of Occupancy Conditions Attached to Existing Dwellings;

New and Replacement Dwellings;

Replacement of Non-Residential Buildings;

Conversion of existing buildings;

Rural Diversification;

Equestrian Uses;

Employment uses;

Community and Leisure Facilities;

Roadside Services; and

Visitor Based Tourism Development and Tourist Accommodation."

Newark and Sherwood District Council (2019), Amended Core Strategy Development Plan

The Amended Core Strategy for Newark and Sherwood District is part of the Local Development Framework for the area. This strategy outlines the overarching issues and objectives to address over a 20-year period, contextualising this into wider vision, series of objectives and core policies toward delivery.

Core Policy 9 "Sustainable Design" states the following:

"All new development should:

- *Demonstrate an effective and efficient use of land that, where appropriate, promotes the re-use of previously developed land and that optimises site potential at a level suitable to local character."*

Central Lincolnshire Local Plan (2023)

The Local Plan for the central Lincolnshire area sets out the approach to planning policy and overarching development allocations to drive growth in the area over a 20-year period. The Local Plan is contextualised into a wider vision, series of objectives and core policies toward delivery.

Policy S14 "Renewable Energy" covers the commitment to supporting a transition to renewable energy, and includes the following comments:

"Proposals for solar thermal or photovoltaics panels and associated infrastructure to be installed on existing property will be under a presumption in favour of permission unless there is clear and demonstrable significant harm arising.

- *Proposals for ground based photovoltaics and associated infrastructure, including commercial large scale proposals, will be under a presumption in favour unless:*
- *there is clear and demonstrable significant harm arising; or*
- *the proposal is (following a site specific soil assessment) to take place on Best and Most Versatile (BMV) agricultural land and does not meet the requirements of Policy S67; or*

- *the land is allocated for another purpose in this Local Plan or other statutory based document (such as a nature recovery strategy or a Local Transport Plan), and the proposal is not compatible with such other allocation.*

Proposals for ground based photovoltaics should be accompanied by evidence demonstrating how opportunities for delivering biodiversity net gain will be maximised in the scheme taking account of soil, natural features, existing habitats, and planting proposals accompanying the scheme to create new habitats linking into the nature recovery strategy.

Policy S67 "Best and Most Versatile Agricultural Land" states that:

"Proposals should protect the best and most versatile agricultural land so as to protect opportunities for food production and the continuance of the agricultural economy. With the exception of allocated sites, significant development resulting in the loss of the best and most versatile agricultural land will only be supported if:

a) The need for the proposed development has been clearly established and there is insufficient lower grade land available at that settlement (unless development of such lower grade land would be inconsistent with other sustainability considerations);

b) The benefits and/or sustainability considerations outweigh the need to protect such land, when taking into account the economic and other benefits of the best and most versatile agricultural land;

c) The impacts of the proposal upon ongoing agricultural operations have been minimised through the use of appropriate design solutions; and

d) Where feasible, once any development which is supported has ceased its useful life the land will be restored to its former use (this condition will be secured by planning condition where appropriate).

Where proposals are for sites of 1 hectare or larger, which would result in the loss of best and most versatile agricultural land, an agricultural land classification report should be submitted, setting out the justification for such a loss and how criterion b has been met."

Bassetlaw District (2011) Local Development Framework, Core Strategy and Development Management Policies DPD

The Core Strategy for the Bassetlaw District sets out the overarching vision for the area up until 2026, including the policy approach to deliver this.

Policy DM10 "*Renewable and Low Carbon Energy*" is relevant to our Project and states that:

"A. Carbon Reduction

The Council will be supportive of proposals that seek to utilise renewable and low carbon energy to minimise CO2 emissions. Proposals for renewable and low carbon energy infrastructure will need to demonstrate that they:

i. *are compatible with policies to safeguard the built and natural environment, including heritage assets and their setting, landscape character and features of recognised importance for biodiversity;*
ii. *will not lead to the loss or damage to high-grade agricultural land (Grades 1 & 2);*
iii. *are compatible with tourism and recreational facilities;*
iv. *will not result in unacceptable impacts in terms of visual appearance; noise; shadow-flicker; watercourse engineering and hydrological impacts; pollution; or traffic generation; and*
v. *will not result in an unacceptable cumulative impact in relation to the factors above.*

Large-scale renewable and low carbon energy proposals must provide full details of arrangements for decommissioning and reinstatement of the site if/when it ceases to operate.

B. District Heating and Co-location

Proposals for new development in District Heating Opportunity Areas will, where the scale of the proposal permits, be expected to demonstrate consideration of District Heating as a means of achieving carbon compliance. District Heating opportunities include those supplied by heat from waste management sites, power stations, coalmine methane facilities, or new standalone infrastructure. Applicants will be expected to engage with the Council at pre-application stage to assess the feasibility of achieving this objective.

Where District Heating Networks are established, all subsequent new development close enough to connect to such a network will be expected to do so where there are no barriers to this connection.

Proposals for heat-producing development will be expected to demonstrate consideration of the feasibility of utilising its waste heat for heat consuming development. Support will be given to proposals that will ensure the co-location of compatible heat-producing and heat-consuming development.

C. Major Development

Major development proposals will be expected to deliver specific low-carbon and renewable energy infrastructure in line with assessments of feasibility and overall viability.

D. Community Energy Schemes

Support will be given to community led energy schemes in line with the Council's Renewable and Low Carbon Energy Study (or subsequent replacement), on exception sites if necessary, where strong local support is demonstrated."

Draft Bassetlaw Local Plan (2023) 2020-2038: Main Modifications Version, August 2023

This Local Plan sets out Bassetlaw District's planning and policy framework, development strategy and site allocations to inform effective delivery of the overall vision up until 2038.

Policies set out in the Local Plan are relevant to our Project.

Policy ST1 "*Bassetlaw's Spatial Strategy*" states that:

"The spatial strategy for Bassetlaw will be delivered over the plan period 2020-2038 through:

a) managed sustainable development and growth, appropriate to the size of each settlement or location to meet the evidenced need for new homes and jobs, to regenerate the District's town centres, and to support necessary improvements to infrastructure, services and facilities by:

> *i. promoting the efficient and effective use of land and the re-use of previously developed land in sustainable locations, unless there are overriding amenity, biodiversity or heritage matters that preclude such use; and by seeking to minimise the use of the most versatile grade 1-3 agricultural land, where practicable;*
>
> *ii. emphasising the need to develop in sustainable locations in close proximity to transport hubs and key public transport nodes, and by encouraging higher density development in those locations; and*
>
> *iii. ensuring that sufficient physical, social and green/blue infrastructure is delivered to meet identified needs in a timely manner.*

b) enabling the provision of housing land for a minimum of 9,720 dwellings (540 dwellings per annum), through completed sites, sites with planning permission, new site allocations in this Local Plan, and from site allocations in made neighbourhood plans in accordance with the settlement hierarchy in Figure 8 below:

> *a) at the Main Towns:*
>
> *1i. approximately 2,322 dwellings in Worksop Outer Area;*
>
> *2. approximately 238 dwellings in the Worksop Central DPD;*
>
> *3. approximately 2,331 dwellings in Retford; and*
>
> *4. approximately 2,203 dwellings in Harworth and Bircotes.*
>
> *b) by supporting the delivery of approximately 1,412 dwellings in the Large Rural Settlements;*
>
> *c) by supporting the delivery of approximately 1,715 dwellings in the eligible Small Rural Settlements;*
>
> *…*
>
> *4. Countryside*
>
> *c) enabling windfall sites, which are expected to be a reliable source of housing supply during the plan period contributing approximately 912 homes;*
>
> *d) considering land outside of development boundaries and/or outside the built up area(s) of settlements identified in the settlement hierarchy as part of the wider countryside, where development will only be supported where consistent with other policies in the development plan or national policy;*

e) providing for 49 permanent pitches for Gypsy and Travellers by 2037-2038 of which 27 pitches will be provided by 2028-2029 to meet identified local needs;

f) contributing to the provision of approximately 193ha of developable land in the E(g), B2 and B8 Class at the General and Larger Unit Employment Sites, and to meet the needs for B8 sub-regional/regional large scale logistics use only on approximately 118ha of land at the Apleyhead Strategic Employment Site;

g) safeguarding, regenerating and enhancing the role of the District's town centres at Worksop, Retford and Harworth & Bircotes, including a small scale extension to Harworth & Bircotes town centre to secure their longevity as vibrant centres that provide for appropriate housing, business, retail, leisure and community facilities to serve each settlement, and its catchment effectively."

Policy ST51 *"Renewable Energy Generation"* states that*:*

"3. Development that generates, shares, transmits and/or stores zero carbon and/or low carbon renewable energy including community energy schemes will be supported subject to the satisfactory resolution of all relevant site specific and cumulative impacts upon:

a) location, setting and position in the wider landscape, resulting from its siting and scale;

b) natural and heritage assets and their settings;

c) air and water quality;

d) hydrology and hydrogeology;

e) the best and most versatile agricultural land;

f) existing highway capacity and highway safety;

g) noise, light, glare, smell, dust, emissions or flicker;

h) aviation and radar;

i) recreation and local amenity.

Proposals must take into account operational and approved developments, as well as any proposed intensification to operational or approved proposals.

Proposals involving one or more wind turbines will be supported where:

a) the site is located within an area defined as being suitable for wind energy in a made neighbourhood plan or development plan document; and

b) following consultation, it can be satisfactorily demonstrated that all potential adverse planning impacts identified by affected local communities have been fully addressed, including cumulative impacts identified in Part 1 above.

4. All renewable energy development will be expected to provide details of the expected power generation based upon expected yield or local self-consumption to enable effective monitoring of the district's contribution to the national zero carbon targets.

5. A decommissioning programme applied by a Condition to any planning permission granted will be required to demonstrate that the site can be returned to an acceptable state, three years after cessation of operations."

National Guidance

Natural England (1988) 'Agricultural land Classification of England and Wales: Revised criteria for grading the quality of agricultural land (ALC011)

This guidance introduced the ALC, which provides the framework for grading land according to whether physical or chemical attributes of the land in question enforces limitations on agricultural use. This classification can be utilised at different scale and therefore can be applied at local, regional as well as national level.

Natural England (2017) Likelihood of Best and Most versatile Agricultural Land

This guidance is a mapping resource across England which visually represents the quality of agricultural land across an area, expressed through ALC grades which subsequently predict the likelihood of best and most versatile agricultural land. The maps are used for strategic planning purposes at a certain scale and use soil association predictions as the primary evidence base.

Appendix 9-2: Guidance for Assessment of Effects

For this preliminary assessment, the likely significant effects on identified receptors are reported based on the information available at the time of writing. The final assessment of likely significant effects will be reported in the Environmental Statement (ES).

A Minerals Assessment, to demonstrate how impacts to Mineral Safeguarding Areas have been addressed, does not form part of this preliminary assessment, but will be reported within the ES once further baseline information has been obtained and further consultation with the appropriate regulatory authorities has been undertaken.

A Preliminary Risk Assessment (PRA) will be completed for our Site. This will provide baseline data on our Site, alongside an assessment of risks relating to human receptors, controlled waters and other sensitive receptors. This work will be undertaken in line with the technical approach presented in Land Contamination Risk Management (LCRM) (Environment Agency, 2021) and in general accordance with British Standard (BS) 10175: 2011 + A2 2017 (BSI, 2017). The PRA report will include coverage of our Site history, geology, hydrogeology, hydrology, and other issues. A Site walkover has been completed as part of the assessment. An assessment of contaminated land will be completed by means of development of a conceptual site model (CSM), which identifies sources, pathways and receptors for contamination. A pollutant linkage is considered to exist when all three components of the CSM are identified. The significance of each pollutant linkage is then assessed to identify potential risks.

The assessment methodology for land and soils that has been used to support the information provided in this PEIR is detailed below.

Receptor sensitivity for land and soil

Sensitivity criteria for land and soil, derived from the IEMA Guide A New Perspective on Land and Soil in Environmental Impact Assessment [21], are defined in **Table 1** below.

Table 1: Receptor sensitivity for land and soil

Sensitivity (in-situ soils)	Soil resource
Very High	Biomass production: ALC grades 1 & 2 or Land Capability for Agriculture (LCA) Classes 1 & 2 Ecological habitat, soil biodiversity and platform for landscape: Soils supporting protected features within a European site (e.g., Special Area of Conservation (SAC), Special Protection Area (SPA), Ramsar); Peat soils; Soils supporting a National Park, or Ancient Woodland

[21] Institute of Environmental Management & Assessment (IEMA) Guide: A New Perspective on Land and Soil in Environmental Impact Assessment (2022). Available online: IEMA publishes new land and soils guidance - IEMA

Sensitivity (in-situ soils)	Soil resource
	Soil carbon: Peat soils Soils with potential for ecological/landscape restoration Soil hydrology: Very important catchment pathway for water flows and flood risk management Archaeology, Cultural heritage, Community benefits and Geodiversity: Scheduled Ancient Monuments (SAMs) and adjacent areas; World Heritage and European designated sites; Soils with known archaeological interest; Soils supporting community/recreational/educational access to land covered by National Park designation Source of materials: Important surface mineral reserves that would be sterilised (i.e., without future access)
High	Biomass production: ALC grade 3a, or LCA grade 3.1. Ecological habitat, soil biodiversity and platform for landscape: Soils supporting protected features within a UK designated site (e.g., UNESCO Geoparks, Sites of Special Scientific Interest (SSSI) or Areas of Outstanding Natural Beauty (AONB), Special Landscape Area, and Geological Conservation Review sites); Native Forest and woodland soils; Unaltered soils supporting semi-natural vegetation (including UKBAP Priority habitats) Soil carbon: Organo-mineral soils (e.g., peaty soils) Soil hydrology: Important catchment pathway for water flows and flood risk management Archaeology, Cultural heritage, Community benefits and Geodiversity: Soils with probable but as yet unproven (prior to being revealed by construction) archaeological interest; Historic parks and gardens; Regionally Important Geological and Geomorphological Sites (RIGS); Soils supporting community /recreational/educational access to RIGS and AONBs Source of materials: Surface mineral reserves that would be sterilised (i.e. without future access)
Medium	Biomass production: ALC grade 3b or LCA grade 3.2 Ecological habitat, soil biodiversity and platform for landscape: Soils supporting protected or valued features within non-statutory designated sites (e.g., Local Nature Reserves (LNR), Local Geological Sites (LGSs), Sites of Nature Conservation Importance (SNCIs), Special Landscape Areas; Non-Native Forest and woodland soils Soil carbon: Mineral soils Soil hydrology: Important minor catchment pathway for water flows and flood risk management Archaeology, Cultural heritage, Community benefits and Geodiversity: Soils with possible but as yet unproven (prior to being revealed by construction) archaeological interest; Soils supporting community/recreational/educational access to land Source of materials: surface mineral reserves that would remain accessible for extraction

Sensitivity (in-situ soils)	Soil resource
Low	Biomass production: ALC grades 4 & 5 or LCA grades 4.1 to 7 or Urban soils Ecological habitat, soil biodiversity and platform for landscape: Soils supporting valued features within non-designated notable or priority habitats/landscapes. Agricultural soils Soil carbon: Mineral soils Soil hydrology: Pathway for local water flows and flood risk management Archaeology, Cultural heritage, Community benefits and Geodiversity: Soils supporting no notable cultural heritage, geodiversity nor community benefits; Soils supporting limited community/recreational/ educational access to land Source of materials: Surface mineral reserves that would remain accessible for extraction
Negligible	As for low sensitivity, but with only indirect, tenuous, and unproven links between sources of impact and soil functions

Receptor sensitivity for groundwater

Sensitivity criteria for groundwater, derived from professional judgement, are defined in the **Table 2** below.

Table 2: Receptor sensitivity for groundwater

Sensitivity	Criteria guide
High	The receptor has low ability to absorb change without fundamentally altering its present character and is of high environmental value or of national importance. In terms of hydrological receptors, this relates to principal aquifers (within groundwater Source Protection Zones).
Medium	The receptor has moderate capacity to absorb change without significantly altering its present character and has some environmental value or is of regional importance. In terms of hydrological receptors this relates to principal aquifers (outside of groundwater Source Protection Zones) and secondary (A, B or undifferentiated) aquifers (within groundwater Source Protection Zones).
Low	The receptor is tolerant of change without detriment to its character and is of low environmental value or local importance. In terms of hydrological receptors this relates to secondary (A, B or undifferentiated) aquifers (outside of Groundwater Source Protection Zone) and non-designated aquifers.

Magnitude of Impact for land and soil

Where an impact is considered to be present, the magnitude of the impact is classified using the criteria presented the **Table 3** below, which are derived from the

IEMA Guide A New Perspective on Land and Soil in Environmental Impact Assessment[22].

Table 3: Land and soil magnitude of impact

Magnitude of impact (change)	Description of impacts restricting proposed land use
Major	Permanent, irreversible loss of one or more soil functions or soil volumes (including permanent sealing or land quality downgrading), over an area of more than 20ha or loss of soil-related features, as advised by other topic specialists in EIA team (including effects from 'temporary developments'*) or Potential for permanent improvement in one or more soil functions or soil volumes due to remediation or restoration over an area of more than 20ha, or gain in soil-related features, as advised by other topic specialists in EIA team (including effects from 'temporary developments'*)
Moderate	Permanent, irreversible loss of one or more soil functions or soil volumes, over an area of between 5ha and 20ha or loss of soil-related features, as advised by other topic specialists in EIA team (including effects from 'Temporary Developments'*) or Potential for improvement in one or more soil functions or soil volumes due to remediation or restoration over an area of between 5ha and 20ha, or gain in soil-related features, as advised by other topic specialists in EIA team
Minor	Permanent, irreversible loss over less than 5ha or a temporary, reversible loss of one or more soil functions or soil volumes, or temporary, reversible loss of soil-related features, as advised by other topic specialists in EIA team. or Potential for permanent improvement in one or more soil functions or soil volumes due to remediation or restoration over an area of less than 5ha or a temporary improvement in one or more soil functions due to remediation or restoration or off-site improvement, or temporary gain in soil-related features, as advised by other topic specialists in EIA team
Negligible	No discernible loss or reduction or improvement of soil functions or soil volumes that restrict current or proposed land use
** Temporary developments can result in a permanent impact if resulting disturbance or land use change causes permanent damage to soils.*	

[22] Institute of Environmental Management & Assessment (IEMA) Guide: A New Perspective on Land and Soil in Environmental Impact Assessment (2022). Available online: IEMA publishes new land and soils guidance - IEMA

Magnitude of Impact for groundwater

Where an impact is considered to be present, the magnitude of the impact is classified using the criteria presented in **Table 4** below, which are derived from professional judgement. Impacts can be positive or adverse.

Table 4: Groundwater Magnitude of Impact

Magnitude of impact	Criteria guide
High	Total loss or major alteration to key elements or features of the baseline conditions to the extent that post-development character or composition of baseline conditions will be fundamentally changed.
Medium	Loss or alteration to one or more key elements or features of the baseline conditions to the extent that post-development character or composition of the baseline conditions will be materially changed.
Low	Minor shift away from baseline conditions. Changes arising will be detectable but not material; the underlying character or composition of the baseline conditions will be similar to the pre-development situation.
Negligible	Very little change from baseline conditions. Change is barely distinguishable, approximating to a 'no change' situation.

Significance of effect for land and soil

The significance of effect is based on the sensitivity of the receptor and the magnitude of impact, as outlined in **Table 5** below (derived from IEMA guidance[23]). The significance of effect can be adverse or positive.

The significance of an effect is reported as either 'significant' or 'not significant'. Any effects that have been determined as 'Moderate' or above are considered to be significant. Any effects that have been determined as 'Slight' or below are considered not significant.

Table 5: Land and Soils Significance of Effect Criteria

		Magnitude of Impact				
		No Change	**Negligible**	**Minor**	**Moderate**	**Major**
Sensitivity	**Very High**	Neutral	Slight	Moderate or Large	Large or very large	Very Large
	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate

[23] Institute of Environmental Management & Assessment (IEMA) Guide: A New Perspective on Land and Soil in Environmental Impact Assessment (2022). Available online: IEMA publishes new land and soils guidance - IEMA

		Magnitude of Impact				
		No Change	**Negligible**	**Minor**	**Moderate**	**Major**
	Negligible	Neutral	Slight	Slight	Neutral or Slight	Slight

Significance of effect for groundwater

The significance of effect is based on the sensitivity of the receptor and the magnitude of impact, as outlined in **Table 6** below (based on professional judgement).

The significance of an effect is reported as either 'significant' or 'not significant'. Any effects that have been determined as 'Moderate' or above are considered to be significant. Any effects that have been determined as 'Minor' or below are considered not significant.

Table 6: Groundwater significance of effect criteria

		Magnitude of Impact			
		Negligible	**Low**	**Medium**	**High**
Sensitivity	**High**	Negligible effect	Moderate or Minor effect	Major or Moderate effect	Major effect
	Medium	Negligible effect	Minor effect	Moderate effect	Major or Moderate effect
	Low	Negligible effect	Minor effect or negligible effect	Minor effect	Moderate or Minor effect

Appendix 9-3: Environmental Measures

Embedded Mitigation Measures

A number of mitigation measures will be applied within our Project, and this preliminary assessment has been based on the principle that these measures have been 'embedded' into the design of our Project to remove potential significant effects as far as practicable. For example, this includes the considered placement of infrastructure.

Embedded (primary) environmental mitigation measures are considered to be an inherent part of our Project. Embedded mitigation measures relevant to this preliminary land, soil and groundwater assessment include (but are not necessarily limited to) the following:

- Where not used for Solar PV development, BESS, or substations, prioritise the use of non-BMV land for the creation of legacy/permanent habitats where practicable.
- All internal access tracks and cable routes will use existing tracks, crossings and/or gaps in the hedgerows wherever practicable.
- Cabling routes will run alongside access tracks as much as possible to avoid wider excavations.

Additional Mitigation

Construction and decommissioning phases

In order to minimise likely effects relating to land contamination and to protect groundwater, additional mitigation during the construction and decommissioning phases will include the following:

- An Outline Construction Environmental Management Plan (oCEMP) and an Outline Decommissioning Environmental Management plan (DEMP) will be submitted in support of and secured by the DCO. The oCEMP and DEMP will be implemented and managed by the contractor undertaking the works. The oCEMP and DEMP will set out measures to avoid, minimise or mitigate effects on the environment. This would include procedures to mitigate against erosion and contaminated land and include emergency procedures to manage accidental spillages and leaks.
- The construction and decommissioning phases of work would be audited and monitored against the requirements of the oCEMP/DEMP by the contractor to ensure adherence.

With respect to soils and agricultural land, the following additional mitigation measures will be adhered to:

- An outline Soil Management Plan (oSMP) will be submitted in support of and secured by the DCO to manage any potential impacts to the soil (and agricultural land) during and on completion of the construction phase, and during the decommissioning phase. The oSMP will identify those areas within our Site that may be more susceptible to damage, for example, the temporary access tracks, construction compounds and steep slopes; and will set out details of when soil handling should be avoided (for example when it is wet or after periods of heavy rainfall or high winds) and it will advise on when soils are suitable for being handled or trafficked. The oSMP will also detail measures for soil management and follow the principles of best practice to maintain the physical properties of the soil, with the aim of restoring the land to its pre-construction condition following the temporary construction use and at the end of the lifetime of our Project, after decommissioning. Soil protection measures during construction, operation and decommissioning include:
  - Areas for landscaping should be left undisturbed wherever possible and should be fenced off from the works areas to preserve soil quality.
  - The management of trafficking on the land when the soil is in a suitable dry condition is key to managing the risk of soil compaction. All traffic should keep to defined routes across our site to contain the risk of soil compaction. As a general guide, construction works should avoid or undertake minimal traversing across our site and soil handling during the period early December to late March.
  - The soil moisture state should be assessed on site by a suitably qualified person prior to any work commencing and after rainfall events. Soil should only be handled when dry and friable.
  - Machinery with tracks or low ground pressure tyres should be used to spread the weight and minimise compaction.
  - If it is not possible to strip topsoils when they are below the plastic limit, they should be deposited into windrows prior to lifting them into their final bund once they have dried out sufficiently.
  - Stripped soils should be stored in designated bunds, normally close to their final destination ready for use. They should always be stored off the floodplain to preserve the soil and water quality.
  - Topsoil should be stored in bunds up to 3m high to minimise damage during storage.
  - Soils should be placed in stores for as short a time as possible, whilst minimising damage to the soil or site.
  - All bunds which will be in place for more than 6 months should be sown with a low maintenance grass seed mix.
  - Restoration should start at the furthest point from each site exit to ensure that soils once deposited are not trafficked by earth moving machinery.
  - Subsoil compaction should be removed prior to replacing the topsoil.

  - Topsoil should be reinstated to its full depth, maintaining and tying into the original contours on either side of the strip to allow surface water flow.
  - Timing of cultivation operations will be critical to the success of the restoration with the soils only being worked when in a dry and friable condition.
  - Reinstatement of soil should be monitored by a suitably qualified competent person.
  - Permanent post construction drainage may be required as part of land reinstatement and existing drainage will be replaced if damaged to ensure continued use. Any existing drains which are cut off/damaged by the works should be diverted into local drainage traps, to minimise sediment release.
  - On completion of the restoration works the soils will be in a fragile condition and all work should be geared towards stabilising the soil structure and establishing a strongly growing crop to ensure the best chance of a successful and sustainable restoration.

- The construction and decommissioning phases of work would be audited against the requirements of the oSMP by the contractor to ensure adherence.

Operational phase

Based on the assessment of preliminary environmental information, potential impacts to land contamination and groundwater will be principally managed and secured by the implementation of an outline Operational Environmental Management Plan (oEMP), which will summarise measures to prevent damage to the land during the operation of our Project.

Additional mitigation measures relating to groundwater protection include:

- Pile depths would be minimised, where practicable, and areas of impermeable surfaces will be designed to ensure groundwater infiltration and any risk of groundwater flooding is mitigated.
- Measures to avoid, minimise or mitigate effects on the environment will be documented within and secured by the oEMP. This would include best practice procedures, including measures for pollution prevention and emergency procedures to manage accidental spillages and leaks.

Further information will be provided relating to the procedures to manage the potential impact of firewater (which may contain chemicals from firefighting substances.

With respect to soils and agricultural land, embedded mitigation has addressed some potential effects. Other mitigation includes:

- Measures to ensure the quality of the land is maintained throughout the operational phase of our Project will be documented within and secured by the oSMP and the oEMP. The oSMP will identify those areas within our Site which may be more susceptible to damage (for example, steep slopes); and conditions when it would not be appropriate to handle the soil (for example when it is wet or after periods of heavy rainfall or high winds). The oSMP will also detail measures for soil management and follow the principles of best practice to

maintain the physical properties of the soil, with the aim of maintaining the condition of the land until the end of the lifetime of our Project.

- While the potential impacts on soils during the operational phase are expected to be minimal, good practice will be employed to ensure that any works (such as the maintenance and the management of the land underneath the Solar PV Modules) will be undertaken in a manner that prevents damage to the soil resource, so far as practicable.
- The land within our Site, including the land underneath the solar PV panels and within the field margins, will be managed through the implementation of an Outline Landscape and Ecological Management Plan (LEMP), which will be submitted in support of and secured by the DCO. This Plan will set out requirements for the management and remediation of vegetation during the operational phase to ensure the planting is sustained for the life of our Project.



one earth

solar farm

One Earth Solar Farm

Preliminary Environmental Information Report [EN010159]

Chapter 10: Buried Heritage

May 2024

One Earth Solar Farm Ltd

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10. Buried Heritage

Summary of Preliminary Likely Significant Effects

10.1. Based on the detail available at the time of writing and our current understanding of our Project, this Chapter concludes that:

- There is the potential for unknown buried heritage assets within the Site;
- With the implementation of adequate mitigation measures prior to, or during the construction phase of our Project, the potential for significant effects on buried heritage assets is considered to be low;
- There is very low potential for adverse effects/direct impacts during the maintenance, and decommissioning phases as it is not anticipated there will be any ground works affecting undisturbed deposits during these phases of our Project;
- There will be no significant indirect impacts on buried heritage deposits within the Site or the wider Study Area during the operation, maintenance, and decommissioning phases.

10.2. The forthcoming, subsequent Desk Based Assessment (DBA) and Environmental Statement (ES), will include further modelling, design, and assessment work. This will include any further details on any mitigation strategies that will be implemented for our Project. The results will be set out in the ES chapter submitted as part of the Development Consent Order (DCO) application.

Introduction

10.3. This chapter of the PEIR has been prepared by Iceni Projects and presents the likely significant environmental effects of our Project upon Buried Heritage, meaning below the ground heritage assets (archaeology), which are both designated and not designated. The assessment of likely significance is based on our current understanding of the archaeological baseline. The assessment provides a preliminary, high-level assessment of the potential changes and/or impacts anticipated from the construction operation, maintenance, and decommissioning phases of our Project. Our assessment considered the impact on the known (and unknown) buried heritage assets.

10.4. This Chapter presents our current understanding of the main receptors identified at this stage which have the potential to be impacted by our Project. Following this, potential mitigations strategies, potential for positive effects and the significance of effects are presented.

10.5. The assessment of potential impacts on buried heritage assets has been based on professional judgment. The experience of the consultants that have prepared this chapter, who are competent experts for the purpose of the EIA Regulations, is set out in **Appendix 1-1**. It is informed by the environmental information we have collected to date (which is detailed in this Chapter), as well as the current description of our Project, as set out in **Chapter 4: Our Project**.

10.6. The results of ongoing and future surveys, further assessment, consultations, archaeological evaluation, and potential mitigation measures will inform the more detailed assessment that will be included in the ES Chapter that will form part of our DCO submission. More specific mitigation measures will also be considered at the ES stage in response.

10.7. This Chapter is supported by the following appendices:

- **Appendix 10-1: Legislation, Policy, and Guidance**
- **Appendix 10-2: Assessment Methodology**
- **Appendix 10-3: Preliminary Impact Assessment: Locations for Substations**
- **Appendix 10-4: Preliminary Impact Assessment: Options for River Crossing**
- **Appendix 10-5: Detailed Scope of Assessment**
- **Appendix 10-6: Consultation responses outlined in Scoping Opinion and actions in response**

Current Buried Heritage Baseline Conditions

10.8. The approach to the assessment of Buried Heritage considers the potential for likely significant environmental effects (in EIA terms) on below ground heritage assets but excludes consideration of above-ground heritage assets and their setting, which are dealt with in **Chapter 11: Cultural Heritage**.

Buried heritage aspects considered within this Chapter include:

- Direct and indirect impacts to known archaeological remains;
- Direct and indirect impacts to anomalies identified from the review of known satellite imagery of the topography of the Site (LIDAR imagery), as possible or probable archaeological remains;
- Direct and indirect impact to anomalies identified during the preliminary assessment of the results of the currently ongoing geophysical surveys that have been carried out to date. The purpose of this type of survey is to identify below ground anomalies which may suggest the presence of potential buried heritage deposits; and,
- Potential for direct and indirect impact on areas we have not yet undertaken any geophysical survey on, which may contain unknown archaeological remains.

Study Area

10.9. The purpose of a buried heritage study area is to provide a contextual archaeological background of the Site and its surroundings, to assess the potential effects to known buried heritage assets, and to understand the potential for unknown assets that may be affected by our Project.

As required by the relevant guidance[1] two different study areas have been identified and considered:

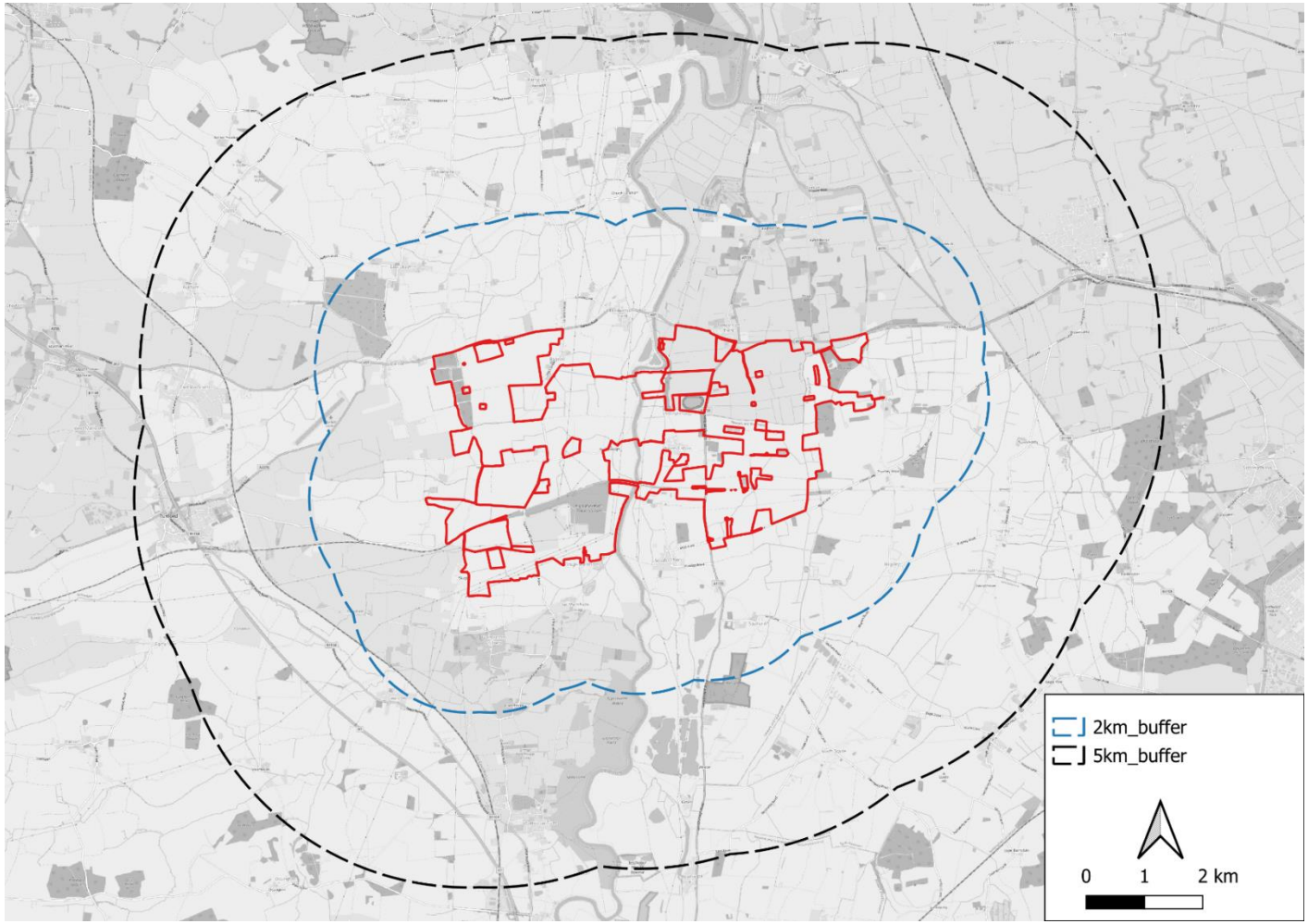
- 2km radius from the Site and connection routes for undesignated heritage assets; and,
- 5km radius from the Site and connection routes for Designated Heritage Assets (i.e. Scheduled Monument).

10.10. The above Study Areas are presented in **Figure 10-1.**

10.11. Any inclusion in this and future assessment of assets outside of the defined Study Areas will be based on research and professional judgment. These will be only discussed where they are considered to provide additional context information to inform the potential for unknown buried heritage assets that may be impacted by our Project.

[1] Lincolnshire County Council "Guidance for large schemes including NSIPs and EIAs, General Scoping Opinion for the Historic Environment," supplied by Matthew Adams on 09/10/2023.

Figure 10-1: Buried Heritage Study Areas



Collection of Buried Heritage Data

10.12. An understanding of the buried heritage context of our Project has been gained through a combination of desk-based research and analysis, and fieldwork. The following sources were consulted in the production of this assessment:

- British Geological Survey (BGS) - Solid and Drift geology digital mapping and geological borehole data where applicable;
- Historic Environment Record (HER) - Data detailing the results of any previous archaeological investigations on our Site and in the surrounding Study Area. The HER Data was obtained in November 2023[2];
- Historic England - Information on statutory designated assets data including the National Heritage List for England (NHLE), World Heritage Sites, Scheduled Monuments, Listed buildings, and any identified Heritage at Risk;
- LIDAR - Site Lidar imagery as available from: [redacted]
- Host Authority – Details within the local planning authority (LPA) Local Plan's and other information on historic environment policies, conservation areas and locally listed buildings where published online;
- Geophysical Survey - A geophysical survey is currently being undertaken by Headland Archaeology with commencement in January 2024 in accordance with the Project Design and Written Scheme of Investigation (WSI, Iceni 2023)[3]. It is noted that the information presented in this Chapter represents our preliminary findings to date, and that the survey is still ongoing. The final report for the geophysical survey is not available at the time of the writing, and therefore has not been included in this Chapter. Relevant preliminary results are discussed in **Appendix 10-3 and Appendix 10-4** as part of the preliminary impact assessment for the construction phase of our Project; and
- Historic Landscape Characterisation – details from the Historic Landscape Characterisation Project for Lincolnshire (English Heritage and Lincolnshire County Council, 2011); and
- the Nottinghamshire Historic Landscape Characterisation Project 1998 – two thousand.

Assumptions, Limitations & Uncertainties

[2] Data received in November 2023, Nottingham HER data License No. 2023/10, and Lincolnshire HER data Licence No. HES000063

[3] Submitted to the Nottinghamshire and Lincolnshire Archaeological Advisors on 21/12/2023. Accepted by Jan Allen on 15/03/2023 and by Matthew Adams during meeting on the 30/04/2024.

10.13. The HER is not a record of all surviving heritage assets, but only of all the known buried heritage assets recorded in the area so far. The HER information is not complete and does not preclude the subsequent discovery of further elements of the historic environment that are, at present, unknown.

10.14. This PEIR provides preliminary information based on the design of our Project to date and the data gathered at this point in time. Some of the information and conclusions reached at PEIR stage will be reviewed and supplemented in full and final form within the ES.

Current Results

10.15. A review of known buried heritage assets recorded in the Lincolnshire and Nottinghamshire HER, LIDAR and cropmarks imagery and preliminary results of the geophysical survey currently being undertaken, revealed a number of heritage assets demonstrating evidence of extensive human activities in the area from the early prehistoric period through to the modern period.

10.16. The buried heritage assets have been grouped together based on chronology, locations and if the impact upon them is equivalent, to save repetition by assessing them individually. A group number has been assigned to each one, referring to the relevant chronologic phase (PH for prehistory, RO for Roman…). A full list of the groups, along with the list of the heritage assets included and a brief description is included in **Table 10-1 to Table 10-6**. When included in groups of assets, the Scheduled Monuments, which have value that transcend the wider grouping, will be assessed separately when discussing any potential effects arising from our Project.

Historic Landscape Characterisation

10.17. Our Project falls withing different Historic Landscape Characterisation (HLC) areas, as identified by Nottinghamshire and Lincolnshire LPAs.

10.18. An assessment of HLC's setting and value, and of the impact of our Project on them form part of **Chapter 11: Cultural Heritage**. There are considerations about the HLC's which are considered to be relevant for a Buried Heritage perspective.

10.19. Nottingham

10.20. The Nottinghamshire Historic Landscape Characterisation Project was carried out between 1998 and 2000 by the Environment Department of Nottinghamshire County Council, with sponsorship from English Heritage.

10.21. The vast majority of our Site is included in the 'Reflecting Open Fields' HLC, the southeast part of our Site on the east bank of River Trent is included in the 'Modern Modified Field' HLC, and the northern part on the west bank of the River is included in the 'Unenclosed River Valley Meadow'.

10.22. The 'Reflecting Open Fields' were created by enclosure mirroring between the 18th and 19th centuries mostly mirroring the 15th/16th centuries 'Fossilised Open Field Patterns', which in turn might have followed 10th/11th centuries, or earlier enclosures.

10.23. This shows a potential substantial continuity of land use for agricultural purposes, at least from the medieval period for the majority of our Site.

10.24. The 'Modern Modified Field' mostly comprises lands where the 19th century field pattern has been reorganised after World War II and it is not visible anymore, or for which only 50% of the field boundary are still visible. In some areas, this modification caused the removal of enclosure and medieval landscape assets, revealing earlier elements such as Roman and prehistoric field boundaries and settlements. Providing a suitable underlying soil and geology, cropmarks have proved to represent the main markers of pre-medieval buried heritage assets in these areas.

10.25. Therefore, fields included in this HLC shows a good visibility of buried heritage assets, and it is expected that the assessment of cropmarks and consequently other archaeological surveys such Geophysical Survey, to provide a reliable baseline collection methodology within Modern Modified Field patterns.

10.26. The 'Unenclosed River Valley Meadow' HLC mostly comprises current or former open riverside pastures, meadows or commons that retain traditional boundaries and the unenclosed character visible on the 19th century maps. The majority of meadow lands saw a continuity of use as pasture since the Roman period through the medieval ages and until the 20th century.

Lincolnshire

10.27. The Lincolnshire Historic Landscape Characterisation Project began in October 2008, with the aim to categorise and characterise the landscape of the county with specific reference to its development over time.

10.28. The Lincolnshire section of our Project falls within the 'Trent Valley' HLC, which shows evidence from excavation and aerial photography of occupation and utilisation of the landscape in this character area from the prehistoric and Roman periods. There is little surviving visible evidence of this in surviving landscape features, apart from the alignment of two Roman roads and possibly the line of the Foss Dyke canal which may be of Roman construction. The two Roman roads are the main connection route from Lincoln to Newark, and they both lie outside of the Study Area defined for our Project.

10.29. The organisation of the present landscape probably has its origins in the early medieval period, and it was consolidated after World War II when the use of increasingly heavy farm machinery required the removal of hedgerows and field boundaries.

Designated Heritage Assets within the Study Areas

- There are two Scheduled Monuments ('SM') within our Site but excluded from the developable area: Roman Vexillation Fortress, Two Roman Marching Camps and a Royal Observers Corps Monitoring Post, Newton-on-Trent (NHLE: 1003608); and Whimpton Moor Medieval Village and Moated Site, Ragnall (NHLE: 1017567).

- There are two further Scheduled Monuments within the 2km Study Area: Ringwork at Kingshaugh Farm, East Markham (NHLE: 1018619); and Cross in St Peter and St Paul's Churchyard, Kettlethorpe (NHLE: 1018289).

- There are three further Scheduled Monuments within the 5km Study Area: Moat, three fishponds, enclosures, hollow way, and part of a road at Hall Yard (NHLE: 1008247); Moated site W of Church Road (NHLE: 1017858); and Fleet Plantation moated site (NHLE: 1008594).

Archaeological Background

10.30. Isolated findspots and casual, unstratified finds which are not included in the groups will not be included in this section of the PEIR, as their contribution to the understating of the wider archaeological background is negligible compared to stratified and contextualized finds. However, high concentrations of unstratified finds of a specific date within or in close proximity to our Site, which are considered to be helpful to define the buried heritage background and may represent evidence or inform for the potential of unknown archaeological remains within our Site will be included.

Geology

10.31. The underlying bedrock geology of our Site is Mercia Mudstone throughout. Superficial (upper) geology varies, however. The floodplain either side of the Trent consists of alluvial clay, silt, sand, and gravel deposits laid down up to 11.8 thousand years ago. In the areas further afar from River Trent, the superficial geology consists of Holme Pierrepont Sand and Gravel Member, laid down 2.5 million to 11.8 thousand years ago, Blown Sand deposits formed between 2.588 million years ago and the present, and further alluvial deposits alongside the Trent's tributaries, such as those along the Fledborough Beck in the western part of our Site.

10.32. The buried alluvial deposits along the River Trent have archaeological potential for the survival of paleoenvironmental remains dating to the prehistoric Holocene (post ice age). Such remains have the potential for environmental reconstruction via waterlogged seeds, pollen, macro fossils etc along with sedimentological examination. They may also contain indicators of human activity and early landscape management. Human activity may also be present from the terrace gravels that flank the river in the form of flint tool or tool working remains.

Palaeolithic Period to Iron Age (Before AD 43)

10.33. Within our Site, the known main prehistoric heritage assets (PH001) have been detected through a number of surveys, cropmarks and aerial photography analysis and archaeological interventions on the area of Newton Cliff on the east bank of River Trent, between North Clifton and Newton-on-Trent, west of Thorney and encircling the Roman Vexillation Fortress and marching camps (NHLE: 1003608).

10.34. Within the same area on the east of River Trent, slightly North of Newton-on-Trent and outside of our Site, a possible prehistoric enclosure associated with casual unstratified flints have also been recorded (PH007).

10.35. Over 50,000 artefacts have been discovered within the broader Study Area. Field excavations exposed significant remains spanning the late Mesolithic to late Neolithic/early Bronze Age, such as remains of a late Mesolithic structure, waste pits and flint tool production debris, Neolithic structure and Bronze Age features and finds. This suggests a late Mesolithic to late Neolithic/early Bronze Age occupation in the area, perhaps an intermitted/seasonal one connected to the exploitation of the rich River Trent resources.

10.36. The scattered, unstratified nature of the finds, mostly collected via field walk survey, would suggest that any potential archaeological asset or site in this the of collection would have been severely damaged by agricultural activities, such as ploughing.

10.37. Further east, southeast of Newton-on-Trent, extensive cropmarks were identified, suggesting the presence of a large number of ditches, field boundaries, trackways, and linear features, along with a number of enclosures and possible pit features (PH002). Whilst the dating is unconfirmed, the features were thought likely to date to the Iron Age or Roman periods. The preliminary results of the geophysical survey confirmed the presence of potential unknown buried heritage assets southeast of Newton-on-Trent.

10.38. More findspots east of Newton-on-Trent (PH003), slightly outside of our Site, are further markers of the prehistoric archaeological potential within our Site and the Study Area.

10.39. In close proximity to our Site and suggesting the presence of further prehistoric buried heritage assets, the excavation at Andrew's Field nearby South Clifton (PH004) returned a number of neolithic to early bronze age artefacts, but no features. Similarly, the number of casual finds, mostly flints, not associated with features or clear markers of occupation were recovered between North and South Clifton, outside of our Site but within the Study Area.

10.40. Cropmarks associated with a number of flints are recorded approximately 1.6km northeast of our Site close to Hardwick (PH005), confirming the presence of scattered prehistoric occupation also in areas further afar from River Trent.

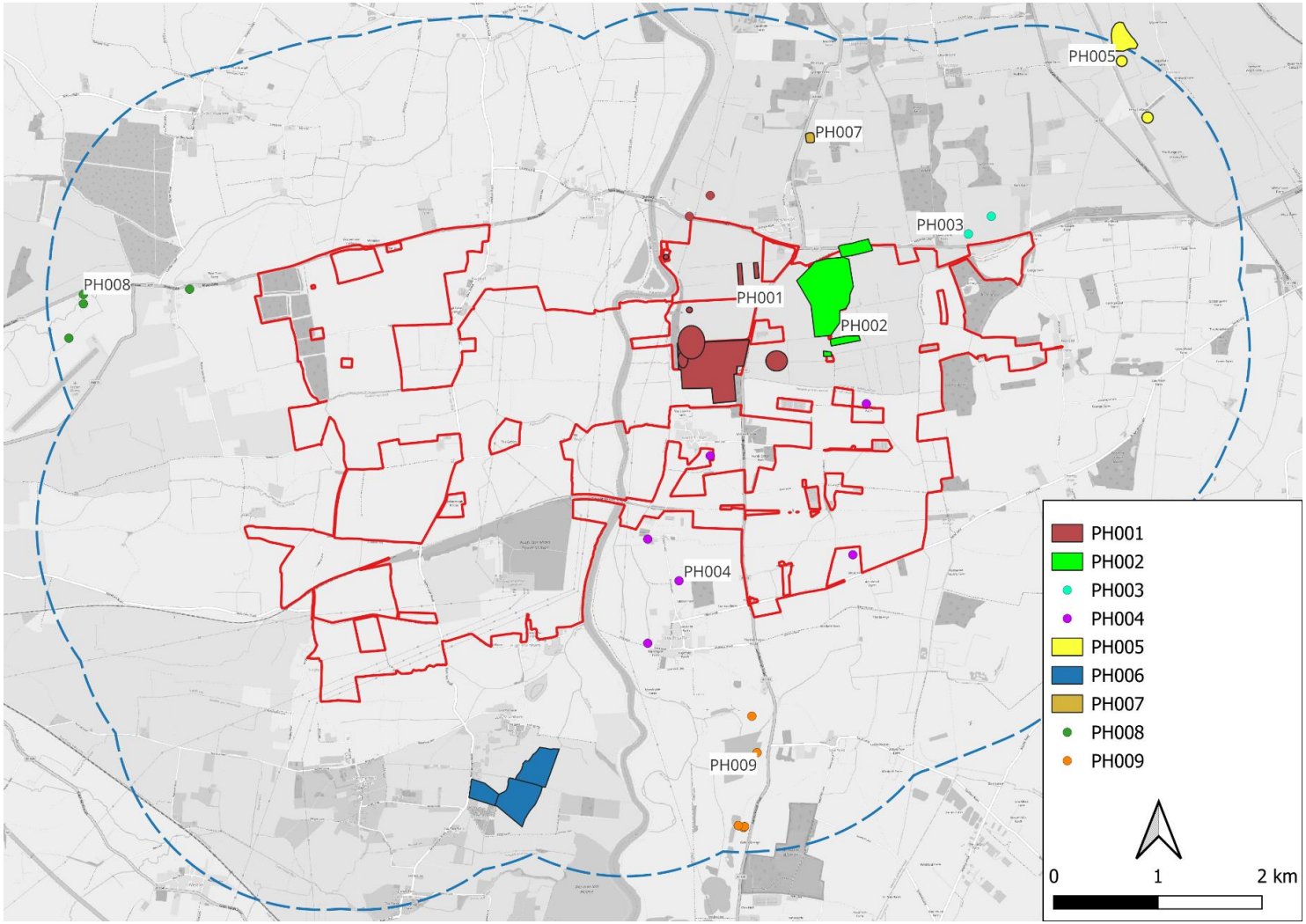
10.41. At Girton Quarry, approximatively 2km south of our Site, a number of cut features (such as ditches and pits), burnt mounds and prehistoric pottery have been recorded during topsoil stripping and quarrying activities (PH009). Potentially related, sporadic unstratified casual finds and artifact scatters are recorded east of Spalford.

10.42. On the west bank of River Trent, around Low Marhnam approximatively 1km south of the Site, a prehistoric enclosure with connected cut features and trackways has been recorded (PH006). The presence of cropmark in the same area suggests the potential for consistent prehistoric activity in the area.

10.43. Approximately 1.5km west of the Site in the area, in close proximity with Darlton and the Ringwork at Kingshaugh farm, a prehistoric scrape and two saddle querns have been recovered as casual finds (PH008). Despite these being unstratified, they may suggest a degree of prehistoric activities in an area showing a substantially reduced occupation markers compared to Newton-on-Trent and Low Marhnam.

10.44. Groups of Prehistoric assets are listed in **Table 10-1** and shown in **Figure 10-2**.

Figure 10-2: Groups of Prehistoric Assets



Roman Period (AD 43 – 410)

10.45. Consistently with the Prehistoric period, the area between North Clifton and Newton-on-Trent shows important traces of Roman occupation.

10.46. The most significant known Roman remains on our Site are those of the Vexillation Fortress and marching camps. This area is a protected Scheduled Monument (along with a Royal Monitoring Corps observation post, NHLE: 1003608) and is located to the southwest of Newton-on-Trent, on the eastern bank of the Trent where the river bends sharply (RO001). The fortress dates from the 1st century AD, during the military conquest of Britannia by the Roman Army and forms a rare subset of Roman defensive sites. The observation post, which forms part of the monument, was principally a Cold War era monitoring station for spotting enemy aircraft and reporting nuclear explosions and the resultant spread of radioactive fallout in the event of nuclear attack. It was in use between 1961 and 1991.

10.47. Excavations to the north of the fortress uncovered a number of 2nd century Romano-British kilns (RO002).

10.48. As discussed above about PH002, LIDAR imagery confirms the presence of features of potential Roman chronology within our Site, southeast of Newton-on-Trent (RO003)

10.49. On the West bank of River Trent south of Ragnall, aerial photographs, cropmarks and the preliminary results of the geophysical survey currently being undertaken, shows the presence of a number of earthworks and enclosures. These have been interpreted as a potential Roman settlement (RO004).

10.50. In close proximity to our Site and suggesting the presence of further Roman buried heritage assets, the archaeological monitoring on the excavations for the replacement of a water pipeline through Dunham on Trent (RO005), returned a small quantity of pottery sherds dated to the 1st century AD.

10.51. Cropmarks and cut features associated with a potential Roman enclosure are recorded approximately 1.6km northeast of our Site close to Hardwick (RO006), where also there were traces of prehistoric land occupation.

10.52. In the northeast corner of the Study Area, close to RO006 and approximatively 1.5km from our Site, runs The Fosse Dyke, a potential Roman canal which has been reused also during the medieval period (RO007).

10.53. Again, in substantial continuity of land use, the prehistoric enclosure near Low Marhnam (PH006, as above) show potential Roman phases of enclosures, cut features and trackways which have been detected through aerial imagery (RO008).

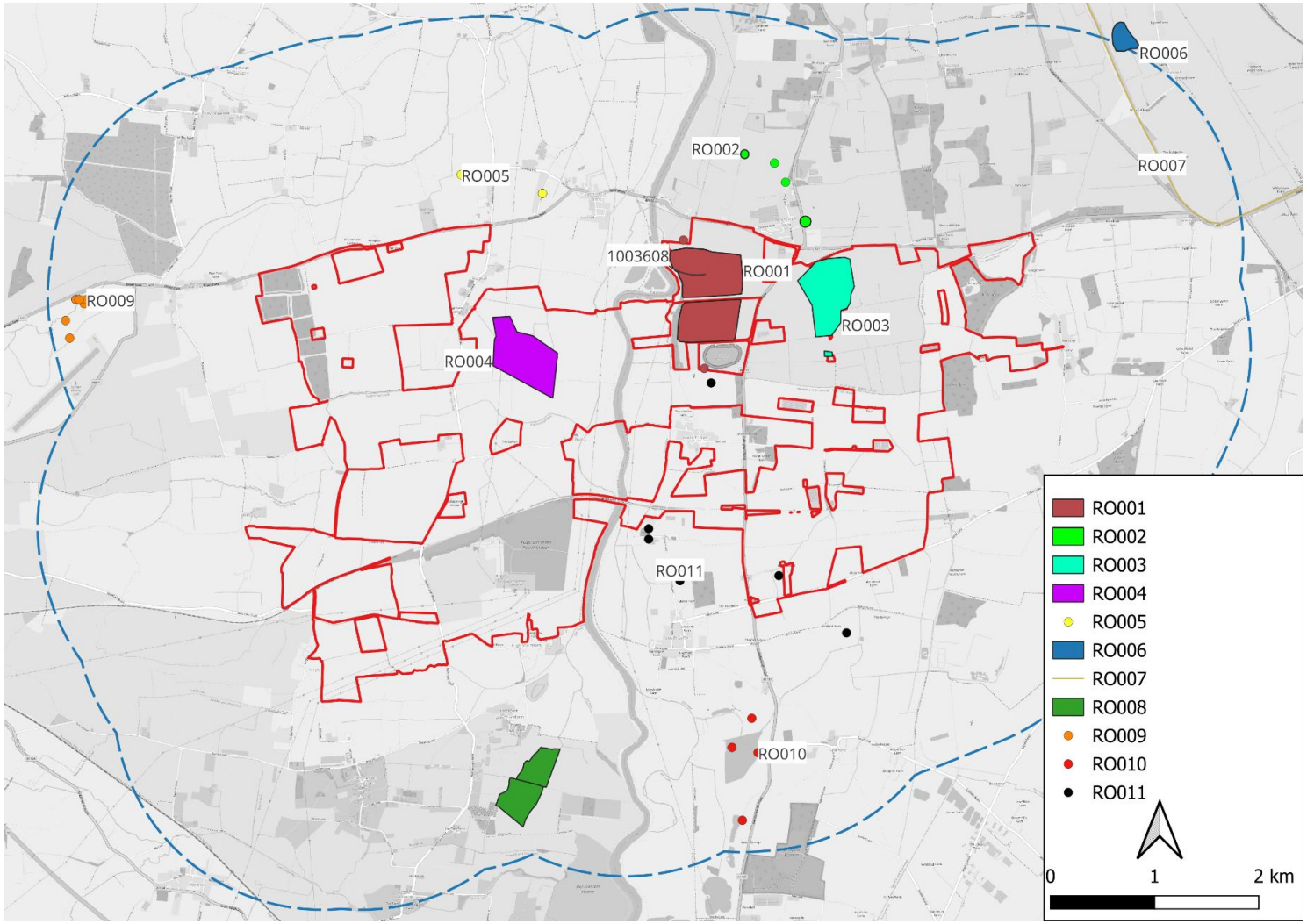
10.54. Approximately 1.5km west of our Site and in close proximity to the Scheduled Monument of Ringwork at Kingshaugh Farm (ME011, below), a collection of Roman pottery and building materials recovered during field walking suggests the presence of a nearby Roman Villa (RO009).

10.55. In the area west of Spalford, more than 1km south of our Site a number of Roman pottery fragments and some potential cut features have been recorded during archaeological interventions (RO010).

10.56. A number of casual finds between North and South Clifton (RO011) confirm the presence of an extensive Roman occupation on the east bank of River Trent in proximity of our Site.

10.57. Groups of Roman assets are listed in **Table 10-2** and shown in **Figure 10-3**.

Figure 10-3: Groups of Roman Assets



Saxon and Medieval Period (AD 410 –1485)

10.58. The main medieval buried heritage within our Site is Whimpton Moor medieval village and moated site (ME001), which is also designated as Scheduled Monument (NHLE: 1017567). The monument includes the earthwork and buried remains of Whimpton Moor medieval village and the moated site. The earthworks represent former house platforms, boundaries, ponds, a moated dwelling and remains of ridge and furrow cultivation. Potentially connected to the medieval village, northwest of the Study Area there have been found two skeletons, one in a stone coffin.

10.59. Similar remains of abandoned sunken villages are known within the wider Study Area, at Ragnall (ME002), Skegby (ME003), Fledborough (Deserted Village of Woodcotes, ME004) and at the Shrunken Village of Thorney (ME005). Even if they lie outside of our Site their presence suggests the potential for unknown buried heritage assets that may be affected by our Project:

10.60. In substantial continuity with the prehistoric and Roman period, a number of Saxon and medieval occupation markers are located between North Clifton Newton-on-Trent, within our Site. Scatters of medieval pottery collected during systematic field walk survey and remnants of ridge and furrow cultivation noted as visible crop marks variously suggest that the area was still being in use during the medieval period (ME006).

10.61. Outside of our Site but within the Study Area, documentary evidence and aerial photographs suggest the presence of the medieval settlement of Newton (ME007), in close proximity but outside of our Site on the north, and of a medieval field system or cultivation remains comprising ridge and furrows (ME008).

10.62. The Medieval Deer Park surrounding and comprising the medieval manor of Kettlethorpe (ME009) covers a portion of the northeast corner of our Site, and spans north until the end of the Study Area. This asset includes a number of heritage assets, including the Cross in St Peter and St Paul's Churchyard, Kettlethorpe (NHLE:1018289), located 1.6km north of our Site.

10.63. Immediately east of the Medieval Deer Park and approximatively 1.5km north of our Site but within the Study Area, lies the late Anglo-Saxon and medieval Settlement of Laughterton (ME010). During an evaluation at Home Farm, the remains of medieval stone structures were recorded. These included a possible stoking hole for an oven or kiln and a base for a circular structure of unknown function. It appears to be a concentration of settlement evidence in the centre of Home Farm. The presence of 12th century flood deposits and the lack of remains in trenches the east suggests that this wetter, lower lying land was used for fields or meadows. The area of settlement recorded during the evaluation was slightly raised, and further raised areas were noted in the vicinity of the excavations.

10.64. Approximately 1.4km west from Whimpton Moor medieval village, outside of our Site but within the Study Area, is located the Ringwork at Kingshaugh Farm (ME011). This is a Scheduled Monument (NHLE: 1018619) comprising the earthwork and buried remains of Kingshaugh Camp, a ringwork which surrounds the 17th century Kingshaugh House.

10.65. Remnants of ridge and furrow cultivation have been noted as visible crop marks variously across the Study Area, such as the ones identified though aerial photograph west of Fledborough (ME012), approximatively 40m far from our Site.

10.66. Within the village of Fledborough, the Church of St Gregory at Fledborough (ME013) lies in proximity of our Site, and whist its setting is not discussed in this chapter, there is potential for ancillary buildings to be present within our Site.

10.67. Around our Site there are active settlements with known Saxon or medieval origins such as Dunham-on-Trent, Fledborough, North Clifton, South Clifton and High Marnham. Even if these are lying outside of our Site but within the Study Area, their proximity with it may suggest the presence of unknown buried heritage assets related to them and potentially affected by Our Project.

10.68. Excavation at Dunham, approximately 750m north of our Site and within the Study Area, recorded medieval artefacts and features related to the medieval phase of the village (ME014). Earthworks are still visible along Upper Row and slightly north of Dunham. Documentary evidence suggest the presence of the deserted village of Swainston, which location is unknown.

10.69. Similarly to St Gregory at Fledborough, the medieval churches of St. George at North Clifton (ME015) located south of North Clifton and outside of our Site but within the Study Area may suggest the presence of unknown buried heritage deposits in the surrounding areas.

10.70. Medieval field boundaries have been recorded within the Study Area approximatively 1km north of our Site at Lanham (ME016) on the west bank of River Trent, and northeast of our Site on the east bank of the river, around Hardwick (ME020). The latter are part of the medieval shrunken village which pattern could reflect the presence of a monastic demesne farm within or adjacent to the current village of Hardwick.

10.71. Archaeological monitoring of excavation for the replacement water main through parts of Skegby, Normanton-on-Trent, Low Marnham and High Marnhan returned a number of medieval and post medieval artifacts and features, mostly related to road surfaces and linear cut features, such as ditches and lanes (ME017 and ME018). This suggest that there is potential for contain further unknown medieval buried heritage assets connected to viability or field system in the part of our Site in proximity with Skegby.

10.72. Within the Study Area, and approximatively 830m south of our Site, during archaeological monitoring of ground works in the area east of Spalford near Girton Quarry, a number of medieval cut features have been recorded along with medieval pottery collected during systematic field walk survey (ME019).

10.73. Within the 5km Study area, here are three further medieval Scheduled Monuments the ‘Moat, three fishponds, enclosures, hollow way and part of a road at Hall Yard’ (NHLE: 1008247) approximatively 2.2km southwest (ME021); the ‘Moated site W of Church Road. (NHLE: 1017858), approximatively 3.4km east (ME022); and, the ‘Fleet Plantation moated site’ (NHLE: 1008594), approximatively 4.2km north (ME023). While substantially far from our Site, these confirms the extensive medieval occupation within the wider Study Area, and therefore the potential for unknown buried heritage assets dated to the medieval period.

10.74. Saxon and Medieval groups of assets are listed in **Table 10-3** and shown in **Figure 10-4** and **Figure 10-5**.

Figure 10-4: Groups of Saxon and Medieval Assets

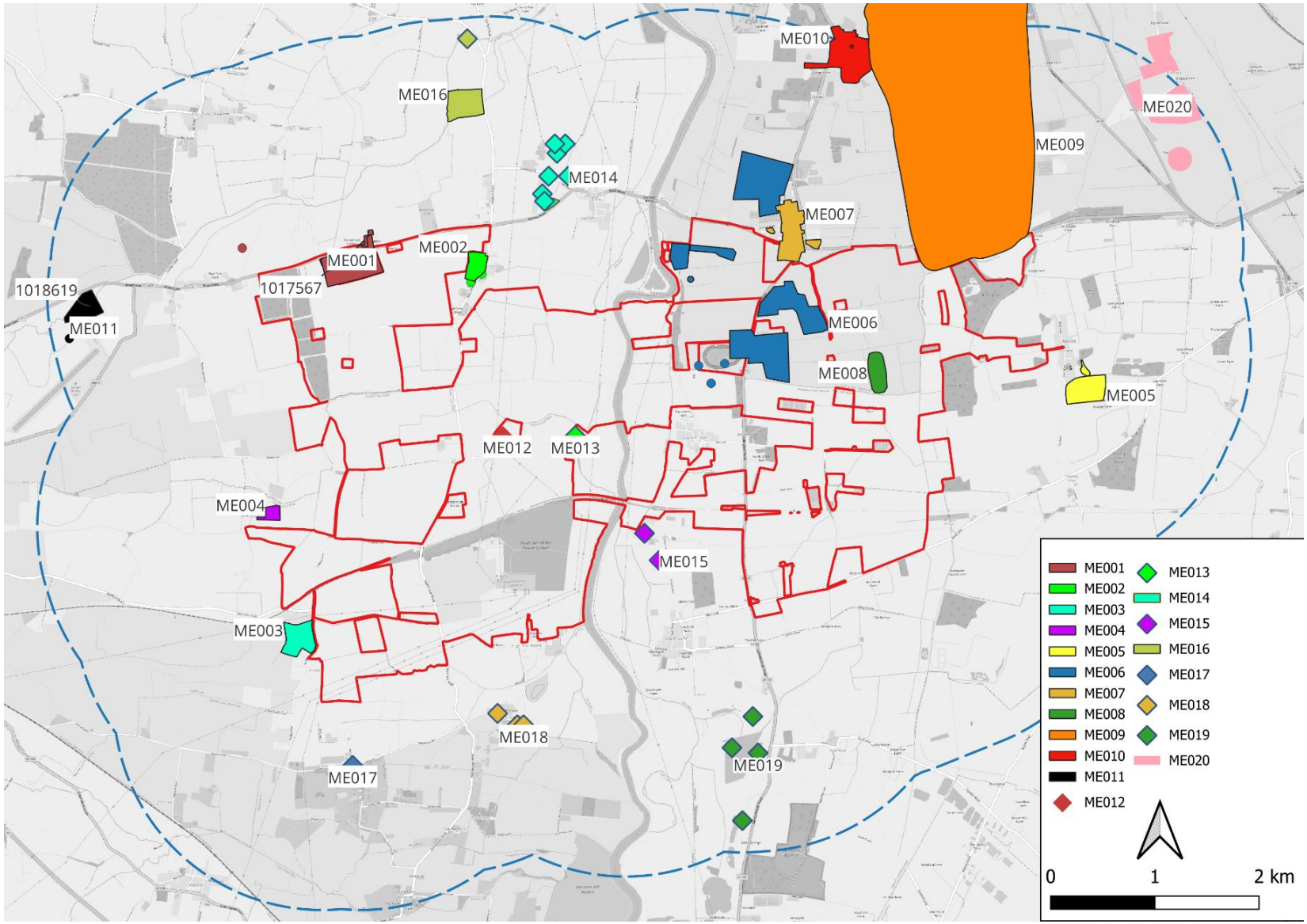
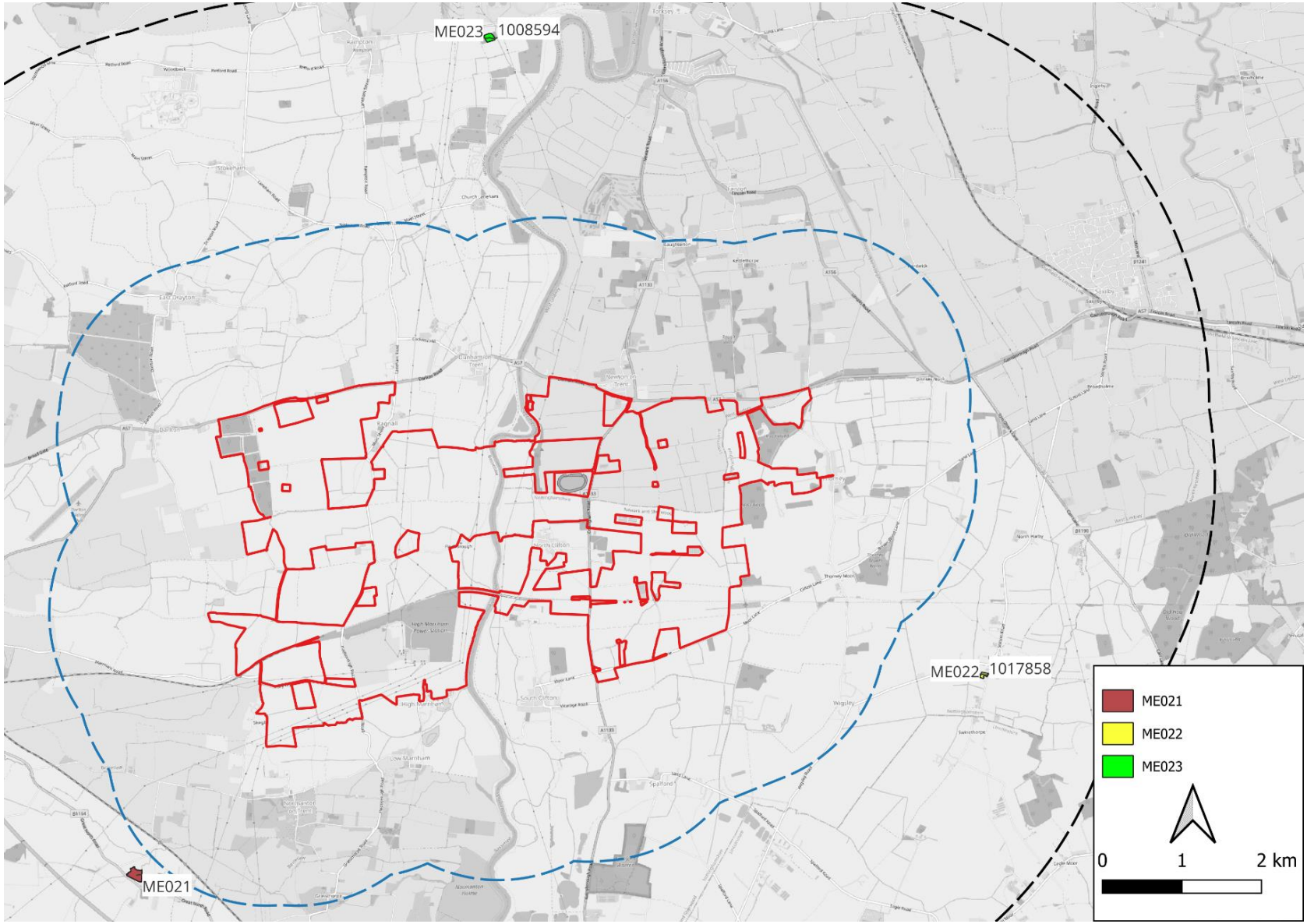


Figure 10-5: Groups of Saxon and Medieval Assets Within the 5km Study Area



Post-medieval to Modern Period (AD 1485 – present)

10.75. The majority of the post-medieval and modern buried heritage assets lie outside of our Site, which appears to have been predominantly under agricultural use throughout the post-medieval and modern periods.

10.76. Within our Site, the former Royal Observer Corps underground observation post constitute together with the Vexillation a protected Scheduled Monument (RO001, List Entry Number 1003608). The post was built during the Cold War, as part of a national system to provide civil and military authorities with essential information in the event of a nuclear attack.

10.77. The Medieval Deer Park of Kettlethorpe (ME008), shows also some post-medieval redevelopments such as banks, ditches, drains and the erection of walls mostly located around Kettlethorpe Hall.

10.78. On the west bank of River Trent, map depictions suggest the presence of two brick kilns: one nearby Ragnall (PM001) and one east of Skeby (PM002). Both are thought to be built at the end of the 18th century, but they are last recorded on the 1836. Potential buried remnants related to these kilns may still be present on Site.

10.79. If any unknown post-medieval and modern buried heritage assets are present outside of our Site, these are expected to be located in the proximities of the current inhabited villages, barns and farmstead - such as Dunham (PM003), Newton-on-Trent (PM004), Woodcoates (PM005), North Clifton (PM006), South Clifton (PM008), Thorney (PM008), High (PM009) and Low Marnahm (PM010), Ragnall (PM011) and Fledborough (PM012). Specifically, the vicinity of Ragnall, Fledborough, Skegby and North and South Clifton to our Site may increase the potential for unknown assets related to the post medieval and modern development of the villages to be encountered during excavations, such as the Grounds at Ragnall Hall (grouped with PM011), which extend partially within our Site.

10.80. Post-Medieval and Modern groups of assets are listed in 10-4 and shown in **Figure 10-6**.

Undated

10.81. Across our Site and in the wider Study Area there are a number of known buried heritage assets which cannot be attributed to any specific phase. These have been detected thorough past archaeological interventions, geophysical surveys, reviews of archive resources, LIDAR, or aerial imagery. Their form and morphology may lead to reasonably well-informed judgments on their likely origins and character; however, in some cases, it is only through further field evaluations (trial trenching) that a robust commentary can be provided on their nature and thus importance.

10.82. At this stage, only the undated buried heritage assets that are not assumed to be likely part of any of the groups previously discussed will be included. This decision is based on proximity with similar dated assets, negligible significance and professional judgement and is informed only by available information and will be reviewed at DBA and ES stage.

10.83. Based on the above, the undated assets included in **Table 10-5** have been grouped only based on their location and proximity to each other as their nature and chronology is still not clear. This will be reviewed if further information becomes available from the geophysics currently ongoing and included in the DBA or following the trial trenching evaluation and included in the ES.

10.84. **Figure 10-7** shows the location of all the undated buried heritage assets, including the ones detected during the geophysical survey, and **Appendix 10-5** presents the commentary and assessment.

Figure 10-6: Groups of Post Medieval Assets

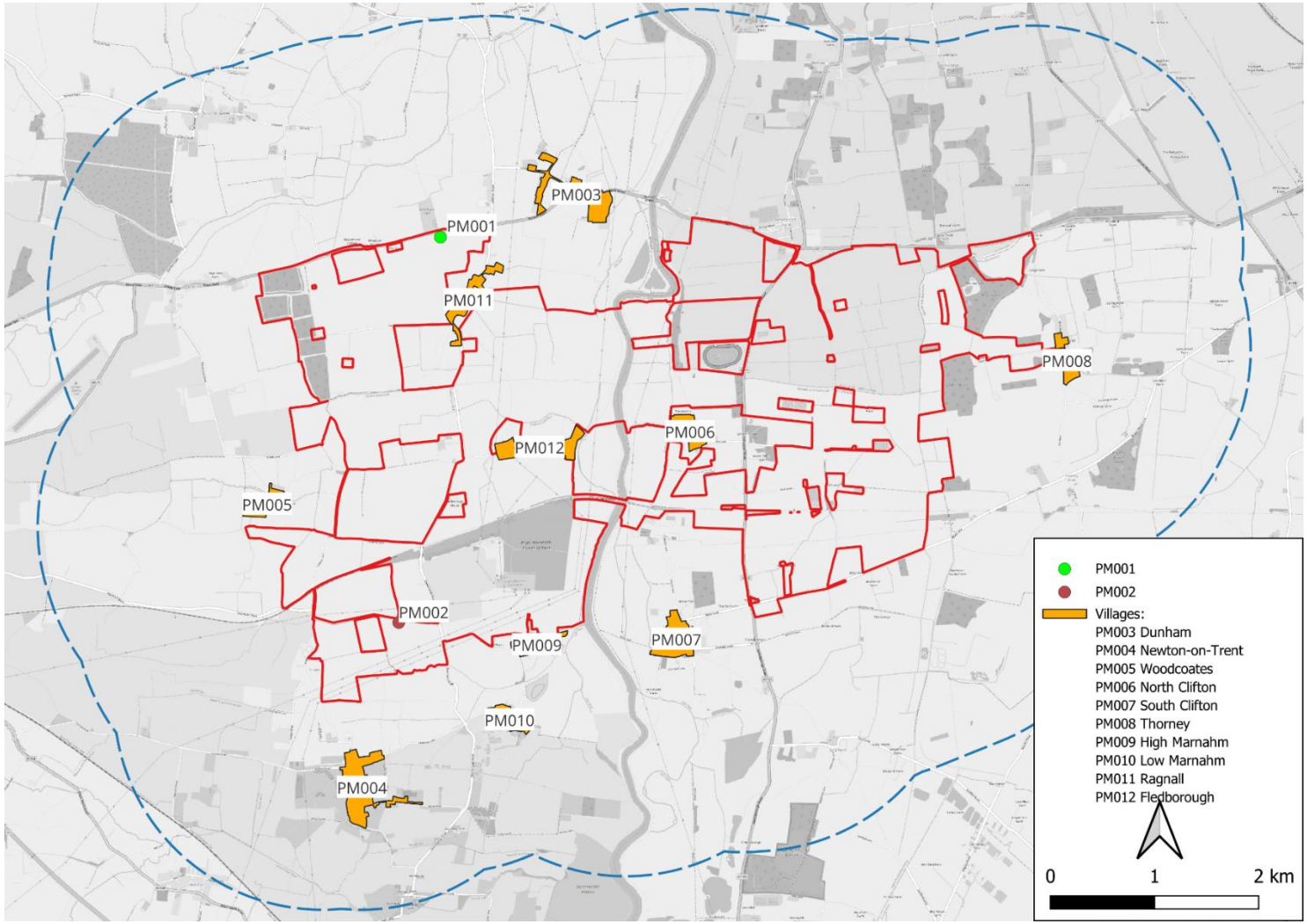


Figure 10-7: Groups of Undated Assets

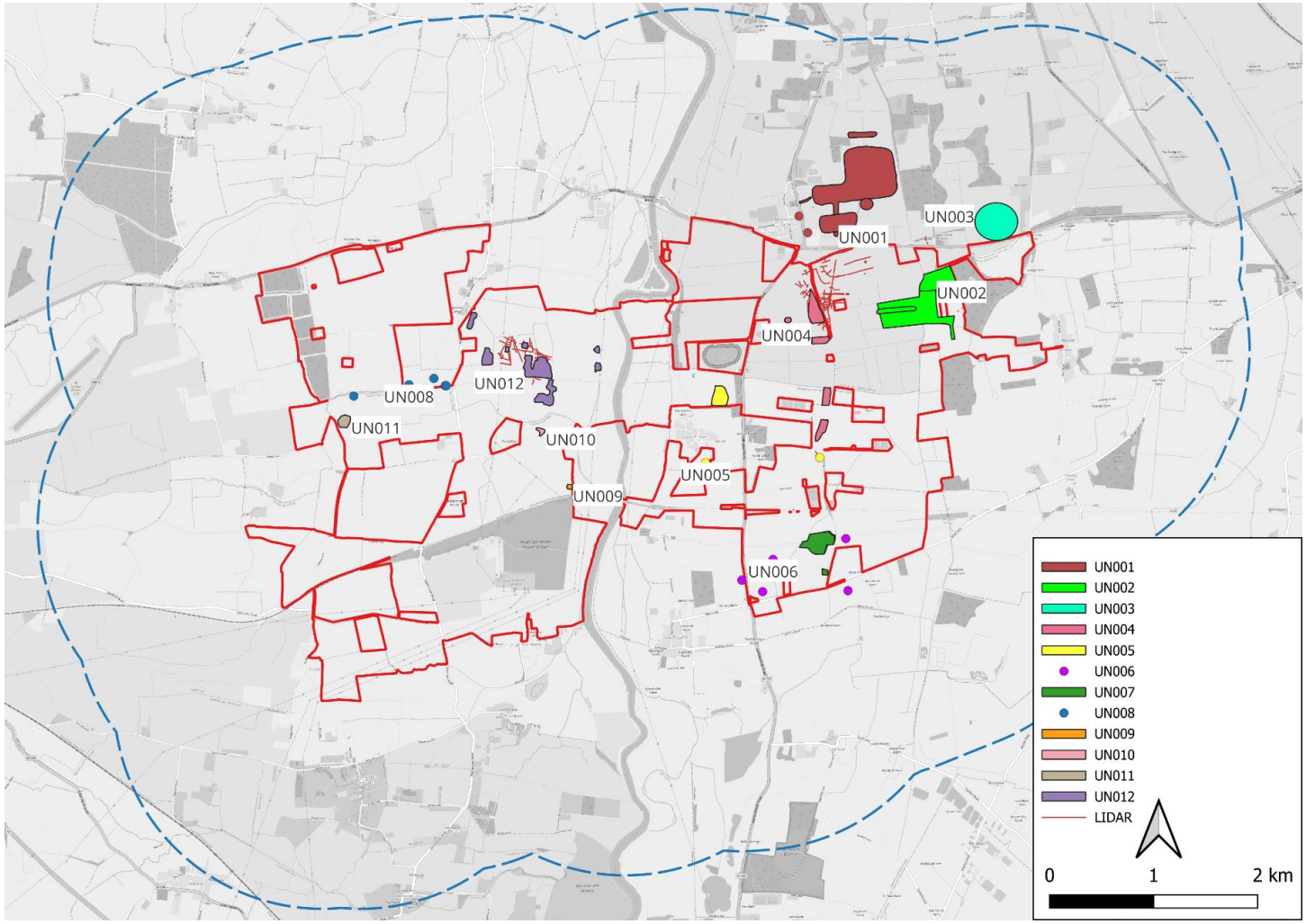


Table 10-1: List of Prehistoric Assets

Group n.	HER ref n.	Asset name
PH001	MLI50362	Linear Feature, Berkland Wood, Newton-on-Trent
	MLI52572	Prehistoric Flints
	MLI52573	Prehistoric Flints
	MLI52574	Prehistoric Flint Scrapers, Newton-on-Trent
	MLI52576	Mesolithic Occupation Site, Newton-on-Trent
	MLI52577	Neolithic Occupation Remains, Newton Cliff
	MLI52578	Early Bronze Age Occupation Remains, Newton Cliff
	MLI98341	Early Neolithic Feature and Flint Blade, Newton on Tren
	MLI98497	Mesolithic microliths, Newton-on-Trent
	MLI99021	Undated Ditches, Newton-on-Trent
	MLI99022	Parallel Ditches, Newton-on-Trent
	MLI99231	Possible Iron Age Ditched Enclosures, Newton-on-Trent
	MLI99361	Iron Age Pottery Scatter, Newton-on-Trent
	MLI99362	Late Mesolithic to Early Bronze Age Artefact Scatter
	MNT10549	Pit At Newton Cliffs, Area D
	MNT10550	Preh-Ro Finds Scatter, Newton Cliffs, Area E
	MNT4689	Mesolithic Flints from North Clifton
	MNT8643	Neolithic Finds from North Clifton
	MNT8644	Bronze Age Finds from North Clifton
PH002	MLI52579	Linear Feature and Enclosure Cropmarks, Newton-on-Trent
	MLI52585	Linear Cropmarks, Newton-on-Trent
	MLI99026	Multi Ditch Boundaries, Newton-on-Trent
	MLI99027	Rectilinear Enclosure and Ditches, Newton-on-Trent
PH003	MLI50101	Neolithic Chalk Axe head, Kettlethorpe
	MLI50103	Stone Axe
PH004	MNT4668	Neo/BA Finds from South Clifton
PR005	MLI90943	Cropmark Prehistoric or Romano-British Enclosures, Boundaries and Ditches, Hardwick
	MLI52607	Prehistoric Flints
	MLI52608	Prehistoric Flints
PR006	MNT17120	Possible Henge at Normanton on Trent
	MNT17129	Settlement Complex at Normanton on Trent
	MNT15140	Settlement Complex at Marnham
	ENT4249	Resistivity Survey
	MNT12010	Worked Flint from Normanton on Trent
PH007	MLI500097	Neolithic Flint Scraper Found E Of River Trent
	MLI52562	Prehistoric Enclosures, Berkland Wood, Newton-on-Trent
PH008	MNT9948	Saddle Quern from Kingshaugh, Darlton
	MNT11465	Scraper From Kingshaugh, Darlton
	MNT5697	Worked Flints from Darlton
PH009	MNT26029	Burnt Mounds And "Water Pits" At Girton Quarry Northern Extension
	MNT11833	Prehistoric Pits at Girton Quarry Northern Extension
	MNT11831	Pit Alignment and Ditch at Girton Quarry Northern Extension
	MNT1830	Mounds And Pits at Girton Quarry Northern Extension

Table 10-2: List of Roman Assets

Group n	HER ref n.	Asset name
RO001	MLI54212	Roman Vexillation Fortress, Newton-on-Trent (NHLE: 1003608)

	MLI99269	Roman Oven and Ditch, Newton-on-Trent
	MLI99270	Roman Ditch, Newton-on-Trent
	MLI50546	Roman Temporary Camps, Newton Cliff
	MLI50710	Roman Finds East of the River Trent, Newton-on-Trent
	MLI99267	Roman Copper Alloy Object, Newton-on-Trent
	MNT8645	Romand Finds from North Clifton
RO002	MLI116379	Roman Pottery Sherds, Manor Farm, Newton-on-Trent
	MLI116380	Roman Pottery Sherds, Manor Farm, Newton-on-Trent
	MLI52596	Romano-British Pottery Kilns
	MLI116381	Roman Activity, Manor Farm, Newton-on-Trent
RO003	MLI52579	Linear Feature and Enclosure Cropmarks, Newton-on-Trent
	MLI99027	Rectilinear Enclosure and Ditches, Newton-on-Trent
RO004	MNT15374	Settlement Of Ragnall
RO005	MNT11393	Roman Pottery from Upper Row, Dunham on Trent
	MNT5803	Iron Age/Ro Coinf from Dunham
RO006	MLI90943	Cropmark Prehistoric or Romano-British Enclosures, Boundaries and Ditches, Hardwick
RO007	MLI52273	Fosse Dyke, West Lindsey
RO008	MNT17129	Settlement Complex at Normanton on Trent
	MNT15140	Settlement Complex at Marnham
RO009	MNT15847	Roman Villa at East Markham
	MNT8720	Roman Finds from Darlton
	MNT4593	Roman Finds from Darlton
	MNT5699	Roman Finds from Trenches, Kingshaugh, East Markham/Darlton
	MNT11467	Roman Pottery from Kingshaugh
	MNT8636	Roman Finds from Kingshaugh Camp, Darlton
RO010	MNT5778	Roman Pottery from Girton
	MNT5777	Roman Pottery from Girton
	MNT11828	Roman Pottery from Girton
	MNT11829	Roman features, Girton Quarry northern extension, South Clifton
RO011	MNT8641	Roman Pottery from North Clifton
	MNT4664	Roman Brooch from North Clifton
	MNT8727	Roman Pottery from South Clifton
	MNT4649	Roman Pottery from South Clifton
	MNT8638	Roman Finds from South Clifton

Table 10-3: List of Medieval Assets

Group n.	HER ref n.	Asset name
ME001	MNT15307	Deserted Village of Whimpton at Ragnall
	MNT4584	Earthwork Complex at Ragnall
	MNT15848	Cemetery At Ragnall
	MNT5700	Burial At Ragnall
	MNT4582	Earthwork Complex at Darlton
ME002	MNT4687	Church At Ragnall
	MNT15978	Shrunken Village of Ragnall
	MNT15372	Church Of St Leonard; Church of St Oswald at Ragnall
ME003	MNT25791	Shrunken Village at Skegby (Marnham)
	MNT9910	Earthwork Complex at Skegby (Marnham)
	MNT25791	Shrunken Village at Skegby (Marnham)
ME004	MNT15311	Deserted Village of Woodcotes at Fledborough
	MNT4595	Earthworks Complex at Fledborough
ME005	MNT15349	Shrunken Village of Thorney
	MNT4652	Earthworks At Thorney
	MNT4651	Moat And Pond at Thorney

	MNT15348	Moated Site and Fishponds at Thorney
	MNT5744	Site Of Thorney Hall
	MNT15869	Thorney Hall
	MNT8642	Ruins Of Church at Thorney
ME006	MLI99013	Ridge and Furrow, Newton Cliff
	MLI99012	Ridge and Furrow, Newton Cliff
	MLI99028	Ridge and Furrow, Newton Cliff
	MLI52567	Anglo-Saxon Cruciform Long Brooch, Newton-on-Trent
	MLI52569	Medieval Pottery, Newton Cliff
	MLI52589	Ridge and Furrow
	MLI52581	Ridge and Furrow Field System, Newton-on-Trent
	MLI52570	Medieval Ring (Find Spot)
	MNT8646	Early Medieval Finds from North Clifton
	MNT8647	Medieval Finds from North Clifton
ME007	MLI52590	Newton Settlement
	MLI99011	Ridge and Furrow, Newton-on-Trent
	MLI99006	Ridge and Furrow, Newton-on-Trent
ME008	MLI52588	Cultivation Remains
ME009	MLI50099	Medieval Deer Park, Kettlethorpe
	MLI50091	Kettlethorpe Hall and moated site, Kettlethorpe
	MLI50098	St Peter and St Paul's Church, Kettlethorpe
	MLI50092	'Katherine's Arch', Kettlethorpe
	MLI50640	Plot Wood, Kettlethorpe
	MLI50646	Blackthorn Wood, Kettlethorpe
	MLI53808	Medieval Settlement of Kettlethorpe
	MLI50104	Medieval Groat Found Near Park Farm.
	MLI52566	St Peter's Church, Newton-on-Trent (NHLE: 1018619)
	MLI52593	White House Farm, High Street, Newton-on-Trent
	MLI50100	Cross, St Peter, and St Paul's Churchyard, Kettlethorpe
	MLI96820	Gateway, Gate Piers, and Mounting Block, Kettlethorpe Hall, Kettlethorpe
ME010	MLI53810	Medieval Settlement of Laughterton
	MLI54278	Late Anglo-Saxon Remains on Land at Home Farm, Laughterton
ME011	MNT15306	Ringwork At Kingshaugh Farm (NHLE: 1018619)
	MNT9946	Medieval Pottery from Darlton
	MNT9914	Medieval Finds from Kingshaugh Camp
ME012	MNT10534	Fledborough ridge and furrows
ME013	MNT15371	Fledborough, The Church of St Gregory at Fledborough
ME014	MNT11394	Midland Purple From Upper Row, Dunham on Trent
	MNT5992	Earthworks At Dunham
	MNT11391	Metalling On Low Street, Dunham on Trent
	MNT4642	Documentary Reference to Swainston
	MNT11384	Medieval Pottery from Manor Croft, Dunham on Trent
	MNT15345	Medieval Village of Swainston
	MNT15346	Possible Manor House Site at Dunham
	MNT4644	Excavated Structure at Dunham
	MNT5992	Earthworks At Dunham
ME015	MNT10531	St. George At North Clifton
	MNT5802	Early Medieval Spearhead from North Clifton
ME016	MNT6165	Field Boundaries, Laneham
	MNT15363	Laneham Mills
ME017	MNT12003	Med/P Med Road Surface and Features at Normanton on Trent

ME018	MNT12013	Possible Medieval Lane or Ditch at Low Marnham
	MNT12014	Stone And? Medieval Raised Ground at Marnham
	MNT12011	Medieval Or Later Metalling at Low Marnham
ME019	ENT3796	Fieldwalking At Girton Quarry Northern Extension By TPAT
	MNT11826	Medieval Pottery from Girton Quarry Northern Extension, South Clifton
	ENT3801	Watching Brief at Girton Quarry Northern Extension By TPAU
	ENT3802	Watching Brief, Phase 5, Girton Quarry Northern Extension, By TPAT
ME020	MLI52614	Ridge And Furrow Field System
	MLI52611	Settlement Remains, Hardwick
	MLI52617	Settlement Or Farmstead of Drinsey
ME021		Moat, three fishponds, enclosures, hollow way and part of a road at Hall Yard (NHLE: 1008247)
ME022		Moated site W of Church Road (NHLE: 1017858)
ME023		Fleet Plantation moated site (NHLE: 1008594)

Table 10-4: List of Post Medieval and Modern Assets[4]

Group n.	HER ref n.	Asset name
PM001	MNT4611	Map Depiction of a Kiln at Ragnall
PM002	MNT15325	Brick Kiln at Marnham
PM003	N/A	Dunham
PM004	N/A	Newton-on-Trent
PM005	N/A	Woodcoates
PM006	N/A	North Clifton
PM007	N/A	South Clifton
PM008	N/A	Thorney
PM009	N/A	High Marnahm
PM010	N/A	Low Marnahm
PM011	N/A	Ragnall
PM012	N/A	Fledborough

Table 10-5: List of Undated Heritage Assets

Group n.	HER ref n.	Asset name	Source
UN001	MLI52586	Possible Settlement Features, Newton-on-Trent	HER
	MLI52587	Possible Ring Ditches	HER
	MLI80970	Undated Linear Ditch	HER
	MLI54276	Undated Features, High Street, Newton-on-Trent	HER
	MLI125797	Undated Post Holes, Newton-on-Trent	HER
	MLI99007	Broad Ditch, Newton-on-Trent	HER
	MLI50362	Linear Feature, Berkland Wood, Newton-on-Trent	HER
UN002	MNT4647	Linear Features at Thorney	HER
	MLI52595	Ditched Trackway	HER
	MNT4648	Enclosure And Linear Feature at Thorney	HER
	N/A	Potential enclosure?	LIDAR

[4] For simplicity and due to the extensive number of assets included in villages and considering that the majority of them will be assessed and discussed as part of the Cultural Heritage PEIR, in this chapter the groups will not show the list of HER reference numbers, as provided in the previous tables.

UN003	MLI54251	Undated Cropmarks, West of Park Farm Cottages	HER
UN004	N/A	Potential Extension of RO003	Geophysical survey
UN005	N/A	North Of North Clifton	Geophysical survey
	MNT7782	Earthworks at North Clifton	HER
	MNT25856	Settlement at North Clifton	HER + Lidar
UN006	MNT4692	Enclosures at North/South Clifton	HER
	MNT10519	Field Boundary at South Clifton	HER
	MNT4667	Cropmarks at South Clifton	HER
	MNT4669	Enclosures at North/South Clifton	HER
	MNT10518	Cropmarks at South Clifton	HER
UN007	N/A	Potential enclosures related to UN006?	Geophysical survey
UN008	MNT6701	Bank At Fledborough (Earthwork)	HER
		Scarp at Ragnall	HER
		Possible Quarry at Ragnall	HER
		Hollow at Ragnall	HER
		Bank at Ragnall	HER
UN009	N/A	West of Fledborough	Geophysical survey
UN010	N/A	South of Fledborough	Geophysical survey
UN011	N/A	Potential Enclosure	Geophysical survey
UN012	N/A	Potential Extension of RO004	Geophysical survey

Potential for unknown buried heritage assets

10.85. Frequent, and intensive agricultural activities such as ploughing and turf farming which involves a constant land stripping, extensive field consolidation activities together with the use of heavy agricultural machinery is likely to have contributed to a partial or complete removal of any buried deposit in some areas.

10.86. The River Trent is tidal at this location, and the Site is located partly within Flood Zones 2 and 3 (see **Chapter 8: Hydrology and Hydrogeology**).

10.87. Floods, as direct impact through soil removal and the groundworks for flood defences around the villages such as High and Low Marnham and North and South Clifton, may have negatively affected buried heritage survival.

10.88. Nonetheless, the substantially undeveloped and rural nature of our Site suggests a low level of potential truncation coming from any other form of modern development that may have affected any surviving buried heritage deposit. The baseline assessment indicates that there is high potential for buried heritage remains of early prehistoric to post-medieval date to survive within our Site.

Further Data Collection

10.89. A non-exhaustive list of resources that are going to be consulted for the production of the DBA forming the technical appendix to the ES is below:

- Archaeological Data Service (ADS) - A comprehensive archive of published and unpublished fieldwork reports;
- Landmark - Ordnance Survey (OS) maps from their historic first edition through to modern OS mapping. Earlier historic maps will also be consulted where available;

- Reports – Reports on ongoing and future archaeological investigations, such as the currently ongoing geophysical survey and forthcoming archaeological evaluations;
- Further developed design and baseline information for our Project - Proposed parameter plans, modelling, topographical survey, contamination report, existing Site services and utilities report;
- Aerial Photographs held by Historic England Archives, Lincolnshire HER, and Nottinghamshire HER.**;** and
- Portable Antiquities Scheme database, to complement HER data.

Future Buried Heritage Conditions

Collection of Future Predicted Data

10.90. If our Project was not implemented, it is expected that the fields included in our Site will maintain their current use as predominantly arable land.

10.91. Whilst this would prevent any impact arising from our Project, changes to buried heritage assets may still occur due to the prolonged soil erosion and degradation connected to agricultural activities, such as ploughing, trenching and use of heavy machinery.

10.92. It is expected that in the absence of our Project, the baseline would remain as existing, and the currently ongoing detrimental effects on buried heritage assets resulting from soil erosion from agricultural activities and turf farming will continue.

10.93. The non implementation of our Project would also prevent further archaeological investigations in the area, thus any further beneficial input into the wider understanding of the archaeological landscape of the area.

Environmental Measures

Mitigation by Design

10.94. Mitigation by design (avoidance of development and preservation of archaeological assets in situ) can allow important or sensitive buried archaeological remains to be preserved completely from any disturbance.

Construction

10.95. An Outline Construction Environmental Management Plan (oCEMP) will be submitted as part of our DCO application (**Appendix 4-2 in Volume 2,** presents environmental measures which will be included in the oCEMP) and is anticipated that, where reasonably practicable and appropriate, buried heritage assets which could experience major or moderate adverse effects resulting from any phase of our Project, will be avoided, and preserved in situ, as per NPPF requirements and HE guidelines.

10.96. Where necessary and practicable, the mounting structure for solar arrays will involve micrositing of piles[5] in order to avoid specific archaeological features and/or it will be supported by concrete footings rather than piles, avoiding the need for ground intrusive impact[6]. The mitigation by design will follow and be informed by the results of the geophysical survey and targeted evaluation in the form of trial trenching. This will allow the design of our Project to adapt and respond to the buried heritage considerations, to assess residual effects (if any) and avoid any unnecessary loss of significant heritage assets.

10.97. At the time of the writing, the following design measures relevant to preservation of known and unknown buried heritage assets have been incorporated within the illustrative masterplan to mitigate potential harm:

- No development is proposed on or directly adjacent to the two Scheduled Monuments with our Site (the Roman Vexillation Fortress Scheduled Monument; and Whimpton Moor Scheduled Monument). Substantial buffers around these designated heritage assets are incorporated into the design (see **Appendix 4-1** on our Project Design Principles);
- Areas of ecological mitigation and enhancement and the removal of developable land (from our first consultation) around North Clifton and South Clifton; and,
- Areas of ecological mitigation and enhancement incorporated to south of Newton-on-Trent.

10.98. Site specific mitigation measures will be discussed and implemented as part of the ES.

Maintenance

10.99. Any future maintenance and/or reinstatement works will be subject to prevailing legislation, guidance and permitting regimes at the time of the implementation.

10.100. The maintenance design will consider and be advised by the buried heritage ES, and any potential impact on buried heritage arising from maintenance operations will be discussed with the relevant stakeholders (including LPAs' Archaeological Advisors) and addressed by conditions. Any detrimental effect will be mitigated at design stage or by archaeological fieldwork.

[5] EN-3, paragraph 2.10.138

[6] As suggested by Commercial Renewable Energy Development and the Historic Environment: Historic England Advice Note 15: 'Mitigation may be possible; for example, the use of concrete bases for the panels, which entail less ground disturbance. Planning guidance published by BRE supported by Cornwall Council notes that: "Where possible Solar PV arrays should be installed using 'pile' driven or screw foundations, or pre-moulded concrete blocks (shoes), and capable of easy removal. The use of shoes may be required for archaeological sensitive areas." The vehicles and equipment used during construction can also damage archaeological remains.'

10.101. An Outline Operational Environmental Management Plan (OOEMP) will ensure that any area of heritage value will be protected during operation and maintenance, and no further ground disturbance is anticipated to occur during this stage or, where non practicable adequate mitigation measures will be implemented prior to this.

Decommissioning

10.102. The decommissioning works will be subject to prevailing legislation, guidance and permitting regimes at the time of decommissioning.

10.103. Our Project will be operational for a period of up to 60-years after the construction period ends. Ahead of decommissioning, a Decommissioning Environmental Management Plan (DEMP) will be prepared by a third party and is anticipated to include similar techniques and mitigation measures as the CEMP to protect buried heritage assets, and any specific areas mitigated through design and avoidance at design and construction phase, will be also considered and protected during decommissioning. Based on the above, it is expected that the decommissioning phase will not have any additional impacts compared to the construction phase.

10.104. The solar panels and associated infrastructure will be removed in accordance with the relevant statutory process agreed and in place at the time. Potential risks unknown at the time of the writing, if any, to buried heritage assets resulting from removal of piles (vibration, ground disturbance), and/or associated groundworks, will be discussed with the relevant stakeholders post consent, pursuant to a condition and ahead of commencement and required mitigations will be implemented.

Archaeological Mitigation

10.105. If mitigation by design cannot be applied and direct impact to buried heritage assets resulting from the construction of our Project is likely to occur, a program of physical archaeological mitigation will be implemented, and the type of mitigation would be dependent on the significance of the asset.

10.106. The archaeological mitigation scope and method statement, the Project Desing and WSI will be discussed and agreed where possible with the relevant stakeholders and will be informed by ongoing consultation with the Archaeological Advisors to Lincolnshire and Nottinghamshire and Historic England, by the results of the ongoing geophysical survey, forthcoming field evaluation and by the DBA/ES Chapter.

10.107. It is expected that the following industry-wide recognised archaeological mitigation measures will be included in the program of archaeological mitigation and will be applied to as forms of control and mitigation over any potential impact on buried heritage assets, depending on their significance and the extent of our Project's impacts:

- Archaeological Excavation or Strip, Map and Record Excavation;
- Archaeological Watching brief; and
- Geoarchaeological deposit modelling/profiling (coring) in areas of paleo-environmental potential.

10.108. A further review of the archaeological mitigation strategies to be implemented during the different phases of our Project, and how these will be applied to the different receptors will be included in the ES chapter, when there is more information about the actual archaeological survival on site (via field evaluation) and the extent of the impacts of our Project.

Enhancement

10.109. Further interpretation of the archaeological resource within our Site could be an enhancement opportunity by increasing understanding and public awareness of the heritage resource. Some examples of potential for new knowledge within our Site include landscape setting and context of the Scheduled Monuments at Whimpton Moor medieval village and Roman Vexillation Fortress outside of their immediate proximities.

10.110. Our Project also provides the opportunity for public engagement and outreach. The forms of engagement and outreach are numerous but may include site tours, media pieces such as news articles, local talks and online presentations, schools and college visits, site information boards, interpretive reconstruction/visualisation or app based digital and spatial information. The form of engagement/outreach will depend on the nature of the archaeological remains present, but the principal aim will be, where possible, to engage as wide and diverse a population as possible on any relevant archaeological findings.

10.111. A further review of the potential enhancement resulting from our Project will be included in the ES chapter when more information about the actual archaeological survival on site (via field evaluation) and the extent of the impacts of our Project become available.

Stakeholder Consultation

10.112. Appendix 10-6 outlines the Planning Inspectorate's comments in the Scoping Opinion that relate to buried heritage and the consultation responses that the Planning Inspectorate received in the preparation of the Scoping Opinion. This Appendix also outlines how the Applicant has responded to these comments.

10.113. Early, non-statutory consultations have been undertaken with the relevant consultees (including Historic England, Lincolnshire County Archaeological Advisors and Nottinghamshire County Archaeological Advisor) in support of our Project to discuss the ongoing geophysical survey, the scope of the DBA and the forthcoming archaeological interventions. Further information is provided in **Table 10-6**.

Table 10-6: Overview of Stakeholder Consultation Stakeholder

Stakeholder	Date of Consultation	Relevant Considerations for the PEIR
Lincolnshire and Nottinghamshire City Councils	16/11/2023	We presented our Project and discussed the approach to DBA, PEIR, geophysical survey and trial trenching evaluation.

	01/12/2023	Draft Project Design and Written Scheme of Investigation for geophysical survey issued for consideration.
	21/12/2023	Updated WSI and Project Design for geophysical survey issued for consideration.
	01/03/2024	We discussed the PEIR structure and scope of the assessment. Expected further evaluation scope and strategies have been discussed at a high level.
	15/03/2023	Project Design for geophysical survey approved by Jan Allen (Lincolnshire by email)
	30/04/2024	Project Design for geophysical survey approved by Matthew Adams. Draft trial trenching strategy presented by Iceni, LCC, NCC and HE asked for a more information regarding trenching percentages.
Historic England	29/02/2024	We presented our Project and discussed the approach to the PEIR, to the geophysical survey work at the Scheduled Monuments at Newton-on-Trent & at Whimpton and to specific non-designated archaeological assets. Agreed that a member of Historic England will be involved in future engagement with Lincolnshire and Nottinghamshire City Councils.

Potential Likely Significant Effects Scoped Out

10.114. As advised by PINs in the Scoping Opinion and in light of the non-statutory consultations held so far, the following effects have been scoped out of the Buried Heritage Assessment:

- Direct and indirect impacts to known and unknown archaeological remains during operation phase.

Preliminary Environmental Assessment

Approach

10.115. Any new development has the potential to result in direct and indirect impacts on buried heritage assets. Direct impacts include physical actions on surface features or buried heritage remains, such as total or partial removal of the asset; indirect impacts include those which occur not as a primary consequence of actual project actions but are still induced by our Project.

10.116. The following subheadings set out the approach to the preliminary assessment for the construction, operation, maintenance, and decommissioning phases of our Project.

Methodology

10.117. The process of impact assessments applied to buried heritage involves the following steps:

- Understanding the buried heritage assets. This includes describing the asset, its surroundings and defining its significance;
- Understanding the level and degree of impact (magnitude of change) to the significance of the buried heritage assets;
- Assessing the potential for unknown buried heritage assets based on known baseline preliminary evidence;
- Determining the significance of effect on buried heritage assets caused by our Project, by considering the magnitude of the impact and assessing the significance of the change.

10.118. The full assessment methodology is provided in **Appendix 10-2.**

10.119. For the purposes of this assessment, isolated findspots and casual/unstratified finds are grouped together (unless not already part of one of the groups identified in Tables10.1 to 10-5), as their value and the magnitude of change are negligible.

Receptors and Receptor Significance[7]

10.120. At this stage, all the known buried heritage assets within our Site and within the Study Area have been considered in the assessment.

[7] In this chapter the term significance has been used in place on sensitivity to match the assessment methodology described in Appendix 10-2.

10.121. The list of receptors along with their significance is provided in **Appendix 10-5**. This is based on the information collected so far and on professional judgment. The significance of buried heritage assets will be reviewed considering information collected during the forthcoming archaeological evaluation and presented in the ES.

Defining Effects

10.122. The potential for effects on buried heritage assets to be significant as result of groundwork activities during the construction, maintenance and decommissioning of our Project is outlined below. In EIA terms, effects classified as major or moderate are considered 'significant'. Effects classified as minor or negligible in scale are considered 'not significant'.

Construction

Effects on Identified Buried Heritage Assets (Receptors)

10.123. Effects during construction are typically derived from localised intrusive groundworks, which depending on extension and localisation may lead to permanent and irreversible truncation, compaction, full or partial loss of buried remains or deposits. These are considered direct impacts, and may arise during or in result of activities including but not limited to:

- Piling associated with the solar panel mounted structures;
- Excavations for transformers and Battery Energy Storage Systems (BESS)
- Excavations for on-site substations (see also **Appendix 10-3**);
- Excavations for cabling, CCTV, fencing, temporary or permanent service trenches for compounds, access roads;
- Excavation for connection(s) to the national power grid;
- Excavations related to the Horizontal Directional Drilling (see also **Appendix 10-4**);
- Traffic of plants and machinery; and,
- Hard and soft landscaping.

Preliminary Assessment

10.124. Ground intrusive activities, although considered to be generally limited[8], have the potential to result in an adverse impact on any buried heritage assets. The order and scale of effects will be determined by the type of intrusive work undertaken for which the details are currently not fixed. They may vary from displacement to a partial of full removal of any buried heritage assets. Without appropriate mitigation and depending on the significance of the assets and on the level of impact, these adverse effects may be considered significant in EIA terms.

[8]NPS EN-3, paragraph 2.10.109

10.125. It is not expected that our Project will permanently alter the geology or the groundwater levels within our Site or in its immediate surroundings, and any indirect effects will be temporary and reversible[9]. Therefore, at the current stage of design and based on professional opinion, it is considered there will be no significant indirect impacts on buried heritage deposits within our Site or the wider Study Area. All potential effects would have been already mitigated through the programme of embedded mitigation.

10.126. Direct impacts related to construction activities are not expected to have any detrimental effect on buried heritage assets outside of the footprint of these activities, as the excavations will be localised and will not exceed the parameters.

10.127. The excavation of cable trenches, access tracks, temporary compounds, and the foundations for the solar panels, have the potential to result in the full or partial removal of buried remains or deposits.

10.128. The installation of the Mounting Structures (sometimes known as piles) will involve very minimal disturbance of the subsoil through effects as truncation, displacement, and vibration.

10.129. Should a pile location (or even several pile locations) coincide with buried archaeological remains, the quantity of displaced archaeological remains in the case of larger features, such as the in-filled ditches described above, would be insignificant compared to that left undisturbed. For discrete or less robust buried features such as pits, post holes or stake holes, the probability that piles would be aligned in such a way that any more than a tiny percentage of the features would be affected is very low, and complete avoidance is the most likely outcome.

10.130. It is not considered, at the time of the writing, that traffic or access of heavy machinery (such as plants) and the associated weight loading/ vibration for the construction operations of our Project may cause impacts on buried heritage assets that are in excess of the impacts arising from the current agricultural activities on our Site, including the use of farm/agricultural machines. The use of gravel and track matts to distribute the weight of heavy machinery, will mitigate the impact arising from ground loading.

10.131. The embedded buffer around the Scheduled Monuments and some of the medieval villages would mitigate or remove any adverse effect on any known buried heritage assets included in the buffer areas.

10.132. Based on our current understanding and our professional judgment and considering the above preliminary assessment and the Environmental Measures discussed from paragraph 10-94, it is considered that with the implementation of adequate mitigation measures there will not be significant residual effects on buried heritage assets arising from our Project. The Detailed Scope of Assessment in Appendix 10-5 illustrate the preliminary Magnitude of Effects on buried heritage assets arising from the effects discussed above and the Residual Risk after the application of the mitigation measures outlined in Paragraph _.

[9] As discussed in Chapter 8: Hydrology and Hydrogeology of this PEIR.

Maintenance

10.133. As per Paragraph 10.99, at the current stage it is not expected that operations relate to maintenance phases of our Project infrastructures will result in any further intrusive ground activities not already addressed for the construction phase.

10.134. As such, no further direct or indirect impact will be assessed in this section.

Decommissioning

10.135. As set out within Paragraph 10.102, as no additional intrusive works beyond the construction footprint will be required to decommission our Project, there is not expected to be further impacts to any buried heritage remains.

10.136. As such, no further direct or indirect impact will be assessed in this section.

Next Steps

10.137. An appropriate archaeological evaluation strategy, including proportionate trial trenching, field walk survey and geoarchaeological modelling, based on the potential and significance of archaeology on our Site, and with consideration of the existing and proposed impacts will be implemented and will also inform the DBA and the evolving design scheme for our Project (such as the optionality for substation and river crossing).

10.138. The scope, methodology and results of the archaeological evaluation (WSI), together with the DBA and ES Chapter will be discussed with the relevant stakeholders (including LPAs' Archaeological Advisors).

10.139. The DBA as technical appendix to the ES Chapter will also include a more detailed assessment and a review of the potential effects on buried heritage assets, supported by the results of the currently ongoing geophysical survey, the results of the forthcoming archaeological evaluations and further desk-based research, as per paragraph 10.90.

10.140. The ES chapter will be based on the further developed design parameters for our Project and will take into account the embedded mitigation included in the various management plans including the oCEMP, OOEMP and DEMP by third parties. These parameters will be discussed, and their potential direct and indirect impact will be assessed in greater detail, along with any enhancement that may have a beneficial effect on buried heritage deposits.

10.141. Where the potential for significant effects in terms of EIA have been identified in this preliminary assessment, where appropriate, further mitigation will be included and will be outlined in the ES and the management plans, including the oCEMP, OOMP and DEMP, as well as a specific Project Design for Archaeological Evaluation.

Conclusions

10.142. **Table 10-7** presents a summary of the preliminary likely significant effects on buried heritage assets, based on their significance and type identified during the PEIR and already considering the mitigation measures discussed from Paragraph 10.94.

10.143. It also includes the next steps to be undertaken as part of the Environmental Impact Assessment.

Table 10-7: Summary of Preliminary Likely Effects

Type of Asset	Significance Of Asset (Value)	Effects	Preliminary Assessment of likely significant effects, after mitigations/environmental measures	Next Steps
Prehistoric	Low	Piling	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Excavations	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Traffic of plants and machinery	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Hard and soft landscaping	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
	Medium	Piling	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Excavations	No likely significant effects (Minor adverse)	Detailed assessment, further analysis, and evaluation work
		Traffic of plants and machinery	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work

Type of Asset	Significance Of Asset (Value)	Effects	Preliminary Assessment of likely significant effects, after mitigations/environmental measures	Next Steps
		Hard and soft landscaping	No likely significant effects (Minor adverse)	Detailed assessment, further analysis, and evaluation work
Roman	Low	Piling	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Excavations	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Traffic of plants and machinery	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Hard and soft landscaping	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
	Medium	Piling	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Excavations	No likely significant effects (Minor adverse)	Detailed assessment, further analysis, and evaluation work

Type of Asset	Significance Of Asset (Value)	Effects	Preliminary Assessment of likely significant effects, after mitigations/environmental measures	Next Steps
		Traffic of plants and machinery	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Hard and soft landscaping	No likely significant effects (Minor adverse)	Detailed assessment, further analysis, and evaluation work
	Medium to High	Piling	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Excavations	No likely significant effects (Minor adverse)	Detailed assessment, further analysis, and evaluation work
		Traffic of plants and machinery	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Hard and soft landscaping	No likely significant effects (Minor adverse)	Detailed assessment, further analysis, and evaluation work
	Low	Piling	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work

Type of Asset	Significance Of Asset (Value)	Effects	Preliminary Assessment of likely significant effects, after mitigations/environmental measures	Next Steps
Saxon and Medieval		Excavations	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Traffic of plants and machinery	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Hard and soft landscaping	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
	Medium	Piling	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Excavations	No likely significant effects (Minor adverse)	Detailed assessment, further analysis, and evaluation work
		Traffic of plants and machinery	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Hard and soft landscaping	No likely significant effects (Minor adverse)	Detailed assessment, further analysis, and evaluation work

Type of Asset	Significance Of Asset (Value)	Effects	Preliminary Assessment of likely significant effects, after mitigations/environmental measures	Next Steps
	Medium to High	Piling	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Excavations	No likely significant effects (Minor adverse)	Detailed assessment, further analysis, and evaluation work
		Traffic of plants and machinery	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Hard and soft landscaping	No likely significant effects (Minor adverse)	Detailed assessment, further analysis, and evaluation work
Post Medieval	Low	Piling	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Excavations	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Traffic of plants and machinery	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work

Type of Asset	Significance Of Asset (Value)	Effects	Preliminary Assessment of likely significant effects, after mitigations/environmental measures	Next Steps
		Hard and soft landscaping	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
	Low to Medium	Piling	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Excavations	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Traffic of plants and machinery	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Hard and soft landscaping	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
Undated	Low	Piling	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Excavations	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work

Type of Asset	Significance Of Asset (Value)	Effects	Preliminary Assessment of likely significant effects, after mitigations/environmental measures	Next Steps
		Traffic of plants and machinery	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Hard and soft landscaping	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
	Low to Medium	Piling	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Excavations	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Traffic of plants and machinery	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Hard and soft landscaping	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
	Low to High	Piling	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work

Type of Asset	Significance Of Asset (Value)	Effects	Preliminary Assessment of likely significant effects, after mitigations/environmental measures	Next Steps
		Excavations	No likely significant effects (Negligible to Minor adverse)	Detailed assessment, further analysis, and evaluation work
		Traffic of plants and machinery	No likely significant effects (Negligible)	Detailed assessment, further analysis, and evaluation work
		Hard and soft landscaping	No likely significant effects (Negligible to Minor adverse)	Detailed assessment, further analysis, and evaluation work

Appendices

Appendix 10-1: Buried Heritage Legislation, Policy and Guidance

Appendix 10-2: Assessment Methodology

Appendix 10-3: Preliminary Impact Assessment:Locations for Substations

Appendix 10-4: Preliminary Impact Assessment: Options for River Crossing

Appendix 10-5: Detailed Scope of Assessement

Appendix 10-6: Consultation responses outlined in Scoping Opinion and actions in response

Appendix 10-1: Buried Heritage Legislation, Policy and Guidance

Review of Policy, Legislation and Relevant Guidance

Legislation, planning policy and guidance relating to Buried Heritage, and pertinent to the Project comprises:

Legislation

Ancient Monuments and Archaeological Areas Act 1979 – Part I Ancient Monuments: Protection of Scheduled Monuments

This legislation established the protection of archaeological heritage in England, Wales and Scotland, and further introduced the legal protection of sites of national significance/archaeological importance as 'Scheduled Monuments'. Through this Act, damage to a scheduled monument became a criminal offence.

Infrastructure Planning (Decisions) Regulations 2010 – specific reference to Regulation 3

This regulation set out the matters which the decision-maker must have regard to, for development consent order applications under the Planning Act 2008. Regulation 3 specifically outlines that if a proposal potentially affects a listed building or its setting, the decision-maker must take into account the desirability of preserving a listed building or its setting, or indeed other features of historical interest. This principle is also mirrored for development consent order applications affecting conservation areas and scheduled monuments and their settings.

National Planning Policy

Overarching National Policy Statement for Energy (EN-1) (2024)

This provides overarching government policy on energy NSIPs, and the way in which any impacts and mitigation measures will be considered. Section 5.9 of this policy statement focusses on the Historic Environment.

Paragraph 5.9.7 states that *"The Secretary of State should also consider the impacts on other non-designated heritage assets (as identified either through the development plan making process by plan-making bodies, including 'local listing', or through the application, examination and decision-making process). This is on the basis of clear evidence that such heritage assets have a significance that merits consideration in that process, even though those assets are of lesser significance than designated heritage assets."*

Paragraph 5.9.9 states that *"The applicant should undertake an assessment of any likely significant heritage impacts of the proposed development as part of the EIA and describe these along with how the mitigation hierarchy has been applied in the ES (see Section 4.3). This should include consideration of heritage assets above, at, and below the surface of the ground. Consideration will also need to be given to the possible impacts, including cumulative, on the wider historic environment. The assessment should include reference to any historic landscape or seascape character assessment and associated studies as a means of assessing impacts relevant to the proposed project."*

Paragraph 5.9.10 states that *"As part of the ES the applicant should provide a description of the significance of the heritage assets affected by the proposed development, including any contribution made by their setting. The level of detail should be proportionate to the importance of the heritage assets and no more than is sufficient to understand the potential impact of the proposal on their significance. As a minimum, the applicant should have consulted the relevant Historic Environment Record (or, where the development is in English or Welsh waters, Historic England or Cadw) and assessed the heritage assets themselves using expertise where necessary according to the proposed development's impact."*

Paragraph 5.9.11 states that *"Where a site on which development is proposed includes, or the available evidence suggests it has the potential to include, heritage assets with an archaeological interest, the applicant should carry out appropriate desk-based assessment and, where such desk-based research is insufficient to properly assess the interest, a field evaluation. Where proposed development will affect the setting of a heritage asset, accurate representative visualisations may be necessary to explain the impact."*

Paragraph 5.9.21 states that *"Where there is a high probability (based on an adequate assessment) that a development site may include, as yet undiscovered heritage assets with archaeological interest, the Secretary of State will consider requirements to ensure appropriate procedures are in place for the identification and treatment of such assets discovered during construction."*

Paragraph 5.9.22 states that *"In determining applications, the Secretary of State should seek to identify and assess the particular significance of any heritage asset that may be affected by the proposed development, including by development affecting the setting of a heritage asset (including assets whose setting may be affected by the proposed development), taking account of:*

- *relevant information provided with the application and, where applicable, relevant information submitted during the examination of the application;*
- *designation records, including those on the National Heritage List for England;*
- *Historic Environment Records;*
- *representations made by interested parties during the examination process; and*
- *expert advice."*

Paragraph 5.9.24 states that *"In considering the impact of a proposed development on any heritage assets, the Secretary of State should consider the particular nature of the significance of the heritage assets and the value that they hold for this and future generations. This understanding should be used to avoid or minimise conflict between their conservation and any aspect of the proposal."*

Paragraph 5.9.27 states that "*when considering the impact of a proposed development on the significance of a designated heritage asset, the Secretary of State should give great weight to the asset's conservation… irrespective of whether any potential harm amounts to substantial harm, total loss, or less than substantial harm to its significance."*

Paragraph 5.9.28 states that *"The Secretary of State should give considerable importance and weight to the desirability of preserving all heritage assets. Any harm or loss of significance of a designated heritage asset (from its alteration or destruction, or from development within its setting) should require clear and convincing justification."*

Paragraph 5.9.32 states that "where the proposed development will lead to less than substantial harm to the significance of the designated heritage asset, this harm should be weighed against the public benefits of the proposal, including, where appropriate securing its optimum viable use."

Paragraph 5.9.33 states that "In weighing applications that directly or indirectly affect non-designated heritage assets, a balanced judgement will be required having regard to the scale of any harm or loss and the significance of the heritage asset."

National Policy Statement for Renewable Energy Infrastructure (EN-3) (2024)

This provides specific policy on how renewable energy NSIPs, should be assessed and determined, and the way in which any impacts and mitigation measures will be considered. Specific extracts relating to our Project are as follows:

Paragraph 2.3.8 states that *"In considering the impact on the historic environment as set out in Section 5.9 of EN-1 and whether the Secretary of State is satisfied that the substantial public benefits would outweigh any loss or harm to the significance of a designated heritage asset, the Secretary of State should take into account the positive role that large-scale renewable projects play in the mitigation of climate change, the delivery of energy security and the urgency of meeting the net zero target."*

Paragraphs 2.10.107 to 2.10.119 state that *"The impacts of solar PV developments on the historic environment will require expert assessment in most cases and may have effect both above and below ground.*

Above ground impacts may include the effects on the setting of Listed Buildings and other designated heritage assets as well as on Historic Landscape Character.

Below ground impacts, although generally limited, may include direct impacts on archaeological deposits through ground disturbance associated with trenching, cabling, foundations, fencing, temporary haul routes etc.

Equally, solar PV developments may have a positive effect, for example archaeological assets may be protected by a solar PV farm as the site is removed from regular ploughing and shoes or low-level piling is stipulated.

Generic historic environment impacts are covered in Section 5.9 of EN-1.

Applicant assessments should be informed by information from Historic Environment Records (HERs) or the local authority.

Where a site on which development is proposed includes, or has the potential to include, heritage assets with archaeological interest, the applicant should submit an appropriate desk-based assessment and, where necessary, a field evaluation. These should be carried out using expertise where necessary and in consultation with the local planning authority, and should identify archaeological study areas and propose appropriate schemes of investigation, and design measures, to ensure the protection of relevant heritage assets.

In some instances, field studies may include investigative work (and may include trial trenching beyond the boundary of the proposed site) to assess the impacts of any ground disturbance, such as proposed cabling, substation foundations or mounting supports for solar panels on archaeological assets.

The extent of investigative work should be proportionate to the sensitivity of, and extent of, proposed ground disturbance in the associated study area.

Applicants should take account of the results of historic environment assessments in their design proposal.

Applicants should consider what steps can be taken to ensure heritage assets are conserved in a manner appropriate to their significance, including the impact of proposals on views important to their setting.

As the significance of a heritage asset derives not only from its physical presence but also from its setting, careful consideration should be given to the impact of large-scale solar farms which depending on their scale, design, and prominence, may cause substantial harm to the significance of the asset.

Applicants may need to include visualisations to demonstrate the effects of a proposed solar farm on the setting of heritage assets."

Paragraph 2.10.137 states that *"The ability of the applicants to microsite specific elements of the proposed development during the construction phase should be an important consideration by the Secretary of State when assessing the risk of damage to archaeology."*

Paragraph 2.10.151 states that *"The Secretary of State should consider the period of time the applicant is seeking to operate the generating station, as well as the extent to which the site will return to its original state, when assessing impacts such as landscape and visual effects and potential effects on the settings of heritage assets and nationally designated landscapes."*

Paragraph 2.10.160 states that *"Solar farms are generally consented on the basis that they will be time-limited in operation. The Secretary of State should therefore consider the length of time for which consent is sought when considering the impacts of any indirect effect on the historic environment, such as effects on the setting of designated heritage assets."*

National Policy Statement for Electricity Networks Infrastructure (EN- 5) (2024)

This provides specific policy on electricity network NSIPs, which could also apply to the cabling and grid connection parts of our Project, including how applications will be assessed and determined, and the way in which any impacts and mitigation measures will be considered.

National Planning Policy Framework (2023)

The National Planning Policy Framework (NPPF) is an overarching document which sets out government planning policy for development outside of the NSIP regime in England, and how this is expected to be applied by local authorities and developers. The NPPF can be an important and relevant consideration for NSIPs as well, but in the event of any conflict, the NPS policy prevails. The NPPF provides a framework for local sustainable development via local plans. **Chapter 16** focusses specifically on 'conserving and enhancing the historic environment'.

The NPPF sets out the importance of being able to assess the significance of heritage assets that may be affected by a development. Significance is defined in Annex 2 of the NPPF as being the *"value of a heritage asset to this and future generations because of its heritage interest. That interest may be archaeological, architectural, artistic, or historic". Significance is not only derived from an asset's physical presence, but also from its setting. The setting of a heritage asset is defined in Annex 2 as "the surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve".*

Paragraph 200 of the NPPF states that *"In determining applications, local planning authorities should require an applicant to describe the significance of any heritage assets affected, including any contribution made by their setting. The level of detail should be proportionate to the asset's importance and no more than is sufficient to understand the potential impact of the proposal on their significance."*

Paragraph 201 states that *"Local planning authorities should identify and assess the particular significance of any heritage asset that may be affected by a proposal (including by development affecting the setting of a heritage asset) taking account of the available evidence and any necessary expertise. They should take this into account when considering the impact of a proposal on a heritage asset, to avoid or minimise any conflict between the heritage asset's conservation and any aspect of the proposal."*

Paragraph 205 states that *"when considering the impact of a proposed development on the significance of a designated heritage asset, great weight should be given to the asset's conservation (and the more important the asset, the greater the weight should be). This is irrespective of whether any potential harm amounts to substantial harm, total loss or less than substantial harm to its significance."*

Paragraph 207 states that *"where a proposed development will lead to substantial harm to (or total loss of significance of) a designated heritage asset, local planning authorities should refuse consent, unless it can be demonstrated that the substantial harm or total loss is necessary to achieve substantial public benefits that outweigh that harm or loss."*

Paragraph 208 states that "*where a development proposal will lead to less than substantial harm to the significance of a designated heritage asset, this harm should be weighed against the public benefits of the proposal including, where appropriate, securing its optimum viable use*."

Paragraph 209 states that "*the effect of an application on the significance of a non-designated heritage asset should be taken into account in determining the application. In weighing applications that directly or indirectly affect non-designated heritage assets, a balanced judgement will be required having regard to the scale of any harm or loss and the significance of the heritage asset."*

Local Planning Policy

Newark and Sherwood District Council (2023) Local Development Framework, Amended Allocations and Development Management Development Plan Document (AADMDPD), Submission Version, January 2024

This amended local Development Plan Document (DPD) has been compiled to ensure that the wider development framework within Newark and Sherwood District Council sufficiently allocates land for development to meet the needs of the area, up until 2033. The document includes *"new and amended Housing and Affordable Housing Policies which replace those included in the Amended Core Strategy and new Gypsy Roma Traveller policies and allocations. The document also sets out amendments to urban boundaries and village envelopes, retail boundaries as well as sites requiring continued protection from development (open space and green infrastructure designations). It also includes a suite of Development Management policies to provide greater direction, help deliver specific allocations and assist in the day-to-day assessment of planning applications."* This DPD is currently under examination via the Secretary of State with an independent planning inspector.

Specific policies within the AADMDPD relevant to our Project include Policy DM4 "*Renewable and Low Carbon Energy Generation*" which states that *"In order to achieve the commitment to carbon reduction set out in Core Policy 10, planning permission will be granted for renewable and low carbon energy generation development, as both standalone projects and part of other development, its associated infrastructure, and the retro-fitting of existing development, where its benefits are not outweighed by detrimental impact from the operation and maintenance of the development and through the installation process upon:*

> *The landscape character or urban form of the district or the purposes of including land within the Green Belt arising from the individual or cumulative impact of proposals;*

Southwell Views as defined in Policy So/PV or the setting of the Thurgarton Hundred Workhouse, as defined in Policy So/Wh;

Heritage Assets and or their settings;

Amenity, including noise pollution, shadow flicker, and electromagnetic interference;

Highway safety;

The ecology of the local or wider area; or

Aviation interests of local or national importance."

Newark and Sherwood District Council (2019), Amended Core Strategy Development Plan

The Amended Core Strategy for Newark and Sherwood District is part of the Local Development Framework for the area. This strategy outlines the overarching issues and objectives to address over a 20-year period, contextualising this into wider vision, series of objectives and core policies toward delivery.

Core Policy 14 "Historic Environment" is relevant to our Project and states that *"Newark & Sherwood has a rich and distinctive historic environment and the District Council will work with partners and developers in order to secure:*

- *The continued conservation and enhancement of the character, appearance and setting of the District's heritage assets and historic environment, in line with their identified significance as required in national policy;*
- *Designated assets and environments comprising Listed Buildings (inclusive of the protected views of and across Southwell's principal heritage assets), Conservation Areas, Registered Historic Parks and Gardens, and Scheduled Monuments. When considering the impact of a proposed development on the significance of a designated heritage asset, great weight should be given to the asset's conservation. The more important the asset, the greater the weight should be. Where adverse impact is identified there should be a clear and convincing justification, including where appropriate a demonstration of clear public benefits;*
- *Non-designated heritage assets including buildings of local interest, areas of archaeological interest and unregistered parks and gardens or as identified on the relevant Historic Environment Record or identified in accordance with locally agreed criteria. In weighing applications that affect directly or indirectly non-designated heritage assets, a balanced judgement will be required having regard to the scale of any harm or loss and the significance of the heritage asset;*
- *The preservation and enhancement of the special character of Conservation Areas including that character identified through Conservation Area Character Appraisals which will form the basis for their management. Important open spaces and features identified through the Conservation Area Appraisal process will be protected through subsequent allocation in the Allocations & Development Management DPD;*
- *Positive action for those heritage assets at risk through neglect, decay, vacancy or other threats where appropriate; and*

- *The protection of Historic Landscapes including the Historic Battlefield at Stoke Field, the Sherwood Forest Heritage Area and the Historic Landscape around Laxton. A sustainable future for Laxton will be sought, which preserves and enhances its Open Field System and culture, the built and natural environment which sustain it, including the Historic Landscape around Laxton, and the institutions which manage it. This will be achieved by working in partnership with the Court Leet, the Crown Estates and the Parish Council. Appropriate new development which facilitates these aims will be supported."*

Central Lincolnshire Local Plan (2023)

The Local Plan for the central Lincolnshire area sets out the approach to planning policy and overarching development allocations to drive growth in the area over a 20-year period. The Local Plan is contextualised into a wider vision, series of objectives and core policies toward delivery.

Specific policies detailed in the Local Plan and are relevant to our Project, as below.

Policy S57 "*The Historic Environment*" states that:

"Development proposals should protect, conserve and seek opportunities to enhance the historic environment of Central Lincolnshire. In instances where a development proposal would affect the significance of a heritage asset (whether designated or non-designated), including any contribution made by its setting, the applicant will be required to undertake and provide the following, in a manner proportionate to the asset's significance:

a) describe and assess the significance of the asset, including its setting, to determine its architectural, historical or archaeological interest;

b) identify the impact of the proposed works on the significance and special character of the asset, including its setting;

c) provide a clear justification for the works, especially if these would harm the significance of the asset, including its setting, so that the harm can be weighed against public benefits.

Development proposals will be supported where they:

d) protect the significance of heritage assets (including where relevant their setting) by protecting and enhancing architectural and historic character, historical associations, landscape and townscape features and through consideration of scale, design, architectural detailing, materials, siting, layout, mass, use, and views and vistas both from and towards the asset;

e) promote opportunities to better reveal significance of heritage assets, where possible;

f) take into account the desirability of sustaining and enhancing non-designated heritage assets and their setting.

Proposals to alter or to change the use of a heritage asset, will be supported provided:

g) the proposed use is compatible with the significance of the heritage asset, including its fabric, character, appearance, setting and, for listed buildings, interior;

h) such a change of use will demonstrably assist in the maintenance or enhancement of the heritage asset;

i) features essential to the special interest of the individual heritage asset are not harmed to facilitate the change of use.

Development proposals that will result in substantial harm to, or the total loss of, a designated heritage asset will only be granted permission where it is necessary to achieve substantial public benefits that outweigh the harm or loss, and the following criteria can be satisfied:

j) the nature of the heritage asset prevents all reasonable uses of the site;

k) no viable use of the heritage asset itself can be found in the medium term through appropriate marketing that will enable its conservation;

l) conservation by grant-funding or some form of not for profit, charitable or public ownership is demonstrably not possible; and

m) the harm or loss is outweighed by the benefit of bringing the site back into use.

Where a development proposal would result in less than substantial harm to a designated heritage asset, permission will only be granted where the public benefits, including, where appropriate, securing its optimum viable use, outweigh the harm.

Where a non-designated heritage asset is affected by development proposals, there will be a presumption in favour of its retention, though regard will be had to the scale of any harm or loss and the significance of the heritage asset. Any special features which contribute to an asset's significance should be retained and reinstated, where possible.

Listed Buildings

Permission to change the use of a Listed Building or to alter or extend such a building will be granted where the local planning authority is satisfied that the proposal is in the interest of the building's conservation and does not involve activities or alterations prejudicial to the special architectural or historic interest of the Listed Building or its setting.

Development proposals that affect the setting of a Listed Building will, in principle, be supported where they make a positive contribution to, or better reveal the significance of the Listed Building.

Conservation Areas

Significant weight will be given to the protection and enhancement of Conservation Areas. Development within, affecting the setting of, or affecting views into or out of, a Conservation Area should conserve, or where appropriate enhance, features that contribute positively to the area's special character, appearance and setting, including as identified in any adopted Conservation Area appraisal. Proposals should:

> *n) retain buildings/groups of buildings, existing street patterns, historic building lines and ground surfaces and architectural details that contribute to the character and appearance of the area;*
>
> *o) where relevant and practical, remove features which have a negative impact on the character and appearance of the Conservation Area;*
>
> *p) retain and reinforce local distinctiveness with reference to height, massing, scale, form, materials and plot widths of the existing built environment;*
>
> *q) assess, and mitigate against, any negative impact the proposal might have on the townscape, roofscape, skyline and landscape; and*
>
> *r) aim to protect trees, or where losses are proposed, demonstrate how such losses are appropriately mitigated against.*

Archaeology

Development affecting archaeological remains, whether known or potential, designated or undesignated, should take every practical and reasonable step to protect and, where possible, enhance their significance.

Planning applications for such development should be accompanied by an appropriate and proportionate assessment to understand the potential for and significance of remains, and the impact of development upon them.

If initial assessment does not provide sufficient information, developers will be required to undertake field evaluation in advance of determination of the application. This may include a range of techniques for both intrusive and non-intrusive evaluation, as appropriate to the site.

Wherever possible and appropriate, mitigation strategies should ensure the preservation of archaeological remains in-situ. Where this is either not possible or not desirable, provision must be made for preservation by record according to an agreed written scheme of investigation submitted by the developer and approved by the planning authority.

Any work undertaken as part of the planning process must be appropriately archived in a way agreed with the local planning authority."

Bassetlaw District Council (2010) Local Development Framework, Publication Core Strategy and Development Management Policies

The Core Strategy for the Bassetlaw District sets out the overarching vision for the area up until 2026, including the policy approach to deliver this.

Policy SO9 is a strategic objective policy of Bassetlaw's Core Strategy. It states:

"protect and enhance Bassetlaw's heritage assets, identify those of local significance, advance characterisation and understanding of heritage asset significance, reduce the number of heritage assets at risk and ensure that development is managed in a way that sustains or enhances the significance of heritage assets and their setting."

Policy DM8 "The Historic Environment" is relevant to our Project and states that:

"Support will be given to development proposals or regeneration schemes (particularly in central Worksop, Retford, and Tuxford) that protect and enhance the historic environment and secure its long-term future, especially the District's Heritage at Risk. Such proposals must recognise the significance of heritage assets as a central part of the development. They will be expected to be in line with characterisation studies, village appraisals, conservation area appraisals (notably the site-specific development briefs that may be found within them), archaeological reports, and other relevant studies.

A. Definition of Heritage Assets

Designated heritage assets in Bassetlaw include:

- *Listed Buildings (including attached and curtilage structures);*
- *Conservation Areas;*
- *Scheduled Monuments; and*
- *Registered Parks and Gardens.*

Non-Designated assets in Bassetlaw include:

- *Buildings of Local Interest;*
- *Areas of archaeological interest;*
- *Unregistered Parks and Gardens; and*
- *Buildings, monuments, places, areas or landscapes positively identified as having significance in terms of the historic environment.*

B. Development Affecting Heritage Assets

There will be a presumption against development, alteration, advertising or demolition that will be detrimental to the significance of a heritage asset.

Proposed development affecting heritage assets, including alterations and extensions that are of an inappropriate scale, design or material, or which lead to the loss of important spaces, including infilling, will not be supported.

The setting of an asset is an important aspect of its special architectural or historic interest and proposals that fail to preserve or enhance the setting of a heritage asset will not be supported. Where appropriate, regard shall be given to any approved characterisation study or appraisal of the heritage asset. Development proposals within the setting of heritage assets will be expected to consider:

- *Scale;*
- *Design;*
- *Materials;*

- *Siting; and*
- *Views away from and towards the heritage asset.*

C. Change of Use Affecting Heritage Assets

The change of use of heritage assets, including Listed Buildings and buildings in Conservation Areas, will only be permitted where the proposed use is considered to be the optimum viable use that is compatible with the fabric, interior, and setting of the building. Evidence supporting this will be submitted with proposals. New uses that adversely affect the fabric, character, appearance, or setting of such buildings will not be permitted.

D. Shopfronts

Proposals for replacement shopfronts or alterations to shopfronts affecting heritage assets will be expected to ensure that traditional shopfronts are retained wherever possible irrespective of the use of the property. New shopfronts will be expected to utilize traditional materials such as timber and be designed to respect the special interest of the building and its setting."

Draft Bassetlaw Local Plan (2023) 2020-2038: Main Modifications Version, August 2023

This Local Plan sets out Bassetlaw District's planning and policy framework, development strategy and site allocations to inform effective delivery of the overall vision up until 2038.

Policies set out in the Local Plan are relevant to our Project.

Policy 43 "Designated and Non-Designated Heritage Assets" states that:

"Proposals for development, including change of use, that involve a designated heritage asset, or the setting of a designated heritage asset will be expected to:

a) conserve, enhance or better reveal those elements which contribute to the heritage significance and/or its setting;
b) respect any features of special architectural or historic interest, including where relevant the historic curtilage or context, its value within a group and/or its setting, such as the importance of a street frontage, traditional roofscape, or traditional shopfronts;
c) be sympathetic in terms of its siting, size, scale, height, alignment, proportions, design and form, building technique(s), materials and detailing, boundary treatments and surfacing, or are of a high quality contemporary or innovative nature which complements the local vernacular, in order to retain the special interest that justifies its designation;
d) ensure significant views away from, through, towards and associated with the heritage asset(s) are conserved or enhanced;
e) in the case of a Conservation Area, to have regard to the established urban grain and ensure that spaces between and around buildings, such as paddocks, greens, gardens

and other gaps, are preserved where they contribute to the Conservation Area's character and appearance.

Proposals that will lead to substantial harm or total loss of significance will be refused unless the substantial harm or loss is necessary to achieve substantial public benefits that outweigh that harm or loss, and it can be demonstrated that:

a) the nature of the heritage asset prevents all reasonable uses of the site;
b) no viable use of the heritage asset can be found in the medium term through appropriate marketing that will enable its conservation;
c) conservation by grant-funding or some form of not for profit, charitable or public ownership is demonstrably not possible; and
d) the harm or loss is outweighed by the benefit of bringing the site back into use.

Proposals that would result in less than substantial harm to the significance of a designated heritage asset will only be supported where it can be demonstrated that the public benefits will outweigh any harm identified.

Non-Designated Heritage Assets

Proposals for development, including change of use, that involve a non-designated heritage asset, or the setting of a non-designated heritage asset will be expected to:

a) have regard to the significance of the asset and its relationship with its setting; and
b) be sympathetic to the local vernacular in terms of siting, size, scale, height, alignment, design and form; proportions, materials.

Proposals that will lead to harm to or loss of significance of a non-designated heritage asset will only be considered supported where it can be demonstrated that:

a) the asset's architectural or historic significance is proven to be minimal; or
b) through an up-to-date structural report produced by a suitably qualified person, the asset is not capable of viable repair; or
c) through appropriate marketing, the asset has no viable use; or
d) the public benefits of the scheme outweigh the loss of significance.

Policy ST42: The Historic Environment states that:

"The historic environment will be conserved and enhanced, sensitively managed, enjoyed and celebrated for its contribution to sustainable communities. Proposals will be supported where they:

a) *give great weight to the conservation and re-use of designated heritage assets (designated and non-designated) and their settings, including for appropriate temporary use, based on their significance in accordance with national policy;*
b) *make a positive contribution to the character and local distinctiveness of the historic environment, including through the use of innovative design;*
c) *positively conserve or enhance a historic designed landscape;*
d) *maintain, conserve, sustain or return to beneficial use designated or non-designated assets;*

e) *capitalise in an appropriate and sensitive manner the regeneration, tourism and energy efficiency potential of heritage assets;*
f) *positively secure the conservation and re-use of 'at risk' heritage assets;*
g) *improve access and enjoyment of the historic environment where appropriate, particularly where they retain, create or facilitate public access to heritage assets to increase understanding of their significance.*

Applicants will be required to submit evidence in line with best practice and relevant national guidance, examining the significance of any heritage assets affected through a Heritage Statement, including any contribution made by their setting. The level of detail should be proportionate to the asset's significance, and the results submitted to the Nottinghamshire Historic Environment Record. In some circumstances, further survey, analysis and/or recording will be made a condition of consent."

Policy ST43 Designated and Non-Designated Heritage Assets states that:

"Proposals for development, including change of use, that involve a designated heritage asset, or the setting of a designated heritage asset will be expected to:

a) conserve, enhance or better reveal those elements which contribute to the heritage significance and/or its setting;
b) respect any features of special architectural or historic interest, including where relevant the historic curtilage or context, its value within a group and/or its setting, such as the importance of a street frontage, traditional roofscape, or traditional shopfronts;
c) be sympathetic in terms of its siting, size, scale, height, alignment, proportions, design and form, building technique(s), materials and detailing, boundary treatments and surfacing, or are of a high quality contemporary or innovative nature which complements the local vernacular, in order to retain the special interest that justifies its designation;
d) ensure significant views away from, through, towards and associated with the heritage asset(s) are conserved or enhanced;
e) in the case of a Conservation Area, to have regard to the established urban grain and ensure that spaces between and around buildings, such as paddocks, greens, gardens and other gaps, are preserved where they contribute to the Conservation Area's character and appearance.

Proposals that will lead to substantial harm or total loss of significance will be refused unless the substantial harm or loss is necessary to achieve substantial public benefits that outweigh that harm or loss, and it can be demonstrated that:

a) the nature of the heritage asset prevents all reasonable uses of the site;
b) no viable use of the heritage asset can be found in the medium term through appropriate marketing that will enable its conservation;
c) conservation by grant-funding or some form of not for profit, charitable or public ownership is demonstrably not possible; and
d) the harm or loss is outweighed by the benefit of bringing the site back into use.

Proposals that would result in less than substantial harm to the significance of a designated heritage asset will only be supported where it can be demonstrated that the public benefits will outweigh any harm identified.

Non-Designated Heritage Assets

Proposals for development, including change of use, that involve a non-designated heritage asset, or the setting of a non-designated heritage asset will be expected to:

a) *have regard to the significance of the asset and its relationship with its setting; and*
b) *be sympathetic to the local vernacular in terms of siting, size, scale, height, alignment, design and form; proportions, materials.*

Proposals that will lead to harm to or loss of significance of a non-designated heritage asset will only be considered supported where it can be demonstrated that:

a) *the asset's architectural or historic significance is proven to be minimal; or*
b) *through an up-to-date structural report produced by a suitably qualified person, the asset is not capable of viable repair; or*
c) *through appropriate marketing, the asset has no viable use; or*
d) *the public benefits of the scheme outweigh the loss of significance."*

Archaeological Sites

"Where evidence suggests that significant archaeological remains exist on site, proposals should be supported by an appropriate archaeological evaluation that provides an assessment of the significance of the remains and considers how the remains would be affected by the proposed development.

Where the 'in situ' preservation of archaeological remains is not possible or desirable, suitable provision shall be made by the developer for the excavation, recording, analysis, storage, relocation of assets and archiving, in accordance with a Written Scheme of Investigation that has been approved by the Local Planning Authority."

National Guidance

Planning Practice Guidance (2023) – Historic Environment (2019)

This guidance sets out the key issues on enhancing and conserving the historic environment. This guidance sets out how the historic environment should be addressed in local plans, the designation process for designated and non-designated heritage assets, the overarching heritage consent process, as well as further information on the consultation process for and other planning issues associated with heritage related proposals.

English Heritage (2008) Conservation Principles, Policies and Guidance

English Heritage, now Historic England, published guidance which aids best practice for a wide range of stakeholders in regard to the historic environment. This guidance mainly focuses on creating and implementing a management regime for its users and further defines value and significance upon heritage receptors.

Historic England (2015), Managing Significance in Decision-Taking in the Historic Environment – Historic Environment Good Practice Advice in Planning: 1. The Historic Environment in Local Plans ('GPA2')

This advice note provides information to a wide range of stakeholders in aid of implementing national historic environment policy within the NPPF and PPG. Therefore, this advice from Historic England should be utilised to support national policy implementation. This guidance further outlines that information required for planning and listed building consent should be proportionate, and any activities around conservation or investigation should again be balanced against heritage significance.

Historic England (2017) The Setting of Heritage Assets – Historic Environment Good Practice Advice in Planning: 3. Historic England and Historic Environment Forum

This advice note provides information to a wide range of stakeholders, in tandem with NPPF and PPG guidance, on managing modification to the setting of several heritage assets. This document furthermore gives practitioners advice on understanding what heritage setting is and how it contributes to the overall heritage significance.

Historic England (2020) Good Practice in Planning 4: Enabling Development and Heritage Assets

This document specifically outlines guidance regarding development to safeguard a heritage asset, which would not normally be approved through the planning system nor be in-line with national or local planning policy. Therefore, this direction from Historic England is to encourage developers and authorities to work together to ensure appropriate development and acceptability, and if required any alternative arrangements.

Historic England (2021) Historic Environment Advice Note 15. Commercial Renewable Energy Development and the Historic Environment ('HEAN15', Historic England)

This Historic England advice note is specifically aimed at developers of renewable energy projects of various sizes (including NSIP and other large proposals), to improve consideration of heritage issues within the proposal process. The overarching detail within this advice note focuses on potential impacts upon the historic environment, associated with the development of renewable energy projects.

This guidance note reflects the requirements of NPS EN-1 and the NPPF and that the process set out in these two documents should be followed when considering renewable energy proposals that may have a harmful impact on the significance of designated and non-designated heritage assets. This is set out in paragraphs 35 to 38. Of particular note is paragraph 36 which states that "*any harmful impact on the significance of a designated heritage asset requires a clear and convincing justification, detailing the benefits of the proposal and enabling them to be weighed against any harm that would be caused to the historic environment. In this regard, EN-3 notes the positive role that large-scale renewable projects play in the mitigation of climate change, the delivery of energy security and the urgency of meeting the national targets for renewable energy supply and emissions reductions. Determining the balance between harm and benefits is done on a case-by-case basis, informed by evidence and assessment (as described in national policy) and taking account of a range of factors and relevant policy and guidance (including other relevant advice in this advice note).*"

Historic England (2022) Planning and Archaeology: Historic England Advice Note 17

This advice note sets the context for archaeology within the planning system. The guidance produced by Historic England summarises responsibility that planning authorities and developers have regarding archaeology through a planning application, how legislation, national policy and guidance should be applied, promoting accuracy and the benefits of implementation.

Professional Regulations and Standards & Guidance

In addition to the above, the following professional regulations, standards and guidance have been considered within the PEIR:

- Chartered Institute for Archaeologists (CIfA), 2023, Standard for archaeological excavation
- Chartered Institute for Archaeologists (CIfA), 2023, Standard for archaeological monitoring and recording
- Chartered Institute for Archaeologists (CIfA), 2014a, Standard and Guidance for the Collection, Documentation, Conservation and Research of Archaeological Materials (revised 2020)
- Chartered Institute for Archaeologists (CIfA), 2014b, Standard and Guidance for Archaeological Field Evaluation (revised 2023)
- Chartered Institute for Archaeologists (CIfA), 2014c, Code of Conduct (revised 2022)
- Chartered Institute for Archaeologists (CIfA), 2014d, Standard and Guidance for the Creation, Compilation, Transfer and Deposition of Archaeological Archives (revised 2020)
- Chartered Institute for Archaeologists (CIfA), 2014e, Standard and Guidance for the Collection, Documentation, Conservation and Research of Archaeological Materials.

Appendix 10-2: Assessment Methodology

Overview

This preliminary assessment has been undertaken following the relevant Key Policy, Guidance and Legislation set out in **Appendix 1**.

This section describes the technical methods used to determine the **significance** (value) of the buried heritage assets, the **magnitude of changes** (effects) caused by our Project and the resulting overall **significance of effects**.

Significance (value)

Significance values are guided by its designated status and its heritage interest. Each identified heritage asset can be assigned a value in accordance with the criteria set out in **Table 1** which is based on the distinctions presented in the NPS EN-1. Using professional judgement and the results of consultation with relevant stakeholders, heritage assets are also assessed on an individual basis. Regional variations and individual qualities are also considered where applicable. This includes aspects such as the regional scarcity of specific asset type, or whether assets can be considered to be of schedulable quality due to them being of national importance.

Table 1: Buried Heritage Significance

Value	Description
International / National (very high)	The highest status of asset and indicative of national importance: e.g. World Heritage Sites (WHS), Scheduled Monuments (SMs), Grade I and II* Listed Buildings (LBs), Grade I and II* Registered Parks and Gardens (RPGs), Protected Wrecks, Heritage assets of national importance, well preserved historic landscapes with exceptional coherence, time depth, or other critical factor(s).
National / Regional / County (high)	Archaeological sites that may be designated or undesignated, may contain well preserved or in situ structures, buildings of historical significance, historic landscapes with a reasonably defined extent, or reasonable evidence of occupation/settlement or activities (ritual, industrial etc.). e.g. Grade II RPGs, Conservation Areas (CAs), Designated historic battlefields, Grade II LBs, burial grounds, protected heritage landscapes such as Ancient Woodland, heritage assets of regional or county importance.
Sub-regional / District (medium)	Designated or undesignated archaeological sites with reasonable evidence of human activity. Assets may be of limited historic value but may contribute to district or local knowledge and/or research objectives. May contain structures or buildings of potential historic merit. e.g. Historic village settlements, associated historic field systems and boundaries, historic road systems.
Local Area / Parish (Low)	Heritage assets with a local level cultural or education value only e.g. Historic field systems and boundaries, agricultural features such as ridge and furrow, ephemeral archaeological evidence, artefacts of poor contextual stratigraphy.

Negligible	Historic assets with very little or no surviving archaeological interest or stratigraphic integrity. Buildings and landscapes of no historical significance. e.g. Destroyed objects, buildings of no architectural merit, relatively modern landscape features or disturbances such as quarries, field boundaries, drains etc.
Unknown	Insufficient information exists to assess the importance. Significance of below ground archaeological remains is often unknown until their nature and extent has been sufficiently determined through archaeological fieldwork.

Magnitude of Change

Impacts upon buried heritage assets can arise during the construction, operation, maintenance, and decommissioning phases of the Project; they can be positive or negative; direct or indirect; irreversible (long term) or reversible (temporary); and/or cumulative. Impacts can affect the physical fabric of the asset or their setting. Direct physical impacts are considered permanent and result in the total, or partial loss of a buried heritage asset; these impacts are not reversible. Impacts arising from changes to setting are split between those resulting from construction activities, which can be temporary, or long-term, lasting for the duration of the operational Project but reversible upon decommissioning.

The level and degree of impact (**magnitude of change**) will be assigned with reference to a five-point scale as set out in **Table 2**. The assessment of the **magnitude of change** will be made in consideration of any design mitigation (embedded mitigation), when available at the time of the writing. If no embedded mitigations are proposed at the PEIR stage, a worst-case scenario has been applied whereby all remains will be entirely removed. This will be reviewed for the submission of the ES.

Table 2: Magnitude of Change

Value	Description
High	Change such that the value of the heritage asset is totally altered or destroyed through physical impact or comprehensive alteration to its setting affecting its value, seriously impeding the ability to understand and appreciate the asset.
Medium	Change such that the heritage value of the asset is affected due to alterations to its physical form or noticeable change to its setting through alterations resulting in erosion in the ability to understand and appreciate the asset.
Low	Change such that the heritage value of the asset is slightly affected through physical alteration to its physical form or slight change to its setting affecting the ability to understand and appreciate the asset.
Very Low	Changes that barely affect the value of the asset or its setting, resulting in no real change in the ability to understand and appreciate the asset.
No Change	No alteration or change to the value of the asset or its setting.

Significance of Effect

The overall effect on the asset, caused by the impact, is determined by consideration of the significance of the asset (Table 1) and the magnitude of the impact (Table 2), with a level of professional judgement included in the determination (Table 3). This is identified by the degree of change that would be experienced by the asset and its setting if the Project were to be completed as compared with a 'do nothing' situation. Effects can be neutral, adverse, or beneficial.

Residual major or moderate effects are deemed to be 'significant' for the purposes of the EIA Regulations, in accordance with standard EIA practice. Minor and negligible effects are deemed to be 'not significant.'

Table 3: Significance of Change

Value	Magnitude of Change				
	High	**Medium**	**Low**	**Very Low**	**No Change**
Very High	Major	Major	Moderate	Moderate	Neutral
High	Major	Moderate	Minor	Minor	Neutral
Medium	Moderate	Moderate	Minor	Negligible	Neutral
Low	Moderate	Minor	Negligible	Negligible	Neutral
Very Low	Minor	Negligible	Negligible	Negligible	Neutral

Within NPS EN-1 (5.9.29 – 5.9.32) and the NPPF (paras.205-208), impacts affecting the value of heritage assets are considered in terms of 'harm' and there is a requirement to determine whether the level of harm amounts to 'substantial harm' or 'less than substantial harm'. There is no direct correlation between the significance of effect as reported in this preliminary assessment and the level of harm caused to heritage significance. A major (significant) effect on a heritage asset would, however, more often be the basis by which to determine that the level of harm to the significance of the asset would be substantial. A moderate (significant) effect is unlikely to meet the test of substantial harm and would therefore more often be the basis by which to determine that the level of harm to the significance of the asset would be less than substantial. A minor or negligible (not significant) effect would still amount to a less than substantial harm and would therefore still trigger the statutory presumptions against development; a neutral effect is classified as no harm. In all cases determining the level of harm to the significance of the asset arising from development is one of professional judgement.

Buried Heritage Potential

The **potential** for unknown buried heritage assets is assessed on known baseline evidence, but the physical nature and extent of any archaeological resource surviving within our Site cannot be fully confirmed without investigation. At this stage of the assessment, the potential is identified using professional judgement and knowledge, applying the information available in the baseline data. The Site's baseline potential is compared to the level of existing impact upon it, from modern and historic developments.

The **potential** for surviving buried heritage of various periods can be assigned a value in accordance with the criteria set out in **Table 4**:

Table 4: Buried Heritage Surviving Potential

Potential	Description of receptors
High	The available evidence suggests a high likelihood for past activity within the Site and a strong potential for archaeological evidence to survive intact or reasonably intact.
Moderate	The available evidence suggests a reasonable likelihood for past activity within the Site and a potential that archaeological evidence may survive although the nature and extent of survival is not thought to be significant.
Low	The available evidence suggests archaeological evidence of significant activity is unlikely to survive within the Site, although some minor land-use may have occurred.
Uncertain	Insufficient information to assess.

Appendix 10-3: Preliminary Impact Assessment:Locations for Substations

As per the Parameter Plans presented in Figure 4-3 of Chapter 4: Our Project this PEIR, the locations currently considered for the substations and the buried heritage assets which may be affected are shown in **Figure 1, Figure 2, and Figure 3** below.

A preliminary assessment on buried heritage assets of these locations is included in this Appendix, using the methodology discussed in **Appendix 10-2** and the baseline information discussed from paragraph 10.15.

At the time of the writing, a final design for the substations is not available. Some, but not all of the results of the geophysical survey which is currently ongoing. Therefore, in assessing the effects upon buried heritage remains, a pre-mitigation worst-case scenario has been applied whereby all remains will be at least partially truncated or up to entirely removed within the parameter area.

A full impact assessment for the construction of the substations, including related the cable trenching, will be carried out when the design is further refined, and the report of the geophysical survey is complete. In this appendix we will be highlighting the preliminary physical impact on the relevant Groups as per **Appendix 2**.

Potential Location for Substations on the West bank of River Trent

Location 1

There are no known buried heritages assets within Location 1. The preliminary results of the geophysical survey do not show any potential archaeological feature.

The closest buried heritage asset is located 56m east of Location 1 and outside of our Site, and it is interpreted in the HER record as an undated potential earthwork which has been located through documentary evidence (MNT10012).

Location 2

Within the proposed location the following known buried heritage assets may be affected by the construction of the substation:

- UN009 – Bank at Fledborough; and,
- UN012 – Potential Enclosure (identified during the geophysical survey)

As mentioned above, it is assumed that the construction of the substation will remove the entirety of any buried heritage assets withing the area. **Table 1** below summarises the preliminary likely significant effects of these assets:

Table 1: Preliminary Likely Significant Effects (Location 2)

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Change	Applicable mitigation	Residual Risk	Monitoring Requirement
UN009	Low	Excavation	Full Removal	High	Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
UN012	Low to Medium	Excavation	Full Removal	High	Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA



Figure 1 – Locations 1 and 2 (West of River Trent)

Location 3

There are no known buried heritages assets within Location 3. The preliminary results of the geophysical survey do not show any potential archaeological features.

The closest potential buried heritage asset is located 20m south Location 3 and within Location 4 below (PM002).

Location 4

Within the proposed location the only buried heritage assets that may be affected by the construction of the substation are the potential below ground remains of the Brick Kiln at Marnham (PM002), for which only documentary evidence is known.

Table 2 summarises the preliminary likely significant effects of this asset, assuming its existence and its full removal:

Table 2: Preliminary Likely Significant Effects (Location 4)

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Change	Applicable mitigation	Residual Risk	Monitoring Requirement
PM002	Low	Excavation	Full Removal	High	Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA



Figure 2 – Locations 3 and 4 (West of River Trent)

Potential Location for Substations on the East bank of River Trent

The two proposed locations on the East bank of River Trent are located on adjacent fields, only one of which will be selected for the construction of the substation. Therefore, the two fields will be considered separately for the purpose of this PEIR.

Location 1 – North

Within the proposed location the following known buried heritage assets may be affected by the construction of the substation:

- PH002; and,
- RO003

As mentioned above, it is assumed that the construction of the substation will at least partially truncate or up to entirely remove the entirety of any buried heritage assets withing the area. The table below summarises the preliminary likely significant effects of these assets:

Table 3: Preliminary Likely Significant Effects (Location 1 – North)

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Change	Applicable mitigation	Residual Risk	Monitoring Requirement
PH002	Medium	Excavations	Full removal	High	Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
RO003	Medium	Excavations	Full removal	High	Moderate	Design/Archaeologucal	Minor (adverse)	Construction design/EMPs / DBA

Similar effects may be expected upon potential buried heritage assets related to any of the adjacent groups which may extend to Location 1 (such as PH001 and ME006). The potential impact on these unknown assets will be thoroughly assessed when a full report on the geophysical survey will be produced as part of the ES.

Location 2 - South

There are no known buried heritages assets within Location 2. The preliminary results of the geophysical survey do not show any potential archaeological feature.

Nonetheless, due to the close proximity of Location 2 to known buried heritage assets and the presence of potential buried features detected by the geophysical survey in a North-South alignment, there is potential for the presence of unknown archaeology within Location 2.

Similarly to Location 1 - North, the potential impact on these unknown assets will be thoroughly assessed when a full report on the geophysical survey will be produced as part of the DBA technical appendix to the ES.



Figure 3 – Locations 1 North and 1 South (East of River Trent)

Assessment of Potential Effects on Unknown Buried Heritage Assets

Relevant to all the locations, the direct impact on unknown buried heritage assets resulting from the construction works for the substation can be summarized as below:

Table 4: Assessment of Potential Effects on Unknown Buried Heritage Assets

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Effect	Applicable mitigation	Residual Risk	Monitoring Requirement
Unknown buried heritage deposits	Low to High	Excavations	Full or partial removal	Medium to High	Minor to Major	Design/Archaeological	Negligible to Minor adverse	Construction design/EMPs / DBA

Appendix 10-4: Preliminary Impact Assessment: Options for River Crossing

As per Parameter Plan discussed in **Chapter 4** of this PEIR, there are currently two high level scenarios which are being considered for the river crossing by the design team. A preliminary assessment of the impact on buried heritage assets of these two options is incuded in this Appendix, using the methodology discussed in **Appendix 2** and the baseline information discussed discussed from paragraph 10.15.

At the time of the writing, more developed parameters for these options are not available, nor are the full results of the geophysical survey which is currently ongoing. Therefore, in assessing the effects upon buried heritage remains, a pre-mitigation proportionate worst-case scenario in the context of other solar farms and national legislation which states solar farms have a 'reduced impact' has been applied whereby all remains will be partially truncated and/ or fully removed depending on the extent of the proposed works.

It is assumed that the cable trenching required for both options will utilise existing roads, therefore with limited impact on buried heritage assets. This will be reviewed once a CEMP has been prepared and any impact on buried heritage assets will be assessed at ES stage.

Option 1 – HDD (directional drilling under the river Trent)

At the time of the writing Option 1 is the preferred option

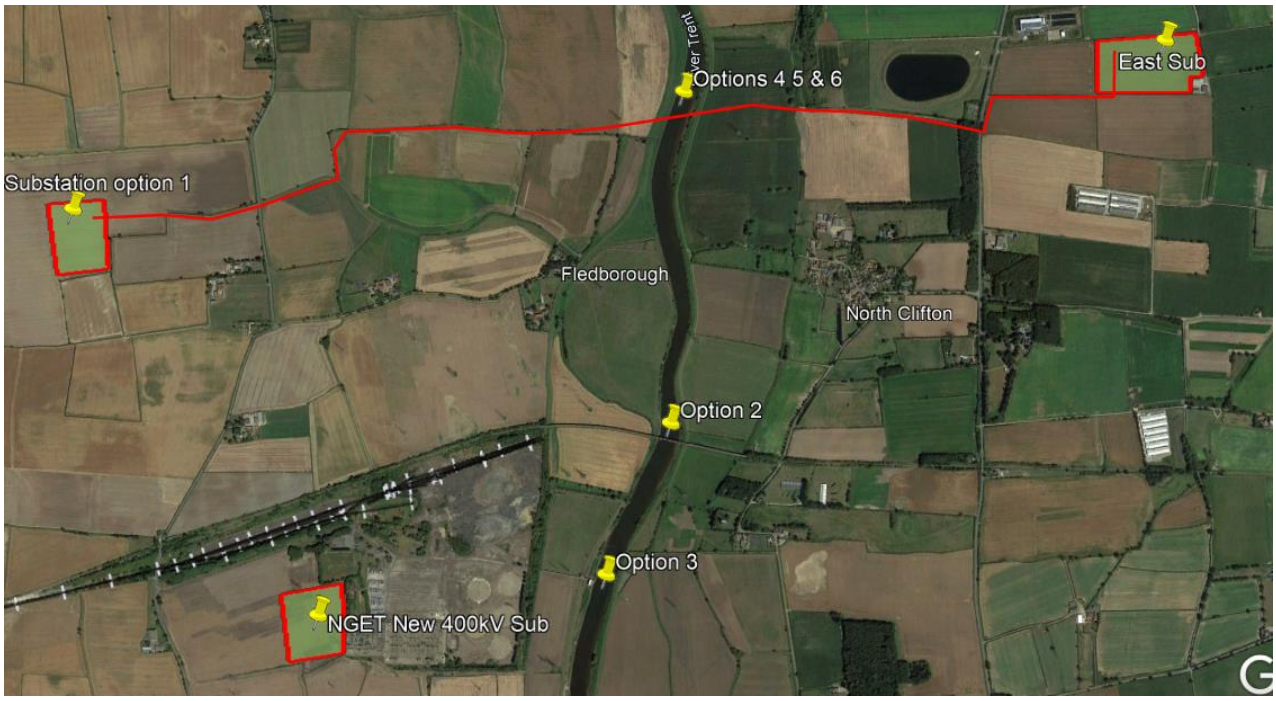
This option includes excavations on both sides of River Trent, localised as shown in **Figure 1**, to allow the installation of cables beneath the river, and a 4.38km of cable routes.

It is expected at least partial truncation, up to full removal of any archaeological and geoarchaeological deposits withing the footprint of the directional drilling areas. **Table 1** summarises the preliminary likely significant effects of these assets:

Table 1: Preliminary Likely Significant Effects (Option 1)

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Effect	Applicable mitigation	Residual Risk	Monitoring Requirement
PH001	Medium	Excavations	Full removal	High	Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
UN013	Low to High	Excavations	Full or partial removal	Medium to High	Minor to Major	Design/Archaeological	Negligible to Minor (adverse)	Construction design/EMPs / DBA

Figure 1 – Proposed cable trenching for Option 1



Similar effects may be expected upon potential buried heritage assets related to any of the adjacent groups which may extend to the HDD area (such as RO001 and RO004, in **Figure 2**). The potential impact on these unknown assets will be thoroughly assessed when a full report on the geophysical survey has been prepared and will be reported on in the ES.

The location for the cable routes shown in **Figure 1** are indicative, as at the time of the writing these are still being discussed. A thorough review of the potential impacts resulting from the cable trenching will be undertaken once more information on the location of the substations, and the final report of the geophysical survey, and will be reported on in the ES.

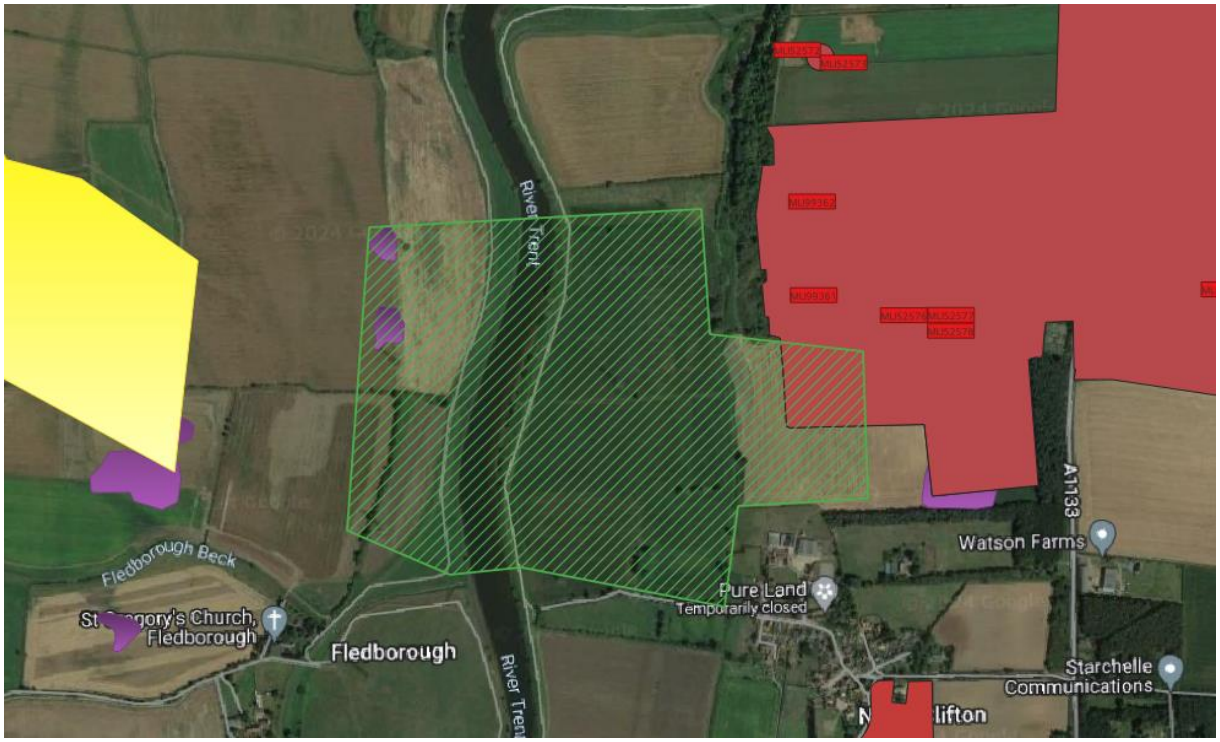


Figure 2 – Location for HDD

Option 2 - Existing Fledborough Viaduct

The only intrusive groundworks expected for Option 2 relate to the cable route connecting the substation on the West bank of River Trent with the one on the East bank.

The total length of the cable route for Option 2 is approximatively 6.42km.

At least partial truncation, up to full removal of any buried heritage assets is expected in any part of the cable route not within the existing road surfaces, and therefore impacting open fields.



Figure 3 – Proposed cable trenching for Option 2

A thorough review of the potential impacts resulting from the cable trenching will be undertaken once more information on the location of the substations, and the final report of the geophysical survey, are available, and will be reported in the ES.

Assessment of Potential Effects on Unknown Buried Heritage Assets

Relevant to both options, the direct impact on unknown buried heritage assets resulting from the construction works can be summarised as below:

Table 2: Assessment of Potential Effects on Unknown Buried Heritage Assets

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Effect	Applicable mitigation	Residual Risk	Monitoring Requirement
Unknown buried heritage deposits	Low to High	Excavations	Full or partial removal	Medium to High	Minor to Major	Design/Archaeological	Negligible to Minor adverse	Construction design/EMPs / DBA

Appendix 10-5: Detailed Scope of Assessement

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Effect	Applicable mitigation	Residual Risk	Monitoring Requirement
PH001	Medium	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
PH002	Medium	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
PH003	Low	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Effect	Applicable mitigation	Residual Risk	Monitoring Requirement
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
PH004	Low	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
PH005	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group.							
PH006	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group.							
PH007	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group.							
PH008	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group.							
PH009	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group.							
RO001	These assets lie within the buffer for MLI54212 and therefore no physical impacts are expected to be affecting the group.							
MLI54212 **(NHLE: 1003608)**	No development is planned within the Schedule Monument Area and therefore no physical impacts are expected to be affecting the group.							
RO002	Medium	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Effect	Applicable mitigation	Residual Risk	Monitoring Requirement
		Excavations	Full or partial removal	Medium to High	Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
RO003	Medium	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
RO004	Medium to high	Piling	Displacement and vibration	Very low	Negligible to Minor	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Moderate to Major	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible to Minor	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Moderate to Major	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Effect	Applicable mitigation	Residual Risk	Monitoring Requirement
RO005	Low	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
RO006	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group.							
RO007	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group.							
RO008	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group.							
RO009	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group.							
RO010	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group.							
RO011	These assets lie outside of the Site and/or have been physically removed from the Site and therefore no physical impacts are expected to be affecting the group.							
ME001	These assets lie within the buffer for MNT4584 and therefore no physical impacts are expected to be affecting the group.							
MNT4584 **(NHLE: 1017567)**	No development is planned within the Schedule Monument Area and therefore no physical impacts are expected to be affecting the group.							
ME002	Medium to High	Piling	Displacement and vibration	Very low	Negligible to Minor	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Moderate to Major	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Effect	Applicable mitigation	Residual Risk	Monitoring Requirement
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible to Minor	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Moderate to Major	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
ME003*	Medium to High	Piling	Displacement and vibration	Very low	Negligible to Minor	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Moderate to Major	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible to Minor	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Moderate to Major	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
ME004*	Medium to High	Piling	Displacement and vibration	Very low	Negligible to Minor	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Moderate to Major	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible to Minor	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Moderate to Major	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
ME005*	Moderate to High	Piling	Displacement and vibration	Very low	Negligible to Minor	Design/Archaeological	Negligible	Construction design/EMPs / DBA

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Effect	Applicable mitigation	Residual Risk	Monitoring Requirement
		Excavations	Full or partial removal	Medium to High	Moderate to Major	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible to Minor	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Moderate to Major	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
ME006	Medium to High	Piling	Displacement and vibration	Very low	Negligible to Minor	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Moderate to Major	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible to Minor	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Moderate to Major	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
ME007*	Medium to High	Piling	Displacement and vibration	Very low	Negligible to Minor	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Moderate to Major	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible to Minor	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Moderate to Major	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Effect	Applicable mitigation	Residual Risk	Monitoring Requirement
ME008*	Medium	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
ME009	Medium to High	Piling	Displacement and vibration	Very low	Negligible to Minor	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Moderate to Major	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible to Minor	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Moderate to Major	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
ME010*	Medium to High	Piling	Displacement and vibration	Very low	Negligible to Minor	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Moderate to Major	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Effect	Applicable mitigation	Residual Risk	Monitoring Requirement
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible to Minor	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Moderate to Major	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
ME011*	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group.							
MNT15306 **(NHLE: 1018619)**	No development is planned within the Schedule Monument Area and therefore no physical impacts are expected to be affecting the group.							
ME012*	Low	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
ME013*	Medium	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Effect	Applicable mitigation	Residual Risk	Monitoring Requirement
		Hard and soft landscaping	Full or partial removal	Medium to High	Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
ME014*	Medium	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
ME015*	Medium	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Moderate	Design/Archaeological	Minor (adverse)	Construction design/EMPs / DBA
ME016	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group.							
ME017*	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group.							
ME018	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group.							
ME019*	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group.							
ME020*	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group.							

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Effect	Applicable mitigation	Residual Risk	Monitoring Requirement
ME021 **(NHLE: 1008247)**	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group.							
ME022 **(NHLE: 1017858)**	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group.							
ME023 **(NHLE: 1008594)**	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group.							
PM001	Low	Piling	Displacement and vibration/Vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
PM002	Low	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Effect	Applicable mitigation	Residual Risk	Monitoring Requirement
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
PM003	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group							
PM004	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group							
PM005	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group							
PM006	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group							
PM007	These assets lie outside of the Site and therefore no physical impacts are expected to be affecting the group							
PM008*	Low to Medium	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
PM009*	Low to Medium	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Effect	Applicable mitigation	Residual Risk	Monitoring Requirement
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
PM010								
PM011*	Low to Medium							
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
PM012*	Low to Medium	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Effect	Applicable mitigation	Residual Risk	Monitoring Requirement
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
UN001	Low to Medium	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
UN002	Low to Medium	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Effect	Applicable mitigation	Residual Risk	Monitoring Requirement
UN003	Low	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
UN004	Low to Medium	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
UN005	Low to Medium	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Effect	Applicable mitigation	Residual Risk	Monitoring Requirement
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
UN006	Low to Medium	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
UN007	Low to Medium	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
UN008	Low to Medium	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Effect	Applicable mitigation	Residual Risk	Monitoring Requirement
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
UN009	Low	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
UN010	Low to Medium	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Effect	Applicable mitigation	Residual Risk	Monitoring Requirement
UN011	Low to Medium	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
UN012	Low to Medium	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Moderate	Design/Archaeological	Negligible (minor adverse)	Construction design/EMPs / DBA
UN013	Low to High (depending on relation with RO004)	Piling	Displacement and vibration	Very low	Negligible to Minor	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Major	Design/Archaeological	Negligible to Minor (adverse)	Construction design/EMPs / DBA

Groups	Significance	Effects	Type of risk on buried heritage assets	Magnitude of Change	Significance of Effect	Applicable mitigation	Residual Risk	Monitoring Requirement
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible to Minor	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Major	Design/Archaeological	Negligible to Minor (adverse)	Construction design/EMPs / DBA
Unknown buried heritage deposits	Low to High	Piling	Displacement and vibration	Very low	Negligible	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Excavations	Full or partial removal	Medium to High	Minor to Major	Design/Archaeological	Negligible to Minor (adverse)	Construction design/EMPs / DBA
		Traffic of plants and machinery	Compression or partial removal	Very low	Negligible to Minor	Design/Archaeological	Negligible	Construction design/EMPs / DBA
		Hard and soft landscaping	Full or partial removal	Medium to High	Minor to Major	Design/Archaeological	Negligible to Minor (adverse)	Construction design/EMPs / DBA
Isolated findspots and casual/unstratified finds	As findspots, these have been physically removed from the Site and the heritage significance of their former locations will not be harmed by Our Project.							

Appendix 10-6: Consultation responses outlined in Scoping Opinion and actions in response

Consultee	Key matters raised	Actions in response
Planning Inspectorate	Agreed to scope out an assessment of impacts during the operational phase of our Project.	None required.
Planning Inspectorate	Potential for decommissioning stage effects should be assessed. An outline DEMP should be submitted with the DCO application.	A preliminary review of the potential for harm resulting from decommissioning has been undertaken in this chapter. A thorough assessment of the likely significant effects during the decommissioning phase will be carried out in the ES Chapter and DBA. The mitigation measures will be included in the outline DEMP, which will be submitted with the DCO application.
Planning Inspectorate	Applicant to consult and seek to reach agreement with the relevant consultation bodies regarding extent, nature, and timing of field investigations and provide evidence of this within the application documents.	Consultation with Lincolnshire Historic Environment (infrastructure) Office, Lincolnshire Senior Historic Environment Officer, and Nottinghamshire Senior Practitioner Archaeology is ongoing and is being coordinated with consultation with the Historic England Inspectors of Ancient Monuments.
City of Lincolnshire Council	Ground-penetrating radar should be used across the site rather than relying only on LIDAR data.	A geophysical survey is currently ongoing on the Site, including the Scheduled Monument areas, access routes and mitigation areas.
City of Lincolnshire Council	The applicant has only listed designated monuments individually as buried heritage assets, rather than listing those known across the site.	HER data has been requested and received from the Lincolnshire and Nottinghamshire HER A list of the relevant designated and undesignated buried heritage assets has been included in the assessment contained in the PEIR stage.

City of Lincolnshire Council	The proposed development is within the vicinity of the deserted village of Woodcotes. (Nottinghamshire HER monument record M4652) The applicant has not identified this site as buried heritage. The applicant must scope this into their assessment, along with mitigations.	The PEIR, ES and DBA will assess all designated and non-designated heritage assets.
City of Lincolnshire Council	The proposed development includes the potential Roman settlement at Ragnall (Nottinghamshire HER monument record M478) and includes this site as a potential area for solar and associated infrastructure in Appendix A of their Scoping Report. This area requires surveying, excluding from the development area, and must be scoped into their assessment	The PEIR, ES and DBA will assess all designated and non-designated heritage assets.
City of Lincolnshire Council	The sunken village of Ragnall (Nottinghamshire HER monument records 6210) and Grounds at Ragnall Hall (Nottinghamshire HER monument record MNT26615) are in close proximity to the development area and must be scoped into the assessment.	The PEIR, ES and DBA will assess all designated and non-designated heritage assets.

Historic England	Where important archaeology is known or suspected to exist, and it is planned to preserve it in situ (paragraph 9.22) there is a need to consider more than construction related impacts. Any changes to the burial environment that the development introduces could lead to the degradation of materials and the loss of information beyond the development boundary (particularly if there are any remains dependent on a stable water environment). To ensure that such impacts (if present) are properly accounted for we would recommend ensuring that opportunities are taken to seek synergies with other topic areas, such as hydrology and hydrogeology. Integrating models from this with an understanding of any potential water dependent heritage assets identified in desk-based work will enable effective early identification of, and engagement with, any sites or areas that may need greater consideration of preservation approaches.	Preservation is Situ, and the potential effect of hydrology and hydrogeology and other relevant disciplines to buried heritage preservation will be discussed at in the ES, once the buried heritage baseline is be updated with the results of the trial trenching survey and any other agreed survey methodology.
Historic England	Historic England welcomes the recognition given to the earlier prehistoric material (Mesolithic and Neolithic) in paragraphs 9.7 and 9.8. Much of this activity was discovered through fieldwalking and, as the project moves forwards, it should be borne in mind that standard archaeological methodologies (such as trial trenching currently proposed in paragraph 9.21) may not be sufficient to ensure the effective identification and characterisation of any similar lithic scatters elsewhere within the landscape.	The requirement and strategy for fieldwalking survey will be discussed during the archaeological evaluation phase and a methodology agreed with Historic England the relevant LPA's archaeological advisors if required.
Historic England	Further Baseline Data (9.19) should also include existing borehole data, and the applicants should seek to construct desk-based deposit model as part of the DBA.	The requirement for a geoarchaeological deposit model will be discussed with Historic England the relevant LPA's archaeological advisors and included in the DBA if required.

	A deposit modelling led approach will help delimit the presence / absence and nature of Pleistocene and Holocene deposits within different areas the site. Through this process, it may be possible to divide the site into landscape zones according to variations in the depositional sequence which will help in identifying areas of risk for unknown archaeology and where different types of activity may be expected.	
Historic England	Although Palaeolithic activity is not currently known within the study area, the potential for there to be some presence should not be completely ignored. Creating a preliminary deposit model will help develop an understanding and model risk in this regard and will be particularly relevant for areas of deeper disturbance such as cable routes etc.	See above.
Historic England	The presence of scheduled Roman military sites (a vexillation fortress and two marching camps) in the immediate vicinity of the scheme indicates the high archaeological potential of the area around the proposal, and there is high potential to harm buried archaeological remains associated with the Scheduled Monument. It should be noted that the area of the Scheduled Monument represents only what was visible from aerial photos at the point in time that the scheduling decision was made, and not the actual extent of the camps or the surviving archaeology.	The preliminary assessment of the potential impact on the Roman vexillation fortress and two marching camps has been carried out in the PEIR. A thorough review of the impact on the Vexillation Fortress and Two Marching Camps will be included in the Buried Heritage ES Chapter and DBA.

	The southern area of protection at Newton-on-Trent (Roman Vexillation Fortress, two Roman Marching Camps, and a Royal Observer Corps monitoring post), appears to comprise the northern part of second camp. This potential for nationally significant remains at the site has previously been demonstrated during a 2011-12 program of evaluation for Anglian Water's Hall Reservoir (Gilmour 2012), which discovered a Roman oven containing the remains of Roman bread. It will also be very important to develop an understanding of movement along and across this part of the Trent from the Roman through the Early Medieval periods (including Viking).	
Historic England	Particular consideration should be given to the landscape setting and context of the scheduled monuments at Whimpton Moor medieval village and moated site and the Ringwork at Kingshaugh Farm, in the latter instance a close understanding of how/if the ringwork articulated to the topography, roads and river will be important	The archaeological assessment of the of the scheduled monuments at Whimpton Moor medieval village and moated site and the Ringwork at Kingshaugh Farm will be part of the DBA. The setting of the scheduled monuments at Whimpton Moor medieval village and moated site and the Ringwork at Kingshaugh Farm will be assessed as part of the Cultural Heritage chapter in the ES, with cross referencing with the Buried Heritage Chapter in the ES, where appropriate. to facilitate a rounded interpretation.
Lincolnshire City Council	The full suite of available desk-based information needs to be competently assessed including all available records, air photos, LiDAR assessments and local sources. This understanding and the geophysical survey results will inform a robust programme of trial trenching to provide evidence for the site-specific archaeological potential of the development and provide the basis for an effective mitigation strategy to deal with the archaeological impact.	The Desk Based Assessment will be undertaken in line with the legislation and guidance which regulates the production of these documents.

Lincolnshire City Council	The proposed lack of evaluation (geophysics and evaluation trenching) is of very significant concern to the Council. Failure to undertake sufficient evaluation now while there's time, pushing evaluation and subsequent agreement of the mitigation strategy to post consent is a high-risk strategy which can easily lead to significant construction delays and escalating costs as well as unnecessary destruction of heritage assets. It may also lead to consent for a scheme which is subsequently found to be undeliverable in terms of the information submitted with the application.	Consultation has commenced regarding the potential forthcoming scope of evaluation, based on the results of the geophysical survey as they come in. A preliminary impact assessment has been carried out in the PEIR and further assessment will be carried out for the ES Chapter.
Lincolnshire City Council	The full extent of the proposed impact area including the connector route corridors must be included in the evaluation process.	In line with the applicable legislation and guidance, the design and construction impacts will be assessed in response to the design detailed submitted as part of the DCO application.
Lincolnshire City Council	the Scoping Report makes it clear that the ES Chapter will be based entirely on the DBA without the support of further non-intrusive or intrusive fieldwork. This is wholly insufficient to assess the archaeological potential of the site, nor will it be sufficient to inform an appropriate mitigation strategy.	The ES chapter will be supported by the DBA and will be informed by the results of the geophysical survey, trial trenching and any further survey agreed with Historic England the relevant LPA's archaeological advisors.
Lincolnshire City Council	Non-intrusive survey (ie. geophysics and fieldwalking) must be tested with site wide evaluation trenching as a minimum requirement to properly understand the archaeological potential within the developmental impact area.	Any non-intrusive survey will inform and be tested by proportionate program of trial trenching.
Lincolnshire City Council	We would expect the DBA to be complete and the field evaluation to be well underway by the time the PEIR is produced.	At the present stage, the work on the Desk Based Assessment is ongoing. This Preliminary Environmental Impact Report has been produced to assess the potential impacts on the buried heritage assets identified so far.

		The DBA and the subsequent ES will review the conclusions of the PEIR and expand on them with more design information and an updated baseline. The assessments will be based on the results of the geophysics, trial trenching and any further evaluation methodology agreed with the LPA's Archaeological Advisors.
Lincolnshire City Council	The Scoping Report anticipates undertaking a limited programme of field evaluation prior to construction. Again, we strongly disagree that post-consent is the correct time to undertake investigative work that should be informing the application	It is expected that the field evaluation will be carried out prior to consent. Further evaluation may be carried out post-consent if required to advise on archaeological constraints and mitigation on specific areas.
Lincolnshire City Council	We would further raise the issue of only targeting areas identified in the DBA which is necessarily limited to known data. This approach is flawed and would lead to a limited understanding of the archaeological resource based on confirmation bias rather than a genuine programme of investigation.	The DBA will inform the trial trenching strategy which will be targeting potential archaeology across the full impact zone which will be identified in the DBA, aerial and LiDAR assessment, and geophysical survey results. A proportionate trial trenching evaluation will also be performed in blank areas within the Site.
Lincolnshire City Council	We do not accept that there will be no impact from maintenance of the site. Many older solar farms are undergoing significant redevelopment during their mid-life, including complete removal of panel infrastructure and highly intrusive groundworks. For areas where preservation in-situ is preferred, measures will need to be implemented in the OEMP to ensure there is no impact to the archaeological resource.	The Planning Inspectorate has agreed to scope out the operational impacts of our Project.

LincoInshire City Council	We do not agree with the applicant's belief that decommissioning will result in no impact to the archaeological resource. The removal of infrastructure can be more damaging in many circumstances than the initial installation. Decommissioning impacts will need to be considered at the application stage and appropriate mitigation secured as part of the DCO requirements.	A preliminary review of the potential for harm resulting from decommissioning has been undertaken in this chapter. A thorough assessment of the of the potential for effects during the decommissioning phase will be carried out in the ES Chapter and DBA. The mitigation measures will be included in the outline DEMP, which will be submitted with the DCO application.
Nottinghamshire City Council	Consideration should be given to undertaking fieldwalking and metal detecting survey to locate the very many types of sites which are not conducive to being discovered through the standard evaluation techniques I have just noted, and which are the only ones currently proposed for this site. A reasonable rationale will be expected for not undertaking such surveys, which on current evidence would be difficult to sustain.	The requirement and strategy for fieldwalking survey and metal detecting survey will be discussed and the Applicant will seek to agree on a methodology with the relevant LPA's archaeological advisors if required.
Nottinghamshire City Council	Consideration of Lidar data is noted. For a scheme of such a scale it might be worth commissioning new, high accuracy Lidar	A programme of geophysical survey is ongoing on Site which utilises the existing lidar data. As such, the geophysical survey detail should supersede the requirement for any further Lidar surveys.

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