NORTH LINCOLNSHIRE GREEN ENERGY PARK

Planning Act 2008

Infrastructure Planning (Applications Prescribed Forms and Procedure) Regulations 2009

APFP Reg. 5(2)(a)

Infrastructure (Environmental Impact Assessment) Regulations 2017

North Lincolnshire Green Energy Park

Volume 6

Environmental Statement

6.2.12 Archaeology and Cultural Heritage

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Acronyms and Abbreviations

Name	Description
AGI	*Above Ground Installation*
BGS	*British Geological Society*
CBMF	*Concrete Block Manurafturing Facility*
CCUS	*Carbon Capture Utilisation and Storage Facility*
CDM	*Construction Design and Management*
CIfA	*Chartered Institute for Archaeologists*
CoCP	*Code of Construction Practice*
CSM	*Conceptual Site Model*
DCLG	*Department for Communities and Local Government*
DCO	*Development Consent Order*
DHN	*District Heat Network*
DHPWN	*District Heat and Private Wire Network*
EIA	*Environmental Impact Assessment*
ERF	*Energy Recovery Facility*
ERM	*Environmental Resources Management*
ES	*Environmental Statement*
EV	*Electric Vehicle*
HE	*Historic England*
HER	*Historic Environment Record*
LPA	*Local Planning Authority*
NHLE	*National Heritage List for England*
NLC	*North Lincolnshire Council*
NLGEP	*North Lincolnshire Green Energy Park*
NPPF	*National Planning Policy Framework*
NPS	*National Policy Statement*
NSIP	*Nationally Significant Infrastructure Project*
PEIR	*Preliminary Environmental Information Report*
PINS	*Planning Inspectorate*
PRF	*Plastic Recycling Facility*
PWN	*Private Wire Network*
RHTF	*Residue Handling and Treatment Facility*

1. INTRODUCTION

1.1 Summary

1.1.1.1 This chapter presents the results of an assessment of potential effects on heritage assets resulting from the Project.

1.1.1.2 A study area for designated and non-designated assets was defined by a 1 km buffer around the Order Limits for the Project, extending in all directions. Impacts on the setting of heritage assets to a distance of 7.5 km have also been considered, these are shown in Plans showing statutory or non statutory historic or scheduled monument sites or features of the historic environment (Document Reference 4.7).

1.1.1.3 Mitigation measures for identified construction impacts include:

- avoidance of designated heritage assets;
- avoidance of non-designated heritage assets where practicable;
- sympathetic design to minimise indirect effects on heritage assets; and
- documentation of significantly affected heritage assets through proportionate archaeological fieldwork.

1.2 Basis of Assessment

1.2.1.1 This chapter considers the potential for significant effects as a result of the Project on archaeology and cultural heritage under three sub-topics:

- buried archaeology: archaeological and palaeoenvironmental remains, including geological deposits that may contain evidence of the human past;
- built heritage: historic buildings and the historic built environment; and
- the historic landscape: the current landscape, whose character is the result of the action and interaction of natural and/or human factors.

1.3 Definition of Heritage Assets

1.3.1.1 Heritage assets are defined by the Government in the National Planning Policy Framework (NPPF), Section 16: Conserving and enhancing the historic environment (Ministry of Housing, Communities and Local Government (MHCLG), 2021) as:

> *'…sites and buildings of local historic value to those of the highest significance, such as World Heritage Sites which are internationally recognised to be of Outstanding Universal Value. These assets are an irreplaceable resource, and should be conserved in a manner appropriate to their significance, so that they can be enjoyed for their contribution to the quality of life of existing and future generations'.*

1.3.1.2 Heritage assets include those designated under legislation and those that are non-designated. Non-designated heritage assets include those identified as such by local authorities through their inclusion within the local Historic Environment Record (HER) and may also include those that are identified from other sources during the course of research and survey.

2. POLICY CONTEXT, LEGISLATION, GUIDANCE AND STANDARDS

2.1.1.1 This assessment takes account of key legislation and policy. The key documents considered relevant to the Project are discussed in Chapter 2: Policy and Legislative Context of the ES **(Document Reference 6.2.2)**. Legislation and policy specifically relating to archaeology and cultural heritage are discussed below.

2.2 Key Policy and Legislation

2.2.1.1 Overarching policy considerations are contained in National Policy Statement (NPS) EN-1. Paragraph 5.8.1 of EN-1 recognises that the construction, operation and decommissioning of energy infrastructure has the potential to result in adverse effects on the historic environment.

2.2.1.2 Paragraph 5.8.11 of EN-1 confirms that decision makers should seek to identify and assess the particular significance of any heritage asset that may be affected by a proposed development, including by development affecting the setting of a heritage asset, taking account of the following:

- evidence provided with the application;
- any designation records;
- the Historic Environment Record, and similar sources of information;
- the heritage assets themselves;
- the outcome of consultations with interested parties; and
- where appropriate and when the need to understand the significance of the heritage asset demands it, expert advice.

2.2.1.3 In considering the effects of a proposed development on any heritage assets, decisions should take into account 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 conservation of that significance and proposals for development (EN-1 Paragraph 5.8.12).

2.2.1.4 EN-1 Paragraph 5.8.14 confirms that there should be a presumption in favour of the conservation of designated heritage assets and the more significant the designated heritage asset, the greater the presumption in favour of its conservation should be. It goes on to state that:

> *"Once lost heritage assets cannot be replaced and their loss has a cultural, environmental, economic and social impact. Significance can be harmed or lost through alteration or destruction of the heritage asset or development within its setting. Loss affecting any designated heritage asset resulting from its alteration or development in its setting should require clear and convincing justification."*

2.2.1.5 NPS EN-1 paragraph 5.8.15 states that:

> *"Where the application will lead to substantial harm to or total loss of significance of a designated heritage asset the IPC (now the Secretary of State) should refuse consent unless it can be demonstrated that the substantial harm to or loss of significance is necessary in order to deliver substantial public benefits that outweigh that loss or harm."*

2.2.1.6 Paragraph 5.8.17 continues that where loss of significance of any heritage asset is justified on the merits of the new development, decisions should consider imposition of a condition on the consent or requiring the applicant to enter into an obligation that will prevent the loss occurring until it is reasonably certain that the relevant part of the development is to proceed.

2.2.1.7 The National Planning Policy Framework (NPPF) and its supporting guidance in the Planning Practice Guidance (PPG) – Historic Environment provide more up to date policy than NPS EN-1 with regard to the assessment of harm. Paragraphs 199 to 203 of the NPPF introduce the concept that heritage assets can be harmed or lost through alteration, destruction or development within their setting and identify that this harm ranges from less than substantial through to substantial. Paragraph 201 of the NPPF has the same direction to refuse consent where a proposed development will lead to substantial harm to (or total loss of significance of) a designated heritage asset as NPS EN-1 paragraph 5.8.15.

2.2.1.8 On 6 September 2021, BEIS published for consultation a suite of five draft National Policy Statements to guide energy development proposals. The new NPSs were subject to consultation until the end of November. The House of Commons BEIS Committee reported on the Revised (Draft) National Policy Statement for Energy on 22nd February 2022, providing recommendations in relation to the suite of revised draft NPSs. The expectation is that the suite of revised NPSs will be designated by Summer 2022.

2.2.1.9 The draft NPS EN-1 reiterates many of the considerations contained in NPS EN-1 but also introduces some additional policy considerations of relevance to assessing effects on heritage assets. Notably these include:

- The requirement for assessments to consider those heritage assets potentially affected by noise, vibration, light and indirect impacts, with the extent and detail of such studies being proportionate to the significance of the heritage asset affected (paragraph 5.9.13).
- The applicant is encouraged, where opportunities exist, to consider how it could make positive contributions to the historic environment (paragraph 5.9.14).

2.2.1.10 NPS EN-3 for Renewable Energy Infrastructure does not include anything that is materially additional to the requirements of EN-1. However, it is worth noting that draft NPS EN-s includes the following consideration at paragraph 2.12.4:

> *"In considering the impact on the historic environment as set out in Section 5.9 of EN-1 and whether it 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."*

2.2.1.11 Other important policy and legislative instruments relevant to heritage assets include the following:

- Ancient Monuments and Archaeological Areas Act 1979 (amended by the National Heritage Act 1983 and 2003;
- Planning (Listed Buildings and Conservation Areas) Act 1990 (amended by the Enterprise and Regulatory Reform Act 2013);
- North Lincolnshire Local Development Framework: Core Strategy (North Lincolnshire Council (NLC, 2011);
- Planning for Renewable Energy Development Supplementary Planning Document (2011) - Policy 4 Heritage Assets; and
- North Lincolnshire Local Plan (NLC, 2003) (Saved Policies, 2007).

2.2.1.12 It is worth noting that the North Lincolnshire Local Development Framework: Core Strategy and North Lincolnshire Local Plan are in the process of being replaced by the Local Plan for North Lincolnshire. This document recently progressed through Regulation 19 consultation stage, which closed on 26th November 2021 with NLC currently reviewing feedback received. Of particular relevance to the Project is emerging Policy HE1p: Conserving and Enhancing the Historic Environment.

2.2.1.13 The policy requires that applications must consult the North Lincolnshire Historic Environment Record as a minimum requirement and reinforces policy requirements contained in the NPS, including the following statement: "Where a development proposal would affect the significance of a heritage asset (whether designated or non-designated), including any contribution made to its setting, it must be informed by proportionate historic environment assessments and evaluations (such as heritage impact assessments, desk based appraisals, field evaluation and historic building reports) that:

- identify all heritage assets likely to be affected by the proposal,
- explain the nature and degree of any effect on elements that contribute to their significance and demonstrating how, in order of preference, any harm will be avoided, minimised or mitigated;
- provide a clear explanation and justification for the proposal in order for the harm to be weighed against public benefits; and
- demonstrate that all reasonable efforts have been made to sustain the existing use, find new uses, or mitigate the extent of the harm to the significance of the asset; and whether the works proposed are the minimum required to secure the long-term use of the asset."

2.3 Key guidance

2.3.1.1 There are several widely accepted and applied sources of guidance that have been considered in undertaking this assessment, including the following:

- Code of Conduct, Chartered Institute for Archaeologists (CIfA), (2019);
- Standard and guidance for historic environment desk-based assessment (CIfA, 2020);
- Conservation Principles: Policies and Guidance for the Sustainable Management of the Historic Environment (draft) Historic England (HE), (2017a); and
- The Setting of Heritage Assets. Historic Environment Good Practice Advice in Planning 3 (HE, 2017b).

3. CONSULTATION

3.1.1.1 Table 1 below presents an excerpt from the Scoping Opinion received from the Planning Inspectorate specific to the archaeology and cultural heritage assessment. The table describes how each response has been or will be addressed by the Project and the EIA.

Table 1 Scoping Consultation Responses

ID	Issue	Inspectorate's comments	Response / Action	Reference within this document
4.8.2	Baseline	If the assessment within the ES is underpinned by previous studies/ surveys/ investigations, then they should be included within, or appended to, the ES. The ES should provide additional figures that depict all designated and non-designated heritage and archaeological assets within the study area. Photomontage(s) of key heritage viewpoints should be included in the ES to enable an understanding of how the Proposed Development, in particular the stack, will impact the setting of heritage assets.	A series of baseline studies are appended to the ES, including a Desk-Based Assessment (Appendix B), a Geoarchaeological Report and Deposit Model (Appendix C) and results of Geophysical Surveys (Appendix D). A photomontage of the view from the scheduled site of 'Flixborough Saxon Nunnery' has been provided in the LVIA chapter as Viewpoint 11 (**Document Reference 6.2.11**)	Appendix B Appendix C Appendix D LVIA Chapter, Figure 15a
4.8.3	Construction impacts	The ES should assess the potential for damage to archaeological assets to arise during the construction phase, and not solely focus on the removal of archaeological assets. Archaeological assets could be damaged by the compaction of the land, vibrations from construction works including piling, and from changes to the ground conditions also has potential. These potential impacts should be assessed and included in the ES. Furthermore, impacts from noise, lighting and an increase in traffic can all affect heritage settings, and therefore these matters should be assessed and included within the ES cultural heritage	Potential impacts, including compaction, vibration, changes in ground conditions and cross-topic impacts have been considered during assessment.	Section 8

ID	Issue	Inspectorate's comments	Response / Action	Reference within this document
		assessment, or appropriate cross-reference should be made if these impacts are assessed in other ES chapters.		
4.8.4	Spatial scope	Due to the proposed 120m height of the exhaust stacks, the Zone of Theoretical Visibility (ZTV) should consider that the stack may be visible from viewpoints outside of the 2.5 km radius ZTV. The ES should provide evidence that no heritage asset outside of this radius would be impacted by the stack or the Proposed Development. Effort should be made to agree that spatial scope and ZTV of the assessment with the relevant statutory bodies. Furthermore, the ES should justify the difference in the ZTV for landscape impacts and cultural heritage impacts.	Following consultation with Historic England and North Lincolnshire Council's archaeological advisor, the potential for indirect impacts on heritage assets beyond the 1 km radius of the study area has been considered in the ES. The potential for impacts on heritage assets as far as 7.5 km radius has been considered in line with NLC's request.	Sections 8.2 & 8.4
	HER scope	The HER data obtained in January 2019 and used for this initial scoping report does not cover the entirety of the proposed development area and will require updating for the EIA	A revised HER request covering the whole of the development area was requested and received in February 2021	See gazetteer in Appendix B
	Settings assessment scope	The spatial scope for the assessment of construction and operational effects on designated heritage assets and the Cumulative Effects Assessment should be increased to a minimum radius of 7.5 km in line with the ZTV and LVIA	The spatial scope for assessments on setting extends to 7.5 km from the ERF facility	See Section 8.2 & 8.4
	Approach to archaeology assessment	The technical scope and approach to archaeology is inadequate and will need to include a staged archaeological field evaluation of non-intrusive and intrusive fieldwork to inform an adequate assessment of heritage significance and the EIA process, and to accord with the relevant NPS, NPPF and local planning policies	Extensive desk-based, geoarchaeological and geophysical surveys have been undertaken in support of this ES. The reports describing completed work and the Written Schemes of Investigation (WSI) reports	Appendices B-F

ID	Issue	Inspectorate's comments	Response / Action	Reference within this document
			outlining upcoming work are included as Appendices B-F. Additional surveys are planned, as set out in Appendix E and Appendix F as discussed with NLC.	
	Settings assessment methodology	The assessment of potential changes to settings of heritage assets and the impact on their heritage significance should be based on the methodology set out in the Historic Environment Good Practice Advice Note 3	The settings assessment has been carried out in accordance with Historic Environment Good Practice Advice Note 3	Section 8.2
	LVIA view from Flixborough	The LVIA should include an additional viewpoint and photomontage of the proposed development from the Flixborough Saxon nunnery Scheduled Monument that can be used to illustrate the heritage settings assessment	This viewpoint has been added to the LVIA photomontages as Viewpoint 11 (**Document Reference 6.2.11**)	LVIA Chapter, Figure 15a-b
4.8.2	Baseline	If the assessment within the ES is underpinned by previous studies/ surveys/ investigations, then they should be included within, or appended to, the ES. The ES should provide additional figures that depict all designated and non designated heritage and archaeological assets within the study area. Photomontage(s) of key heritage viewpoints should be included in the ES to enable an understanding of how the Proposed Development, in particular the stack, will impact the setting of heritage assets.	A series of baseline studies are appended to the ES, including a Desk-Based Assessment (Appendix B), a Geoarchaeological Report and Deposit Model (Appendix C) and results of Geophysical Surveys (Appendix D) A photomontage of the view from the scheduled site of 'Flixborough Saxon Nunnery' has been provided in the LVIA chapter as Viewpoint 11 (**Document Reference 6.2.11**)	Appendix B Appendix C Appendix D LVIA Chapter, Figure 15a-b

ID	Issue	Inspectorate's comments	Response / Action	Reference within this document
		Historic England Consultation Response We caution against a fixed radius approach to the consideration of setting impacts in advance of more work to understand the specific setting sensitivity of assets in the area in relation to the height and massing of the proposed scheme in its cultural landscape context	The settings assessment is not based on a fixed radius.	Section 8.2
		Historic England Consultation Response Historic Environment matters should be addressed in detail both in respect of direct physical impacts upon buried remains and indirect impacts upon the historic environment's setting. In particular, we draw your attention the historic ferry crossing between Amcotts and Flixborough Stather, the setting of the scheduled Saxon Nunnery at Flixborough and other designated heritage assets in views across and along the Trent Navigation. As explored in Historic Environment Good Practice Guide 3 'Setting of heritage Assets' the impacts of works upon archaeological remains associated with designated assets may also represent setting impacts. Particular attention should be paid to the potential for early medieval water frontage and inlet features and the adaptation of the Trent over the intervening centuries	The ES considers both impacts on buried archaeology and settings, including that of archaeological remains associated with the designated Saxon Nunnery at Flixborough. A geophysical survey has established the presence of buried structures at Flixborough Staithe.	Section 8.2 Appendix D

3.1.1.2 Table 2 below presents approaches to the assessment of the historic environment agreed during consultation with the LPA Planning Archaeologist. The table describes how each discussion point has been addressed within the ES.

Table 2 LPA Consultation Discussion Points

LPA ID	Discussion point	LPA comments	Response / Action	Reference within this document
001	Non-intrusive and intrusive surveys	A programme of non-invasive and invasive fieldwork appropriate to the nature of heritage assets with the potential to be impacted by the Project, including a consideration of the potential for unknown buried archaeology, should be developed, agreed with the LPA and undertaken in advance of submission of the ES in support of EIA.	A programme of non-invasive and invasive survey has been developed to support further refinement of archaeology and cultural heritage assessment in advance of ES submission. The survey programme has continued to be discussed and agreed with the LPA, including in Zoom meetings held with the LPA's archaeological advisor and Historic England on September 15th 2021 and with the LPA's archaeological advisor on November 26th 2021.	Section 6.4-6.5
002	Study area	A study area of 1 km from the Order Limits should be applied at PEIR stage to capture all heritage assets with the potential to be directly or indirectly impacted by the Project.	A study area of 1 km has been applied to baseline characterisation for all heritage assets (with the exception of the Historic Landscape). Baseline is presented in a desk-based assessment.	Section 6 Appendix B

3.1.1.3 Table 3 presents relevant comments made during Section 42 and Section 47 consultation specific to Archaeology and Cultural Heritage. The table describes how each response has been addressed by the Project. Responses have been included when they are directly relevant to the Infrastructure Planning (Environmental Impact Assessment) Regulation

2017 (the Infrastructure EIA Regulations 2017), have required a technical clarification and / or further impact assessment. The full set of responses is contained in the Consultation Report (**Document Reference: 7.1 Appendix I-1**).

3.1.1.4 The consultee types for the purposes of statutory consultation under the Planning Act 2008 are as follows:

- s42(a) is with prescribed consultees;
- s42(b) is with local authorities;
- s44 is with consultees with an interest in land; and
- s47 is with the local community.

Table 3 Section 42 and Section 47 Consultation Responses on the PEIR

Consultee type	Consultee	Comments	Response / Action	Reference within this document
S42(a)	Historic England	In our scoping advice we cautioned against a fixed radius approach to the consideration of setting impacts in advance of more work to understand the specific setting sensitivity of assets in the area in relation to the height and massing of the proposed scheme in its cultural landscape context, the proposed scope may be unduly restrictive and should be reviewed in the context of initial results eg from Flixborough Nunnery (Scheduled Monument) and listed buildings on the west side of the river. With regard to the scoping report text at 13.7.1.7 which states; ""For the purposes of assessment and to avoid confusion with 'significance of effect' the term 'value' will be used to describe the historic, archaeological, architectural or artistic merit (Historic England 2017b) of a heritage asset."" we commented that; This approach may be unlikely to make the relationship between EIA and National Policy language clearer. Value is best used in the sense of socially constructed values for aspects of the historic environment as articulated by	Following the statutory consultation, the Applicant engaged with both Historic England and North Lincolnshire Council to agree a scope and methodology for further assessment of archaeological and cultural heritage impacts.	Section 5.2

Consultee type	Consultee	Comments	Response / Action	Reference within this document
		individuals and groups. Significance is the more structured consideration of what makes an asset special or interesting as one might find in a written assessment. Importance is the relative worth placed by society upon a specific asset (for instance through Designation). The best way to avoid confusion may be to use significance in the sense used in National Policy and significant in the sense used in the EIA regulation (to describe the degree of an impact).		
S42(a)	Historic England	We went on to advise that; Historic Environment matters should be addressed in detail both in respect of direct physical impacts upon buried remains and setting impacts upon the historic environment. In particular, we draw your attention the historic ferry crossing between Amcotts and Flixborough Stather, the setting of the scheduled Saxon Nunnery at Flixborough and other designated heritage assets in views across and along the Trent Navigation. As explored in Historic environment Good Practice Guide 3 'Setting of heritage Assets' the impacts of works upon archaeological remains associated with designated assets may also represent setting impacts. Particular attention should be paid the potential for early medieval water frontage and inlet features and the adaptation of the Trent over the intervening centuries.	Detailed assessments of direct physical impacts and settings impacts on the historic ferry crossing between Amcotts and Flixborough Stather, the setting of the scheduled Saxon Nunnery at Flixborough, and other heritage assets affected by the Project, are included in Chapter 12: Archaeology and Cultural Heritage of the Environmental Statement (**Document Reference 6.2.12).**	Section 8.1
S42(a)	Historic England	In section 5.2.1.3 and Table 3 the banding of importance of assets (High / Moderate / Low/ Not Significant) places Grade II listed buildings and Conservation Areas in the Moderate catagory which tends to fail to give appropriate weight to to designated and equivalent assets.	The banding of importance of assets is amended in Chapter 12: Archaeology and Cultural Heritage of the Environmental Statement (**Document Reference 6.2.12**) to acknowledge that Conservation Areas can have differing	Section 8.2

Consultee type	Consultee	Comments	Response / Action	Reference within this document
			levels of importance depending on individual circumstances. Grade II buildings are of acknowledged lower value than Grade I and II* buildings (which are of high value) by nature of their designation and greater number, as well as the fact that their conservation management is normally dealt with by local authorities. We therefore maintain that 'moderate' is the appropriate category.	
S42(a)	Historic England	Section 5.2.2 could usefully reference our GPA 3 Setting of Heritage Assets https://historicengland.org.uk/images-books/publications/gpa3-setting-of-heritage-assets/ for a robust methodology in respect of setting matters.	The guidance provided by GPA 3 is applied and referenced in Chapter 12: Archaeology and Cultural Heritage of the Environmental Statement (**Document Reference 6.2.12**).	Section 5.2.2
S42(a)	Historic England	5.3 bands impacts (High / Medium / Low / Minimal / no Change) such that High equates to Change such that the significance of the asset is totally altered or destroyed. Comprehensive change to setting affecting significance, resulting in changes in our ability to understand and appreciate the resource and its historical context and setting, as the only criteria above medium.	Our view is that this is a robust and widely applied methodology, providing sufficient resolution to identify significant effects on the historic environment. This approach is maintained in Chapter 12: Archaeology and Cultural Heritage of the Environmental Statement (**Document Reference 6.2.12**).	N / A
S42(a)	Historic England	5.4 significance of effect value v magnitude of effect - Table 5. When the banding of importance of asset set out 5.2.1.3 is combined with the banding of impact in 5.3 this would tend to fail to afford sufficent weight to significant environmental effects in all but the most extreme cases.	Our view is that this is a robust and widely applied methodology, providing sufficient resolution to identify significant effects on the historic environment. This approach is maintained in Chapter 12: Archaeology and Cultural Heritage of the Environmental Statement (**Document Reference 6.2.12**).	N / A

Consultee type	Consultee	Comments	Response / Action	Reference within this document
S42(a)	Historic England	In Sections 6 - 10 and the appended Archaeological Desk Based Assessment the initial assessments of impact are premature in the absence of a structured processes of evaluation and assessment. In particular there appears to be tendency through the Desk Based Assessment to see HER entries as assets or indvidual and isolated worth rather than as evidence indicative of patterns of past human activity within a landscape. A structured landscape scale - holistic approach is required which draws on the DBA data alongside lidar, air photographic historic cartographic and documentary sources to inform the modelling of past site use, activity and archaeological potential. Borehole data (existing and new) needs to be combined with geophysical survey and trial excavation to build a deposit model which informs further assessment. See our published advice at https://historicengland.org.uk/images-books/publications/deposit-modelling-and-archaeology/ and https://historicengland.org.uk/advice/technical-advice/archaeological-science/preservation-in-situ/. We refer you to the expertise and advice of the North Lincolnshire Council's Archaeologist and Curator.	The desk-based assessment has been upgraded to take into account these comments. Geoarchaeological modelling has been undertaken based on historic boreholes combined with the results of recent ground investigation work undertaken for the Project. This is included in Section 6: Baseline and Receptors of Chapter 12: Archaeology and Cultural Heritage of the Environmental Statement (**Document Reference 6.2.12**). A series of baseline studies are appended to the ES, including a Desk-Based Assessment (Appendix B), a Geoarchaeological Report and Deposit Model (Appendix C) and results of Geophysical Surveys (Appendix D)	Section 6 Appendix B Appendix C Appendix D
S42(a)	Historic England	We welcome that the report indicated further fieldwork will be necessary but the measures proposed fail to be grounded in appropriate assessment of the site's archaeological potential and the landscape setting and context of designated and other high importance assets in the vicinity of the proposed development. Key stages of assessment have not as yet taken place and as such there is as yet no basis to judge whether the mitigation approaches proposed will be appropriate	These issues have been addressed in further discussions between the Applicant's team, Historic England NLC, including a call on 15th September 2021 and with the LPA's archaeological advisor on November 26th 2021. A programme of works was agreed in principle, comprising an additional geoarchaeological survey, geophysical surveys and trial trenching. A Written	Appendices C-G

Consultee type	Consultee	Comments	Response / Action	Reference within this document
		or what opportunities for the reduction of impacts through design work across the site might be acheived were that understanding in place. There is a significant disconnect between the archaeological potential of this complex landscape and the responses proposed and this needs to be rectified through significant additional work prior to submission of an application. We refer you to advice and expertise of the North Lincolnshire Council Archaeologist and Conservation Officer and our advise as set out above.	Scheme of Investigation (WSI) for the first phases of these works (the geoarchaeological and geophysical surveys) has been agreed. A programme setting out the remaining surveys is included in Chapter 12: Archaeology and Cultural Heritage of the Environmental Statement **(Document Reference 6.2.12).**	
S42(b)	North Lincolnshire Council	Subsequent to the scoping response the approach and methodology for the archaeological EIA was discussed with the applicant and their archaeological consultant on 10 March 2021. Given the short timescale to commission, undertake and report on the above iterative stages to inform and present the results in the ES, the urgency of commencing this programme of work was stressed. Regrettably, it seems that no field evaluation has been undertaken to date. A further meeting with the applicant was held on 16 July, with Historic England and the HER reiterating the necessity of producing the results of this work for the ES and DCO application.	Subsequent to this, there has been further correspondence with Historic England and the NLC's archaeological advisor, followed by calls on 15th September 2021 and November 26th 2021 when strategies for iterative fieldwork (geoarchaeological, geophysical and trial trenching) were set out and agreed. Two WSIs – for geoarchaeological investigation and geophysical investigation of the central and eastern parts of the site – have been agreed and work has been commenced. It was agreed that the Environmental Statement should set out a programme of iterative archaeological survey, and an outline mitigation strategy document. An iterative mitigation programme is included in Chapter 12: Archaeology and Cultural Heritage of the Environmental Statement **(Document Reference 6.2.12)** and has been further discussed and agreed on a call with	Appendix G

Consultee type	Consultee	Comments	Response / Action	Reference within this document
			NLC's archaeological advisor on 26th November 2021.	
S42(b)	North Lincolnshire Council	In the meantime the applicant has produced their Preliminary Environmental Impact Report (PEIR) informed by an Archaeological Desk Based Assessment appended to Chapter 12. This is based on existing HER records and updated data was obtained in February 2021. However, the content of the desk based assessment lacks reference to the full range of sources that we would expect to be consulted as a matter of course in line with professional standards and guidance. These sources should include the national archaeological records (NMR and Historic England research databases), aerial photographic collections, LIDAR data and crucially in this location, a specialist geo-archaeological review of existing data and production of a preliminary deposit model. Evidence of consultation of historic mapping for the study area is omitted and it is unclear what, if any, archive collections were consulted. Nor does the standard site visit and walk-over survey of the proposed development area appear to have been undertaken to identify known and potential remains and verify their condition, or to describe ground conditions.	The desk-based assessment has been upgraded to take into account these comments. Geoarchaeological modelling has been undertaken based on historic boreholes combined with the results of recent geophysical investigation work undertaken for the project. This is included in the baseline section of Chapter 12: Archaeology and Cultural Heritage of the Environmental Statement **(Document Reference 6.2.12)** and in appendices including a desk-based assessment, geoarchaeological model and geophysical report.	Section 6 Appendix B Appendix C Appendix D
S42(b)	North Lincolnshire Council	The baseline evidence produced from the desk-based assessment is insufficient to identify all heritage assets of archaeological interest within the development site, including potential but currently unknown archaeology, or to adequately assess the significance of these assets for the purposes of the EIA. The PEIR acknowledges that this potential for unknown archaeological remains is high 'As a result of the considerable potential for evidence of human	A programme of archaeological field evaluation has been discussed in outline with Historic England and the NLC's archaeological advisor. WSIs for the first phases of this have been agreed. The programme of works will continue during and after submission of the Environmental Statement **(Document Reference 6.0**). The	Appendix G

Consultee type	Consultee	Comments	Response / Action	Reference within this document
		occupation from the earliest periods to the present day and the potential for well-preserved palaeoenvironmental remains under alluvium' (PEIR, 6.2.2.3). In order to more accurately locate, identify and characterise unrecorded archaeology within the proposed development site and assess the significance of the remains to inform the EIA, archaeological field evaluation is required as outlined above.	programme for these works is included in Chapter 12: Archaeology and Cultural Heritage of the Environmental Statement **(Document Reference 6.2.12).**	
S42(b)	North Lincolnshire Council	The PEIR states (section 4.4) that the ES will be supported by data collected from preliminary works (non-archaeological geotechnical investigations) and programmes of non-intrusive and intrusive surveys, to be reported in the ES. We welcome that this programme would be developed and agreed with the NLC, however, contrary to paragraph 4.4.1.2, Section 10.1.1.1 (Residual Effects and Monitoring) does not provide a scope for this pre-assessment survey work.	An iterative programme of archaeological survey was agreed in a call with Historic England and NLC's archaeological advisor on 15th September 2021. WSIs for the first phases of this have been agreed and further surveys were carried out in October and November 2021. Following a further call with NLC's archaeological advisor on 26th November 2021, it was agreed that a WSI should be developed setting out additional geoarchaeological, geophysical and trial trenching surveys to be carried out early in 2022. The programme for these works is included in Chapter 12: Archaeology and Cultural Heritage of the Environmental Statement **(Document Reference 6.2.12).**	Appendices C-G
S42(b)	North Lincolnshire Council	Sections 6 – 10 of the PEIR chapter relating to the baseline evidence, mitigation, assessment of likely effects, further mitigation and residual effects and monitoring, are considered premature until the archaeological field evaluation is completed and	As agreed with Historic England and North Lincolnshire Council's archaeological advisor on the call of 15th September 2021, a mitigation plan is included in Section 7 of Chapter 12:	Section 7

Consultee type	Consultee	Comments	Response / Action	Reference within this document
		heritage assets are sufficiently well identified and understood to assess their significance and the impact of the proposed development and opportunities for mitigation or to off-set harm that cannot be avoided.	Archaeology and Cultural Heritage of the Environmental Statement **(Document Reference 6.2.12)**, and may be modified following completion of evaluation surveys as set out in Appenix E and F of Chapter 12: Archaeology and Cultural Heritage of the Environmental Statement **(Document Reference 6.2.12).**	
S42(b)	North Lincolnshire Council	The LPA is concerned about the considerable gaps in the information provided in the PEIR chapter and appendices and what is necessary to inform the EIA. It is advised that appropriate field evaluation will need to be undertaken at the earliest opportunity to inform the pre-determination EIA and DCO examination process, and that any mitigation measures resulting from the findings of the evaluation should be set out in a final Mitigation WSI, the implementation of which may be secured by an appropriately worded DCO requirement.	Chapter 5: Air Quality of the Environmental Statement **(Document Reference 6.2.5)** contains updated baseline information addressing the gas identified in the Preliminary Environmental Information Report (PEIR). A programme of evaluation fieldwork has underway based on WSIs approved by NLC's archaeological advisor. A programme setting out completion of these surveys is included in Appendix G of Chapter 12: Archaeology and Cultural Heritage of the Environmental Statement **(Document Reference 6.2.12)**, along with a draft mitigation strategy to be finalised after the evaluation work is complete.	Section 7, Appendices C-G
S42(b)	North Lincolnshire Council	The Council's HER will continue to work with the applicant to expedite the timely undertaking and completion of the field evaluation to avoid any potential and unnecessary delay with the DCO application and processes.	The Applicant welcomes the input of NLC's archaeological advisor and will continue to work closely with them, submitting WSIs and method statements for agreement at every stage.	Appendices E-G

Consultee type	Consultee	Comments	Response / Action	Reference within this document
S47	Local Community	As detailed in your consultation booklet, we have various sites of specific interest and areas of archaeological importance including heritage assets of scheduled monuments and listed buildings as well as conservation areas. Your undertaking to reduce any potential effects on these is really not acceptable. Also, in addition to the 192 archaeological sites (5 high value) there is a very strong possibility of other undiscovered sites, therefore you must ensure further extensive surveys take place to identify these and ensure protection.	The potential presence of significant buried archaeology as well as potential impacts on listed buildings and scheduled monuments is recognised and is fully addressed in Chapter 12: Archaeology and Cultural Heritage of the Environmental Statement **(Document Reference 6.2.12)** and an extensive programme of archaeological surveys (geoarchaeological work, geophysical survey and trial trenching) has been agreed in principle in discussion with NLC. Reports of this work are included in Appendix A (Figures), Appendix CB (Geoarchaeological Report) and Appendix DC (Geophysical Survey Report) of Chapter 12: Archaeology and Cultural Heritage of the Environmental Statement **(Document Reference 6.2.12).**	Appendix A Appendix C Appendix D

4. ASSESSMENT PARAMETERS

4.1.1.1 The Project is described in detail within Chapter 3 (**Document Reference 6.2.3**). The following section summarises the key elements and parameters on which the Archaeology and Cultural Heritage assessment has been based.

4.1.1.2 The land within the Order Limits (the Application Land) occupies over 600ha of land to the north west of Scunthorpe, located within the administrative boundary of North Lincolnshire Council (NLC). The site is irregular in shape, comprising several distinct subsections as described below:

- **The Energy Park Land:** This subsection of the Application Land encompasses the core elements of the Project, including the Energy Recovery Facility (ERF), carbon capture utilisation and storage facility (CCUS), bottom ash and flue gas residue handling and treatment facility (RHTF), concrete block manufacturing facility (CBMF), plastic recycling facility (PRF), hydrogen production and storage facility, electric vehicle (EV) and hydrogen (H_2) refuelling station, battery storage and hydrogen and natural gas above ground installations . The potential for temporary and permanent direct and indirect effects will be considered.
- **The Northern District Heat and Private Wire Network (DHPWN) Land:** This subsection forms a linear section of land, extending eastwards from the Energy Park Land along the A1077, before moving south along Normanby Road and the B1431. While above-ground works within this area will be temporary, and have the potential to result in temporary changes to setting, below ground effects may include partial or total removal of buried archaeology.
- **The Southern District Heat and Private Wire Network (DHPWN) Land:** . This land runs broadly north-south following the routes of the A1077 and M181 road corridors from the south western extent of the Energy Park Land. While above-ground works within this area will be temporary, and have the potential to result in temporary changes to setting, below ground effects may include partial or total removal of buried archaeology.
- **Railway Reinstatement Land:** This subsection of the Application Land will comprise development to reinstate the disused railway line. While above-ground works within this area will be temporary, and have the potential to result in temporary changes to setting, below ground effects may include partial or total removal of buried archaeology.

4.1.1.3 For the purposes of assessment, the maximum footprint dimensions and maximum heights have been assumed for all Project elements, as set out in Chapter 3 of the ES. The tallest element will be the ERF stack at 120 m (126.6 m AOD).

4.2 Baseline Data Collection

4.2.1.1 Searches have been conducted for designated and non-designated assets in the following categories:

Designated heritage assets

- World Heritage Sites;
- Listed Buildings, Grade I, II* and Grade II;
- Scheduled Monuments;
- Registered Parks and Gardens;
- Conservation Areas; and
- Registered Historic Battlefields.

Non-designated assets

4.2.1.2 Non-designated historic buildings, structures and built monuments including:

- locally listed buildings; and
- buildings, structures and monuments included in the HER which are of heritage significance.

4.2.1.3 Non-designated archaeological or historic landscape sites including:

- archaeological sites recorded in the HER and/or the Historic England Archives dataset;
- archaeological and other heritage assets predicted or known from desk-based research or fieldwork;
- palaeoenvironmental remains and geological deposits predicted or known to contain evidence for the human past;
- known historic settlements including those identified as being of archaeological interest;
- non-designated historic parks, gardens and battlefields; and
- non-designated assets determined to be of national importance by the Secretary of State.

4.3 Baseline Data Sources

4.3.1.1 Baseline data sources comprise:

- The National Heritage List for England (NHLE) for details of designated sites (dataset acquired Jan 2021);
- North Lincolnshire Council (NLC) for local conservation area appraisal and management documents and their mapping (website accessed April 2021);

- NLC for information on the historic landscape (reporting acquired April 2021);
- NLC for details of non-designated and designated heritage assets held in the HER data (dataset acquired Feb 2021);
- British Geological Survey for information on geological mapping and borehole information (website accessed April 2021);
- National Library of Scotland for historic Ordnance Survey mapping;
- NLC archives for documentary, cartographic and other resources including historic Ordnance Survey maps, tithe, estate and other maps, and other relevant primary sources;
- Readily available published and unpublished sources, building surveys and gazetteers;
- Freely available aerial imagery (including Google Earth satellite imagery, National Collection for Aerial Photography and oblique images from Britain from the Air);
- Freely available Lidar imagery collected by the Environment Agency;
- Local authority or ecclesiastic sources such as faculties, historic maps and documentary sources for burial grounds;
- Data from previous non-invasive and invasive studies, i.e. geophysical survey, coring, trial trenching and building survey; and
- A site visit carried out on October 26th 2021.

4.4 Survey Data

4.4.1.1 A revised desk-based assessment, revised following comments from NLC and Historic England, is appended to the ES as Appendix B.

4.4.1.2 In addition to the desk-based work, this assessment has been informed by the following fieldwork:

- Geoarchaeological monitoring of ground investigations carried out in September 2021 (Appendix C);
- Geophysical surveys (Appendix D).

4.4.1.3 An extensive programme of additional geoarchaeological work, geophysical survey and trial trenching has been agreed in principle in discussion with NLC.

4.4.1.4 A programme of ongoing pre-mitigation surveys are described in Appendix E (geoarchaeological boreholes) and F (trial trenching).

4.5 Scope of Assessment

4.5.1.1 Effects are direct and indirect, temporary, permanent and cumulative. These effects can be both adverse and beneficial.

4.5.1.2 A direct effect may occur as a result of the construction of the Project and may result in the partial or total removal of the physical fabric or land comprising an asset and, in the case of built heritage, its curtilage.

4.5.1.3 For the purpose of this cultural heritage assessment, an indirect effect is defined as one that may occur as a consequence of the construction or operation of the Project by adversely affecting the ability to understand or appreciate a heritage asset as a result of a change to its setting or through changes in the management or land use of archaeological or historic landscape features.

4.5.1.4 A permanent effect may occur as a result of the construction and operation of the Project. A permanent effect is not reversible and may (by definition) result in the permanent loss of, or harm to, a heritage asset, including its setting. A permanent effect may also be a beneficial effect; as a result of changes in land management and associated agricultural practices, or through the removal of negative aspects of the asset's setting.

4.5.1.5 Temporary activities, such as soil storage, contractor's site compounds and access routes, as well as the activities associated with the erection of other facilities and structures, where the site will be returned to its former condition, may result in temporary effects on setting or permanent effects on buried archaeology; such as compaction.

4.5.1.6 A cumulative effect is one arising from the incremental effects of multiple developments on heritage assets. Cumulative effects are presented in Chapter 18 (**Document Reference 6.2.18**).

4.6 Spatial scope

4.6.1.1 The archaeology and cultural heritage assessment presented here considers:

- the effects of the Project on all heritage assets within the Application Land and a study area extending 1 km from it in all directions.
- the effects of the Project on designated heritage assets within an area extending 1.5 km in all directions from the boundary of the 1 km study area.
- the effects of the Project on designated assets beyond the 2.5 km study area where it is determined, through professional judgement, that potential exists for an effect to occur. Professional judgement will be guided by the zone of theoretical visibility (ZTV) (Chapter 11: Landscape and Visual Amenity (**Document Reference 6.2.11**)).

4.6.1.2 The Order Limits and spatial extents of study areas for the archaeology and cultural heritage topic are shown on Figure 1a.

4.7 Temporal Scope

4.7.1.1 In addition to considering the effects of construction resulting from the Project, the archaeology and cultural heritage assessment presented here also considers effects relating to operation. The temporal scope of the assessment assumes a baseline with current conditions as of 2021.

4.8 Technical Scope and Approach to Environmental Impact Assessment

4.8.1.1 All heritage assets within the spatial scope presented in Section 4.6 with the potential to be directly or indirectly affected by the Project are considered and assessed for their heritage significance/value.

4.8.1.2 Where appropriate, built heritage assets have been grouped where the impact experienced from the Project is likely to be the same for assets within that group.

4.8.1.3 The ecological significance of veteran trees, historic hedgerows and ancient woodland, along with the wider landscape is addressed in Chapter 10 (Ecology and Nature Conservation, **Document Reference 6.2.10**) and Chapter 11 (Landscape and Visual Amenity, **Document Reference 6.2.11**).

5. ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

5.1.1.1 The methodology set out below has been developed on the basis of legislation and guidance presented in Section 1 and can be summarised as follows:

- identify baseline heritage assets defined as a result of data collection, collation and analysis from desk-based sources presented in Section 4;
- assess the value/significance of baseline heritage assets and the contribution made by their settings to their value/significance;
- identify and define the magnitude of impact and the significance of the effects resulting from construction and operation of the Project; and
- if possible, identify the spatial extent and techniques to be employed for mitigation measures to reduce the significance of the effects.

5.2 Assessment of Value

5.2.1.1 Baseline heritage assets will be assigned a level of heritage value in accordance with a four-point scale presented in Table 4. This table provides guidance on the elements that contribute to heritage significance (or value). Professional judgement will be applied in all cases regarding the appropriate level of significance to be assigned to individual heritage assets and justified in the text.

5.2.1.2 The nature and character of Conservation Areas varies greatly; from urban areas to houses set in country parks. The special character of these areas is derived from the quality of their buildings and elements that contribute significance and character to the wider landscape. In consideration of this variation, Conservation Areas feature in both the High and Moderate value categories. Professional judgement will be applied to determine the appropriate value category for each Conservation Area.

Table 4 Criteria to assess the value of heritage assets

Value	Criteria
High	■ World Heritage Sites ■ Grade I and Grade II* Listed Buildings ■ Grade I and Grade II* Registered Parks and Gardens ■ Scheduled Monuments ■ Registered Battlefields ■ Conservation Areas (as appropriate) ■ Non-designated heritage assets (archaeological sites, buildings, monuments, parks, gardens or landscapes) that can be shown to have demonstrable national, international or universal importance (value) ■ Burial Grounds and Cemeteries ■ Well preserved historic landscape character areas, exhibiting considerable coherence, time-depth or other critical factor(s)
Moderate	■ Grade II listed Buildings ■ Conservation Areas (as appropriate)

Value	Criteria
	■ Grade II Registered Parks and Gardens ■ Locally listed buildings as recorded on a local authority list ■ Non-designated heritage assets (archaeological sites, buildings, monuments, parks, gardens or landscapes) that can be shown to be of regional importance (value) ■ Historic Townscapes with historic integrity in that the assets that constitute their make-up are clearly legible ■ Averagely well-preserved historic landscape character areas with reasonable coherence, time-depth or other critical factor(s)
1. Low	■ Non-designated heritage assets (archaeological sites, buildings, monuments, parks, gardens or landscapes) that can be shown to be of limited or of local interest only (value) ■ Assets whose values are compromised by poor preservation or survival or of contextual associations to justify inclusion into a higher grade ■ Historic landscape character areas whose value is limited by poor preservation and/or poor survival of contextual associations
2. Not Significant	■ Assets identified as being of no historic, evidential, aesthetic or communal interest ■ Assets whose values are compromised by poor preservation or survival or of contextual associations to justify inclusion into a higher grade ■ Landscape with no or little significant historical interest

5.2.2 Setting

5.2.2.1 Assessments of impact on the setting of heritage assets has been carried out in accordance with GPA3, Historic England's guidance on the Setting of Heritage Assets (Historic England 2017b).

5.2.2.2 The setting of a heritage asset is defined 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. Elements of setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance or may be neutral' (NPPF Annex 2, Glossary).*

5.2.2.3 Setting can contribute to the significance of a heritage asset. It is acknowledged that setting may be affected by other factors, including noise. Where relevant, the contribution of the existing sound environment to the significance of the heritage asset will be identified and the potential change to this will be considered as part of the assessment process.

5.3 Magnitude of Impact

5.3.1.1 Impacts can be direct or indirect, and can be characterised in terms of temporal scope, scale, duration, reversibility and the likelihood of the impact occurring. Table 5 below presents factors influencing assessment of magnitude of impact on the basis of five ratings.

Table 5 Factors influencing assessment of magnitude of impact

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

5.4 Significance of effect

5.4.1.1 Assessment of the significance of effects will consider embedded mitigation associated with the Project. Embedded mitigation is presented in section 7.

5.4.1.2 Assessment of the level of overall significance of the effect is determined by cross-referencing the value of the heritage asset and the magnitude of impact upon it as shown in Table 6.

5.4.1.3 Major and moderate levels of effect are considered significant effects. Effects can be either adverse, neutral or beneficial.

Table 6 Matrix for establishing significance of effect

	Magnitude of impact				
Value	High	Medium	Low	Minimal	No change
High	Major	Major	Moderate	Minor	Neutral
Moderate	Major	Moderate	Minor	Minor	Neutral
1. Low	Moderate	Minor	Minor/negligible	Negligible	Neutral
2. Not significant	Negligible	Negligible	Negligible	Negligible	Neutral

5.4.1.4 Major or moderate effects are considered to be significant in Environmental Impact Assessment (EIA) terms. Within the NPS and NPPF, impacts affecting the significance 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 ES 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. Determining the level of harm to the significance of an asset arising from development impact is based on professional judgement and undertaken on a case by case basis.

5.5 Limitations and Assumptions

5.5.1.1 Although it is unlikely that the overall predicted impacts of the Project on cultural heritage resources will diverge from the assessment presented here, there are three important limitations to the available data set that it is important to highlight.

5.5.2 Third party archive sources

5.5.2.1 Much of the assessment presented here relies on baseline data from third-party sources. More often than not these sources are entirely reliable, yet there are inevitable gaps in their geographical coverage. This data is also often collected through historical and archaeological research in the amateur sphere, which can lead to inaccuracies.

5.5.3 Archaeological visibility and predicted impacts

5.5.3.1 Although below ground impacts can be predicted, there is always potential for encountering previously unknown and unexpected remains. This is especially the case in certain sedimentary contexts as is found in the alluvial and aeolian landscapes of the Scunthorpe and Trent Valley area, where the Project is located. The ongoing geoarchaeological, geophysical and archaeological evaluations appended here (Appendices C-F) and the extensive programme of mitigation works described in Section 7, are specifically designed to increase the reliability of predicted impact assessments. Even for known archaeological sites, however, there is always an element of uncertainty regarding the condition, extent and nature of the resource. The assessment of project impacts may therefore need to be revised following further assessment and evaluation and during the mitigation process itself.

5.5.4 Geophysical survey

5.5.4.1 Geophysical surveys record variation in the form and nature of sub-surface deposits based on their magnetic response and resistance to electricity. They cannot always accurately identify buried archaeological features. They are also not well suited to identifying more ephemeral archaeological

deposits from earlier periods of prehistory. The ongoing geoarchaeological and archaeological evaluations appended here (Appendices C-F), and the extensive programme of mitigation works described in Section 7 are designed to reduce the effects of this limitation by testing possible features and better understanding the depositional context of the impact areas.

5.5.4.2 Although the risk of this occurring has been reduced due to the measures undertaken, the possibility remains, however, that archaeological deposits not identified in impact areas covered by geophysical survey and tested through other evaluation techniques will be encountered during the construction phase of works. For this reason, comprehensive watching briefs, where an archaeologist has a mandate to stop works should any unexpected remains be encountered, are also written into the mitigation plan (Section 7).

6. BASELINE AND RECEPTORS

6.1.1.1 A full archaeological and historic background for the baseline, in its geological context, is presented in an archaeological desk-based assessment presented in Appendix B.

6.2 Designated Sites

World Heritage Sites

6.2.1.2 A World Heritage Site is a cultural or natural landmark that has been recognized by the United Nations Educational, Scientific and Cultural Organization (UNESCO). These sites are deemed worthy of preservation due to their universal value to humanity, both in the present and for future generations.

6.2.1.3 There are no World Heritage Sites within the Application Land or with 1 km of the Application Land.

Scheduled Monuments

6.2.1.4 Scheduled monuments (SM) are sites of national importance which are given legal protection by being placed on a list or 'Schedule' by the Secretary of State for Culture, Media and Sport. This protection is enshrined within the Ancient Monuments and Archaeological Areas Act (1979) amended by the National Heritage Act (1983) and National Heritage Act (2002). Current legislation supports a formal system of Scheduled Monument consent for any work which would affect a designated monument.

6.2.1.5 There are no scheduled monuments within the Application Land. However, there are three scheduled monuments within 1 km of the Application Land as shown on Figure 2a. The nearest of the three is 'Flixborough' Saxon nunnery and site of All Saints medieval church & burial ground at the historic settlement of North Conesby, which is located immediately adjacent to the Application Land.

Listed Buildings

6.2.1.6 Listed buildings are structures of special architectural and historic interest which are afforded statutory protection under the Planning (Listed Buildings and Conservation Areas) Act (1990) and the Town and County Planning Act (1971). Buildings are classified into three categories according to their importance: Grade I listed buildings are of 'exceptional interest', Grade II* buildings are 'particularly important buildings of more than special interest', and Grade II buildings are of 'special interest'. Listed building consent must be obtained from the local planning authority in order to make any changes to the structure which might affect its special interest.

6.2.1.7 There are no listed buildings within the Application Land. As shown on Figure 2a, the nearest Grade I listed building is located approximately 1.2 km outside the Application Land, namely Normanby Hall (**site 99**).

6.2.1.8 There is a single Grade II* listed building within 1 km of the Application Land: Former Church of St John (DBA asset number 106), located within approximately 100 m of the Application Land.

6.2.1.9 There are 11 Grade II listed buildings within 1 km of the Application Land, the nearest of which is The Smithy, in Flixborough village (**site 106**). It is located approximately 30 m outside the Application Land.

Registered Parks and Gardens

6.2.1.10 Parks and gardens of particular historic significance can be inscribed in the Register of Parks and Gardens of Special Historic Interest in England compiled by Historic England. Registration is a material consideration in the planning process, meaning that planning authorities must consider the impact of any proposed development on the landscapes' special character.

6.2.1.11 There are no registered parks and gardens within the Application Land or within 1 km of them.

6.3 Geoarchaeology

6.3.1.1 This summary of the geoarchaeology of the Site and its immediate vicinity is drawn from a number of recent studies including a watching brief of ground investigations (coring), and the development of a deposit model using historic data undertaken in support of the Project (Appendix C). These enable a series of geoarchaeologically distinct zones to be recognised within the Application Land as set out below and shown on Figure 3.

Zone 1

6.3.1.2 This comprises those areas of the Project adjacent to the Trent that lie above deep peat deposits. This covers the site of the ERF at Flixborough Staithe, as well as the CBMF and PRF immediately to the south. Ground investigations on the ERF site have identified deep organic/peat sequences, filling a possible palaeochannel, at a depth of 4.7-6.7 m to 11.7-12.3 m below ground level. These are similar to the sequence studied a kilometre to the north at the Flixborough wind farm (Lilllie & Bunting 2016). Here a core indicated dates for the peat development ranging from 3,985-3820 cal BC to 790-540 BC (in broad terms from the Mesolithic/Neolithic transition to the Middle Iron Age). The upper 4-6 m of these cores comprised alluvial silt/clay deposits.

6.3.1.3 Such a sequence suggests that prehistoric, Roman or medieval settlement remains are unlikely to exist in these areas as they would simply have been too wet for permanent occupation. However, seasonal activities such as hunting, fishing or grazing are very likely to have occurred, and the remains

of structures related to water management/transport could well survive in waterlogged deposits.

Zone 2

6.3.1.4 In the outer floodplain, late Devensian/early Holocene sands are covered by relatively thin deposits of peat and alluvium. The slightly drier character of these deposits, combined with their greater proximity to permanent settlement on the high ground, has made this area attractive to seasonal settlement and, in all probability, pastoral agriculture since prehistory.

6.3.1.5 The Project battery storage and EV and H_2 refuelling station, as well as flood compensation and landscaping areas and the extensive Southern DHPWN alignment, fall within this zone.

Zone 3

6.3.1.6 This area covers the west-facing slopes of the Scunthorpe ridge, covered with wind-blown sands dating to the late Devensian/early Holocene period. Extensive remains of periods dating from the Mesolithic to the medieval period, have been found stratified within these sands.

6.3.1.7 Most of the remaining elements of the Project fall within this zone, including sections of the reinstated railway, areas of landscaping west of the Foxhills Industrial Estate and sections of the Northern DHPWN.

Zone 4

6.3.1.8 The mudstone ridge/plateau lying to the east of the Trent Valley is where most of the permanent settlements of the Roman, medieval and post-medieval period developed. The historic villages of the area – Flixborough, Crosby, Frodingham, Scunthorpe – are all situated on this higher ground, connected to the lower ground to the west by long lanes/trackways.

6.3.1.9 The Project activities affecting these areas comprise the remainder of the reinstated railway together with the eastern portion of the Northern DHPWN.

6.4 Summary of Archaeological Background

6.4.1.1 A detailed desk-based assessment (DBA), providing a detailed chronological review of the history and archaeology of the study area is provided in Appendix B and is summarised briefly here. The site numbers are those assigned in the DBA and shown on Figure 1a.

6.4.1.2 Only a single find of Palaeolithic date (1,000,000-10,000 BC) has been made within the study area (**site 57**), reflecting the significant landscape changes that have taken place during the Holocene period. A number of Mesolithic (10,000-4,000BC) flint tool assemblages have been found in the wind-blown sand deposits overlooking the Trent Valley. The absence of Mesolithic sites in the valley itself, however, suggests they are likely to be

deeply buried under alluvium (if indeed, they have survived subsequent fluvial erosion), although it may also be an accurate reflection of settlement patterns as higher lying and drier ground would have been attractive to hunter-gatherers. A similar pattern is observable for finds of Neolithic date (4,000-2,200 BC). Evidence of Neolithic settlement has been found in the aeolian sands to the east of the ERF site, including at Flixborough (**site 4**) 200 m east of Order Limits.

6.4.1.3 There are many Bronze Age sites and findspots within the study area: again all are on the higher lying aeolian sands to the east of the alluvial deposits of the Trent Valley, including material from the Flixborough sand quarry (**site 4**). This site also produced evidence of Iron Age metalworking, burials and pits. Evidence for Iron Age settlement was also recovered from the Flixborough excavations at North Conesby (**site 78**), immediately east of Order Limits and west of the scheduled area of 'Flixborough Nunnery'. In contrast to the earlier prehistoric period, though, there is evidence of cropmarks suggesting possible Iron Age settlement on the fringes of the floodplain, lying within Application Land (**sites 9-14**).

6.4.1.4 The evidence for Roman settlement within the study area again derives largely from the high ground to the east, with the main focus of settlement located at Dragonby. Roman material has been found immediately to the east of the proposed Gas AGI, including on the site of the former Flixborough sand quarry (**sites 4, 84 & 85**). The cropmark enclosure sites within the Application Land on the eastern edge of the floodplain, could as easily date to the Roman period as to the Iron Age (**sites 9-14**). No Roman material has been found to date on the floodplain part of the study area (though a bog body of late Roman date was recovered from Amcotts in the nineteenth century).

6.4.1.5 The scheduled medieval settlement of North Conesby excavated between 1989 and 1991, is commonly referred to as Flixborough Nunnery, although it is neither at Flixborough nor is it likely to represent the remains of a nunnery. The scheduled site lies c.500 m south of Flixborough village and the remains found within it, dating from the 8th-9th centuries AD, are of a settlement of some 39 buildings with evidence for literacy in the form of numerous *styli* (metal writing instruments). The scheduled area (**sites 78, 82, 83**) lies a short distance east of the Order Limits. The early medieval settlement here continued into the Norman period, when All Saints Church served the village of North Conesby (a deserted medieval village).

6.4.1.6 Many of the villages in the vicinity of the study area have medieval or early medieval origins, including Flixborough and Conesby and, to the west of the Trent, Amcotts. It is in the medieval period that there is the first substantial evidence for settlement in the floodplain, with documentary evidence indicating that Flixborough Staithe (**site 7**) was in existence by the fourteenth century at the latest. As in later centuries this was probably both a ferry crossing and a river port serving the village on the high ground to the east. Neap House (**site 113**) could also mark the site of a medieval riverside settlement, connected to Conesby on the higher ground to the east by a trackway. The river valley remained largely undrained throughout

this period, providing rich grazing land for cattle and sheep during the summer months, but prone to flooding throughout the winter.

6.4.1.7 The landscape of the floodplain was transformed from the seventeenth century onwards by widespread drainage schemes. In the later eighteenth century these were enhanced to enable warping of the low-lying fields of the valley. The drainage of the floodplain enabled the development of scattered farms in the valley. Within the Application Land, though, there was little further change until the twentieth century. Early mapping shows the Ferry Boat Inn beside the ferry landing on the Flixborough side of the ferry crossing to Amcotts (**site 7**).

6.4.1.8 Change came with the creation of steelworks at Normanby in 1905, which were served by a light mineral railway connecting to Flixborough Staithe, which led to the gradual development of industrial facilities by the river. The iron ore for the steelworks came from ironstone mines at Dragonby, and spoil heaps from the works eventually overflowed across much of the deserted settlement of North Conesby. In the post-war period a nitrogen fertilizer factory was built beside the river wharf, where an accident in 1974 caused an explosion which devastated the industrial estate, killing 28 people. The historic Ferry Boat Inn, which stood more or less in the location of the entrance to river wharf today, appears to have been destroyed at this time. The wooden remains of the historic ferry jetty (**site 132**) are believed to survive on the river front just outside the Order Limits.

6.5 Geoarchaeological Studies

6.5.1.1 A geoarchaeological watching brief of geotechnical coring was undertaken between August 24th and September 9th 2021. The results of this work were combined with the results of extensive historic geoarchaeological and geotechnical investigations within the study area to develop a deposit model of the subsurface geoarchaeological sequence (see Appendix C).

6.5.1.2 This revealed the presence of extensive late glacial sands, which were cut into by a network of late glacial to early Holocene infilled channels containing between 0.5 m and 7 m of peat, overlain by up to 8 m of silty sand to clays representing natural overbank deposition or human induced floodplain accretion. The nature of these deposits suggest that '*any archaeological remains present within the alluvial floodplain areas may take the form of prehistoric localised dryland activities (i.e. short lived flint and/or faunal 'camp site' assemblages) to floodplain exploitation (i.e., brushwood trackways and platforms, fish traps etc.). Archaeological remains are more likely to be found in the sandier drier areas to the east of the floodplain*'.

6.5.1.3 The implication of this is that across much of the core area of the Project, which is situated on the central alluvial zone of the valley (Figure 3, Zone 1), any prehistoric remains are likely to be buried below thick surface deposits of medieval/post-medieval alluvium. This observation is further supported by the fact that no evidence of these earlier periods has been recovered from this central floodplain zone within the study area. Only

deeper impacts (disturbance greater than 2-3 m in depth) are therefore likely to affect such remains in Zone 1. Archaeological remains are much more likely to exist in Zone 2, on the floodplain fringe.

6.6 Geophysical Surveys

6.6.1.1 A geophysical survey of accessible impact areas in geoarchaeological Zones 2-4 was undertaken between October 20th and November 3rd 2021. The results of this work are set out in Appendix D and are summarised from north to south below.

6.6.1.2 The first area investigated were fields to the east and north of Flixborough Industrial Estate which revealed the following:

- in the fields to the north of the industrial estate a number of linear features (4005-4009) have been identified as potential archaeology, though some or all could simply be drainage ditches;
- a few possible archaeological features (4011) have also been identified in the field to the north of the mineral railway and east of the road leading to Flixborough Grange;
- the field to the south of First Avenue (which runs east-west through the middle of the industrial estate) contains by far the clearest evidence for significant archaeology (**site 133**), with a series of straight-sided enclosures on its west side (4000, 4001, as well as numerous curvilinear linear features and possible pits further east (4002, 4004, 4013).

6.6.1.3 Further south, surveys were carried out in the impact zone to the north of Phoenix Parkway, to the west of Foxhills Industrial Estate. These revealed the presence of possible archaeological features (5001 and 5002) - although they could also be natural - in an area where aerial photographs have indicated possible features (**sites 11 & 12**).

6.6.1.4 Survey to the north of the B1216 further west, again identified possible archaeological pits (3100), albeit the results from this area were not clear.

6.6.1.5 Further south – along the Southern DHPWN land – there are further possible archaeological features (3000) although their interpretation again remains tentative.

6.6.1.6 In December 2021, a Ground Penetrating Radar (GPR) survey of an area adjacent to the ERF, revealed a regular arrangement of buried structural remains that closely match building and road layouts shown on historical maps, showing the location of the historic site of Flixborough Staithe river port. These features have been numbered 6000–6007 (Wessex Archaeology 2021).

6.6.1.7 Overall, the only two confirmed sets of archaeological features identified by the geophysical survey are those at the ERF and those on the site of the Gas AGI to the east of Flixborough Industrial Estate.

6.7 Impact Areas

6.7.1.1 A number of areas with the potential for buried archaeological remains within the Application Land have been identified and are summarised below and are shown on Figure 5. The degree of physical ground disturbance of the different elements of the Project, which is important in understanding potential impacts on buried archaeology, is summarised in Figure 4. This shows surface disturbance (yellow), excavations to a depth of up to 2 m (light blue), and deeper excavations (dark blue).

6.7.1.2 It should be noted that much of the Application Land (i.e. to the east of the Energy Park beside the Trent) will not require any ground disturbance as it encloses a large area of flood compensation land, where no earthworks are required. These areas are therefore not considered below. Similarly, the footprint of the existing (but currently unused) mineral railway is not considered here because any impacts on buried archaeology along this alignment would have occurred during its original construction.

Area 1

6.7.1.3 This area comprises the location of the ERF at the south-western corner of the Flixborough Industrial Estate. This will include within its footprint the Bunker Hall, which will require the excavation of a shaft up to 10m below current ground surface. Based on the geoarchaeological analysis summarised above, this area falls within Zone 1 and is therefore likely to impact on buried peat deposits, which could include preserved ground surfaces with archaeological remains (**site 134**).

6.7.1.4 Area 1 also includes much of the former site of Flixborough Staithe (**site 7**), the historic river port of Flixborough, including the former site of the Ferry Boat Inn that may have been destroyed in the 1974 disaster. The former landing stage of the Amcotts-Flixborough ferry lies on the river foreshore outside of the Order Limits.

Area 2

6.7.1.5 This area covers the strip of land running south from the ERF site to the B1216. Thus, land falls largely within geoarchaeological Zone 1, a landscape that remained wetland until the seventeenth century containing deeply buried prehistoric river palaeochannels. A CBMF and a PRF will be built at its northern end, likely to require deep foundations through the soft underlying alluvium. Depending on the design of these foundations, they could have impacts on buried sequences of prehistoric palaeoenvironmental, and possibly archaeological significance

6.7.1.6 In the remainder of the area, railway sidings will run along the river bank, while to the east there will be hardstanding, roads and landscaping requiring shallow excavation (less than two metres deep).

6.7.1.7 The only potential heritage asset known to fall within Area 2 is the site of a former brick kiln (**site 124)**, shown on the 1778 estate map to the south of the historic ferry crossing.

Area 3

6.7.1.8 The area comprises that portion of the Application Land where ground disturbance will occur within Geoarchaeological Zone 2, stretching from the southern end of the Energy Park Land and covering the Southern DHPWN and the western section of the Northern DWPWN land. Geoarchaeological modelling has shown that this area comprises a relatively shallow layer of alluvium above natural sands. Cropmarks and previous archaeological observations indicate that there is an elevated potential for the survival of relatively shallow prehistoric/Roman archaeology in this zone.

6.7.1.9 Area 3 encompasses the battery storage and EV and H2 refuelling station and adjacent hydrogen production and storage facilities to the north of the B1216, south-east of Neap House. Geophysical surveys (Appendix D) have identified anomalies in this area which could be archaeological in character.

6.7.1.10 The DHPWN will lead to a relatively narrow impact strip (maximum 30m across) beside the A1077. Geophysical investigations of this impact zone have in places identified anomalies that could have an archaeological origin subject to confirmation (see Appendix D).

6.7.1.11 Impacts to the east of the junction of the B1216 and A1077 fall in an area where cropmarks (**sites 11-13**) suggesting potential later prehistoric/Roman enclosures have been observed.

Area 4

6.7.1.12 This area is situated on the west-facing slopes of the Trent Valley immediately east of the Flixborough Industrial Estate. The underlying geology in this area comprises wind-blown sands. Surface finds of prehistoric worked flint have been recorded in this area; sites 1 & 2.

6.7.1.13 Excavations at Flixborough sand quarry in a similar topographical situation 200m to the east (site 4) encountered buried remains of Neolithic, Bronze Age, Iron Age and Roman date. In addition, a late eighteenth century map indicates that the field to the south of ‘First Avenue’ – the road leading from Flixborough village to the industrial estate – formerly contained a limekiln (site 119), while the field to the north contained a quarry (site 123) which presumably supplied the raw material for the lime burning.

6.7.1.14 The greatest impact in this area will be immediately to the east of the current industrial estate and south of First Avenue, where a substation and Gas AGI will be built, requiring substantial foundations. The results of geophysical survey have already identified archaeological features (straight-sided enclosures) here (**site 133**). Areas to the east and north of this, where tree-planting is proposed as part of the landscape design, also

have archaeological potential based on the results of the geophysical surveys as well as desk-based information (e.g. the former presence of lime kilns).

Area 5

6.7.1.15 Area 5 comprises the Northern DHPWN in Geoarchaeological Zones 3 and 4 (wind-blown sands and mudstone). Here, as elsewhere, the new utilities (insulated supply and return pipework) will be buried adjacent to the road. Significant archaeological finds have previously been identified to the west and south of Foxhills Industrial Estate (**sites 20-23**), indicating that Project works in this area could have a direct impact on undisturbed archaeological features.

Area 6

6.7.1.16 Area 6 refers to the footprint of a flood bund that will be constructed in front of the poultry farm situated less than 400 m north of the Skippingdale Retail Park. This is located at the base of the slope of wind-blown sand, below the historic location of North Conesby and the scheduled site of ‘Flixborough Nunnery’.

7. MITIGATION

7.1.1.1 The mitigation measures summarised below for each Impact Area are based on current understandings of cultural heritage in the Application Land. These may be modified following the completion of evaluation surveys as set out in Appendix E and Appendix F and following further consultation with the Historic Environment Officer for North Lincolnshire. Archaeological mitigation will be carried out in accordance with the measures set out below but developed in detail in the Construction Environmental Management Plan (CEMP) (refer to the CoCP, Annex 7 **Document Reference 6.3.7**).

7.1.1.2 Above all it should be noted that the mitigation measures outlined below are viewed as part of a broader iterative process that the Project is committed to undertaking, whereby further phases of evaluation and then additional phases of mitigation may be required following consultation with the Historic Environment Officer. It is understood that this is as true for the two known archaeological sites identified as part of the current impact assessment evaluation (**site 133 and 134**), as it is for those parts of the landscape yet to be evaluated.

7.1.1.3 The ongoing evaluations described in Appendix E and Appendix F may also identify archaeological features that require either additional evaluation or full excavation and/or sampling.

7.1.1.4 Because of the varied sedimentary and archaeological context of the Project area, a Written Scheme of Investigation (WSI) will outline how the groundworks in each Impact Area should be monitored and recorded. Each area will require their own specific set of provisions for archaeological recording should any remains be encountered and a detailed protocol for suspension of works, consultation with the Historic Environment Officer, and the design and implementation of further evaluation and mitigation works.

7.1.1.5 Watching briefs are recommended for some impact areas. Should traces of archaeological material be encountered during these watching briefs, the supervising archaeologist will have a mandate to suspend all mechanical works enabling controlled archaeological excavation to be undertaken.

7.1.1.6 The programme for the next phase of archaeological field evaluation is set out in Appendix G.

Impact Area 1

7.1.1.7 Following the proposed geoarchaeological and trial trench evaluation (Appendix E and Appendix F, respectively), and following additional consultation with the North Lincolnshire Historic Environment Officer, the buried remains of the medieval/post-medieval settlement at Flixborough Staithe (**site 7**) will be recorded by a controlled archaeological excavation down to proposed foundation levels.

7.1.1.8 The trial trench evaluation (Appendix F), will provide an opportunity to examine the formation of the upper alluvium within geoarchaeological zone 1, the results of which will be discussed with the Historic Environment Officer and a further programme of appropriate evaluation and mitigation designed. Options for further investigation include additional trial trenches, or geoarchaeological trial pits.

7.1.1.9 The lower lying alluvium and peat deposits within Area 1 (**site 134**) that will be impacted by the excavation of the proposed fuel bunker shaft are more difficult to assess with conventional geophysical survey and trial trenching. The geoarchaeological investigations described in Appendix E will provide a useful framework for further potential phases of evaluation and mitigation of these deposits. As soon as this data is available, further consultation with the Historic Environment Officer will be arranged and suitable options explored. Options include, but are not limited to, a strip map and sample investigation or stepped geoarchaeological trial pits.

7.1.1.10 In addition to these measures an archaeological watching brief of the bunker shaft may also be required. A watching brief for such a deep shaft would include special provision to enable a continuous archaeological section to be drawn and appropriate palaeoenvironmental samples to be taken.

7.1.1.11 The surviving historic fabric of Flixborough Ferry (**site 132**), on the foreshore immediately west of the Order Limits, will be recorded at low water to form a permanent record of their form and current condition.

Impact Area 2

7.1.1.12 Area 2 lies almost entirely within geoarchaeological zone 1 and consists of deep alluvial deposits that require an approach to evaluation and mitigation that will, as described above for Area 1, be informed by the results of the geoarchaeological investigation outlined in Appendix E. As soon as this data is available, further consultation with the Historic Environment Officer will be arranged and suitable options explored. Options include trial trenches to evaluate the upper alluvium and larger stepped geoarchaeological test pits to investigate the lower alluvium and peat deposits. If the edge of the peat deposit can be identified on the eastern margin of Area 2 (where waterlogged archaeological remains have a higher likelihood of surviving), open area excavation and detailed palaeoenvironmental sampling may be undertaken if considered appropriate.

7.1.1.13 In addition to these measures an archaeological watching brief of the foundation excavations for the CBMF and the PRF may also be required. A watching brief for such deep foundations would include special provision to enable a continuous archaeological section to be drawn and appropriate palaeoenvironmental samples to be taken.

7.1.1.14 The area where a former brick kiln is known to have been located, to the east of the road south of Flixborough Staithe (**site 124**) will be subject to a comprehensive watching brief.

Impact Area 3

7.1.1.15 Following trial trench investigation of the anomalies identified through geophysical survey (Appendix F), and following additional consultation with the Historic Environment Officer, further excavation of any archaeological remains identified within Impact Area 3 will be undertaken as required.

7.1.1.16 Geophysical surveys of the deep impact area within Area 3, at the proposed location of the H_2 refuelling station, were restricted to its eastern side, where the alluvial deposits are thinner and a number of potential archaeological features were identified for trial trench evaluation (Appendix F). The west side of the proposed H_2 refuelling station, lies within geoarchaeological zone 1 and consists of deep alluvial deposits, Options for evaluation and mitigation within these deep deposits include trial trenches or geoarchaeological test pits, or, if the edge of the peat deposit can be identified, open area excavation and detailed palaeoenvironmental sampling may be appropriate.

7.1.1.17 In addition to these measures an archaeological watching brief of the foundation excavations for the H_2 refuelling station may also be required. A watching brief for such deep foundations would include special provision to enable a continuous archaeological section to be drawn and appropriate palaeoenvironmental samples to be taken.

7.1.1.18 A watching brief will be carried out in the area of the Second World War searchlight battery that formerly existed to the north of the B1216 (**site 10**).

7.1.1.19 Informed by the results of the ongoing geoarchaeological and trial trench evaluations (Appendix E and Appendix F, respectively), and following additional consultation with the Historic Environment Officer, an archaeological watching brief will also be conducted during stripping of the easement for the DHPWN in areas where geophysical survey did not identify any potential archaeological features.

Impact Area 4

7.1.1.20 Following additional geoarchaeological and trial trenching evaluation (Appendix E and Appendix F, respectively), and following additional consultation with the Historic Environment Officer, archaeological excavation of the site of the substation and Gas AGI will take place (**site 133**). Geophysical survey has identified anomalies in this area which suggest former Roman and, in all probability, prehistoric settlement. Previous investigations further east along the same slope have demonstrated both the high archaeological potential of this area, and the tendency of the wind-blown sands to cover old land surfaces. Controlled archaeological excavations down to formation level will thus be conducted across this area in all impact areas.

7.1.1.21 Those portions of Area 4 which fall outside the footprint of the substation/AGI development area, where woodland landscaping is proposed, and where geophysical survey has identified anomalies, may require controlled excavation. This excavation will be informed by the results of the ongoing geoarchaeological and trial trenching evaluation (Appendix E and Appendix F, respectively) and by further stages of consultation with the Historic Environment Officer.

Impact Area 5

7.1.1.22 Given the known potential for prehistoric and later archaeology on the wind-blown slopes of the valley side, an archaeological watching brief will be conducted during stripping of the easement for the DHPWN.

Impact Area 6

7.1.1.23 Following additional geoarchaeological and trial trenching evaluation (Appendix E and Appendix F, respectively), and following additional consultation with the Historic Environment Officer, controlled excavation of any identified features down to impact depth will be required. Given the location of the proposed flood bund at the base of the slope of wind-blown sand and the proximity of the potential Iron Age/Roman cropmark site (**site 9**), there is potential to encounter relatively shallow archaeology in this area.

Mitigation of visual impacts

7.1.1.24 There are few options in terms of direct mitigation of the impacts of the Project on the setting of the Scheduled remains of ‘Flixborough Nunnery’. Screen planting would block views across the Trent Valley and the Isle Of Axeholme and for this reason are not considered here as a viable option. See the recommendations for enhancement in Section 9.4 below.

8. IMPACT ASSESSMENT

8.1 Physical Impacts

8.1.1.1 The levels of impact from different elements of the Project are summarised in Figure 4, where they have been summarised as deep excavations (greater than 2 m below the current ground surface), shallow excavations (less than 2 m deep) and surface works.

8.1.1.2 The work on the reinstatement of the historic mineral railway will affect areas that have experienced substantial previous disturbance as a result of the railway's construction. It is assumed that any buried archaeology that may have existed in these areas has been removed.

8.1.1.3 The details of landscaping design are set out in Chapter 11 (**Document Reference 6.2.11**).

8.1.1.4 While the baseline studies completed so far provide a good guide to archaeological potential within the Application Land, as set out below, evaluation surveys continue in order to establish the extent, nature and significance of these remains with greater certainty (see Appendix E and Appendix F).

8.1.1.5 The following impact assessment deals with each site within each of the Impact Areas in turn. A summary impact assessment table can be found in Appendix H.

Impact Area 1

8.1.1.6 The bunker hall that will be constructed as part of the ERF will be up to 10m deep, and will penetrate into the thick peat deposits previously identified on this site by ground investigations (**site 134**). Investigations of similar sequences a kilometre to the north at Flixborough Grange wind farm indicated it developed between the later Mesolithic and middle Iron Age. The excavation of a substantial shaft to this depth will disturb stratified organic deposits of palaeoenvironmental significance, and potentially prehistoric archaeological material. The value of such deposits is considered to be **moderate**, the magnitude of impact **medium** and the overall effect therefore **moderate** (a significant effect).

8.1.1.7 The railway and riverside Project activities to the west and south of the ERF have the potential to affect buried remains of the historic river port, Flixborough Staithe (**site 7**). If buried remains of this settlement survive, they are likely to be removed as a result of the Project. The value of such remains is considered to be **moderate**, the magnitude of impact **medium** and the overall effect therefore **moderate** (a significant effect).

8.1.1.8 The remains of the historic wooden jetty/wharf at Flixborough Staithe (**site 132**) lie on the foreshore c.10m to the west of the Order Limits. It is possible that there may be indirect effects on the preservation of these remains as a result of the Project components immediately to the east. The

value of such remains is considered to be **low**, the magnitude of impact **low** and the overall effect therefore **minor** (not a significant effect).

Impact Area 2

8.1.1.9 As set out above, the CBMF and a PRF will be built in this area are likely to require deep foundations impacting the underlying alluvial deposits. Depending on the design of these foundations, they could have impacts on buried sequences of prehistoric palaeoenvironmental, and possibly archaeological significance. Based upon the precautionary principle, value of such deposits is considered to be **moderate**, the magnitude of impact **medium** and the overall effect therefore **moderate** (a significant effect).

8.1.1.10 The 1778 estate map shows a brick kiln (**site 124**) formerly lay beside the track leading south along the river from Flixborough Staithe. Buried remains of this may survive below ground. The value of such remains is considered to be **low**, the magnitude of impact **medium** and the overall effect therefore **minor** (not a significant effect).

Impact Area 3

8.1.1.11 A Second World War searchlight battery (**site 10**) formerly existed to the north of the B1216. There may be buried remains of this within Area 3. The value of such remains is considered to be **low**, the magnitude of impact **high** and the overall effect therefore **moderate** (a significant effect).

8.1.1.12 Cropmark evidence for possible Iron Age and/or Roman enclosures (**sites 11 and 12**) have been observed on aerial imagery to the north of Phoenix Parkway. The impact of the DWHPN on these sites will be limited as a result of the relatively narrow dimensions of the utilities corridor. The value of such remains is considered to be **moderate**, the magnitude of impact **low** and the overall effect therefore **minor** (not a significant effect).

8.1.1.13 A further cropmark site (**site 13**), comprising a sub-rectangular enclosure on a slightly elevated area of ground at the junction of the B1216 and A1077, as with the cropmark sites further east, the value of such remains is considered to be **moderate**, the magnitude of impact **low** and the overall effect therefore **minor** (not a significant effect).

Impact Area 4

8.1.1.14 Geophysical survey in the area of the substation and Gas AGI to the east of Flixborough Industrial Estate has identified anomalies indicating a series of straight-sided enclosures, potentially of prehistoric or Roman date (**site 133**), while flint flakes have been found on the surface (**site 2**). Evidence from sand quarrying a short distance to the east indicates the potential of the blown sand deposits of this area to contain multiperiod prehistoric archaeological remains. The value of such remains is considered to be **moderate**, the magnitude of impact **high** and the overall effect therefore **moderate** (a significant effect).

8.1.1.15 Impacts across the remainder of Area 4 will be limited to effects of tree planting. This may affect the site of former limekilns (**sites 119 & 123**) shown on the 1778 Flixborough Estate map. The value of such remains is considered to be **low**, the magnitude of impact **low** and the overall effect therefore **minor** (not significant effects).

Impact Area 5

8.1.1.16 There is no evidence for archaeological remains in this area.

Impact Area 6

8.1.1.17 There is cropmark evidence for an Iron Age and/or Roman enclosure (**site 9**) immediately to the south of the proposed bund. It is possible that the construction of the bund may affect these remains. The value of such remains is considered to be **moderate**, the magnitude of impact **low** and the overall effect therefore **minor** (not significant effects).

8.2 Impacts on Setting

8.2.1.1 Impacts on designated assets have been considered out to a distance of 7.5 km, as illustrated in Figure 2b. The most prominent feature of the Project will be the stack at the ERF, which will be up to 120 m high (126.6 m AOD). The ZTV indicates the degree to which the landscape position of the stack will be very largely masked in views to the east of the mudstone ridge on or behind which most of the historic settlements to the east of the Trent are situated. As a result of this, views from or towards designated listed buildings in many of the closest settlements, Normanby, Flixborough and Scunthorpe, will not be affected by the Project. The same applies to the two listed buildings in Amcotts to the west of the Trent, where the Grade II Church of St Mark and the adjacent Grade II rectory are both well-screened by trees from views to the east.

8.2.1.2 Beyond Amcotts to the north, the nearest listed buildings are in Luddington, nearly 4 km from the ERF. Similarly, to the south, where the nearest listed will be at Keadby and Gunness. The distance of these buildings from the Project, and the presence of many other industrial features in the landscape, means that there will not be material effects on the significance of these heritage assets.

8.2.1.3 The scheduled site of ‘Flixborough saxon nunnery’ (site 78) is situated approximately 1.5 km to the east of the ERF, situated on a west-facing slope. The site was scheduled in 1992 following archaeological excavations of buried remains that demonstrated this was the location of a mid-Saxon high status settlement. The area covers the core of the medieval settlement of North Conesby, including the former site of the Church of All Saints, which existed into the early nineteenth century. The site of the church itself is today marked by clearing in the woods, which partly cover this site.

8.2.1.4 There are no views into or out of the woods. However, in terms of impacts on its setting, it is necessary to also consider the views from the southern edge of the woods looking west across the Trent Valley. At the time of the eighth to ninth century Middle Saxon settlement of this site, its strategic position, with views across all lines of approach from the west, may have been important in terms of security (this was the time of the Viking invasion of eastern Britain). A photomontage showing the effect the Project will have on this view is included in the LVIA chapter as Viewpoint 11 (Figure 15a) (Document Reference 6.2.11) indicating that the new ERF facility and its 120m high stack will have some impact on these westward views across the valley.

8.2.1.5 The Flixborough Industrial Estate does, however, already represent a modern industrial presence within this view from the vantage point of the asset. Furthermore, when one considers that there are no upstanding remains associated with this scheduled monument, which derives its significance almost exclusively from the extant buried remains, and there are no views into or out of the site itself, we can conclude that the changes in this view will only have a slight impact on the significance of this heritage asset.

8.2.1.6 The construction of the ERF will, therefore, have a low adverse effect on the significance of an asset of high value. The overall effect of this change will therefore be a moderate adverse effect.

8.3 Impacts on Designated Sites

World Heritage Sites

8.3.1.2 The Project will have no direct physical impact on any World Heritage Site.

8.3.1.3 As set out in Section 8.2, the Project will not impact on the setting of any World Heritage Site.

Scheduled Monuments

8.3.1.4 The Project will have no direct physical impact on any scheduled monuments.

8.3.1.5 As set out in Section 8.2, the construction of the stack component of the ERF will have a moderate adverse effect on the setting of the scheduled monument known as ‘Flixborough saxon nunnery’.

Listed Buildings

8.3.1.6 The Project will have no direct physical impact on any listed building.

8.3.1.7 As set out in Section 8.2, the Project will not impact on the setting of any listed buildings.

8.4 Impacts on Historic Landscape

8.4.1.1 The Lincolnshire Historic Landscape Characterisation, published in 2011, identifies two Historic Landscape Character Areas (HLCA's) in the vicinity of the Order Limits (Figure 6):

- The greater part of the Energy Park Land falls within 'The Axholme Fens'. The HLCA emphasises the open nature of the landscape in this area with long vistas and only occasional settlements. The many straight drainage ditches and other watercourses are also an important feature;
- The eastern part of the Application Land falls largely within 'The Normanby Scarp', which is defined largely by the two parallel scarps the run north-south across it: the mudstone scarp to the west along which Flixborough stands and which is characterised by surface geology of late glacial blown sands, and the ironstone scarp to the east, which was exploited from the mid-nineteenth century onwards as the source of iron ore for the steelworks at Normanby.

8.4.1.2 As described in the historical summary above, the area of Flixborough itself has changed more than most other areas of the Axholme fenlands. The open, unenclosed moorlands that were essential to its character until the late eighteenth century have been completely changed as a result of the drainage and warping of that period. In the area of the Project, the enclosed landscape of regular fields, punctuated by the major channels of the canal and drainage dykes that replaced the moorland, has also been superseded. The development of the Flixborough Industrial Estate since the Second World War has substantially changed the character of the landscape, something that was further emphasised following the 1974 explosion which removed the remaining historic buildings of Flixborough Staithe. Notwithstanding this, the substantial massing of the Project will be a significantly greater presence in the broader agricultural landscape of the Axholme fenlands. If the Axholme Fens HLCA is considered to be of **moderate** value, the magnitude of impact of the Project can be considered as **medium** leading to an overall **moderate** effect (significant).

8.4.1.3 The ZTV (Chapter 11, Figure 4, **Document Reference 6.2.11**) demonstrates the fact that the Project will largely be masked from the great majority of Normanby Scarp HLCA. If the HLCA is considered to be of **moderate** value, the magnitude of impact from the Project will be **low**, leading to a **minor** effect (not significant).

8.5 Residual impacts

8.5.1.1 The mitigation measures described in Section 7, consist of archaeological excavation and recording. Whilst entirely necessary to prevent the loss of information, archaeological excavation does not have an effect on the residual impact of a project, as shown in the residual impact column the *Summary of Predicted Construction Impacts* Table in Appendix H. The loss of the resource during groundworks that physically remove a resource remains the same.

9. CONCLUSIONS

9.1 Baseline Surveys

9.1.1.1 This assessment has been informed by a desk-based study and geoarchaeological and geophysical surveys. This revealed extensive evidence for archaeological remains in the vicinity of the Project, with a particular concentration on the eastern slopes of the Trent Valley. The absence of archaeological evidence from the floodplain close to the river (including the Energy Park Land) is interpreted as the result of early traces of human settlement under more recent floodplain alluvium.

9.2 Mitigation

9.2.1.1 Section 7 sets out the approach to archaeological mitigation based on the Project impacts and known areas of archaeological sensitivity. This will include two areas of controlled archaeological excavation, including the likely medieval and post medieval structures close at the ERF and the archaeologically sensitive sand deposits at the substation and Gas AGI , to the east of the Flixborough Industrial Estate. Substantial archaeological watching briefs will also be required in a number of areas. Close monitoring of the excavation of the ERF's deepbunker hall with special provision for environmental sampling is also proposed.

9.3 Impact Assessment

9.3.1.1 Significant physical effects have been identified on the following heritage assets:

- Deep sequences of organic deposits of probable prehistoric date (with potential to contain associated archaeology) on the site of the ERF deep fuel bunker, as well as the footprints of the concrete block and plastic recycling facilities;
- The site of a World War 2 searchlight near Neap House (**site 10**);
- Archaeological features identified by desk-based analysis and geophysical survey (**site 133**) on the site of the proposed Gas AGI/substation site to the east of Flixborough Industrial Estate;

9.3.1.2 In addition, the construction of the ERF will have a significant effect on the setting of the 'Flixborough Nunnery' (medieval settlement of North Conesby) scheduled monument (**site 78**).

9.3.1.3 There will also be a significant adverse effect on the Axholme Fens HLCA.

9.3.1.4 In line with NPS EN-1 Paragraph 5.8.14 and Paragraph 202 of NPPF, and as detailed in paragraph 5.4.1.4 of this chapter, these effects are considered to constitute less than substantial harm.

9.4 Enhancement

9.4.1.1 These enhancement proposals are put forward in the context of the significant impacts on the setting of the scheduled site of Flixborough Nunnery and on the historic landscape. While there are no clear options for direct mitigation of such impacts, engagement with local communities and other interested stakeholders provides a way of enhancing knowledge, appreciation and access to the cultural heritage of the area.

9.4.1.2 The site of the former excavation and medieval settlement of North Conesby is currently overgrown and has no signage or information. It is therefore recommended that the Project should work with local organisations (e.g. Scunthorpe Museum/local heritage groups) to improve management and information sharing for the public relating to the site.

9.4.1.3 A programme of public engagement to communicate the results of archaeological field investigation will enhance public understanding and appreciation of the historic environment. In particular the history of Flixborough Staithe – from its origins as a medieval river port to the disaster of 1974 – should be documented and shared with the public, using appropriate media including information boards on or near the site. This should again be done in collaboration with local organisation/heritage groups.

10. REFERENCES

Legislation and Policy

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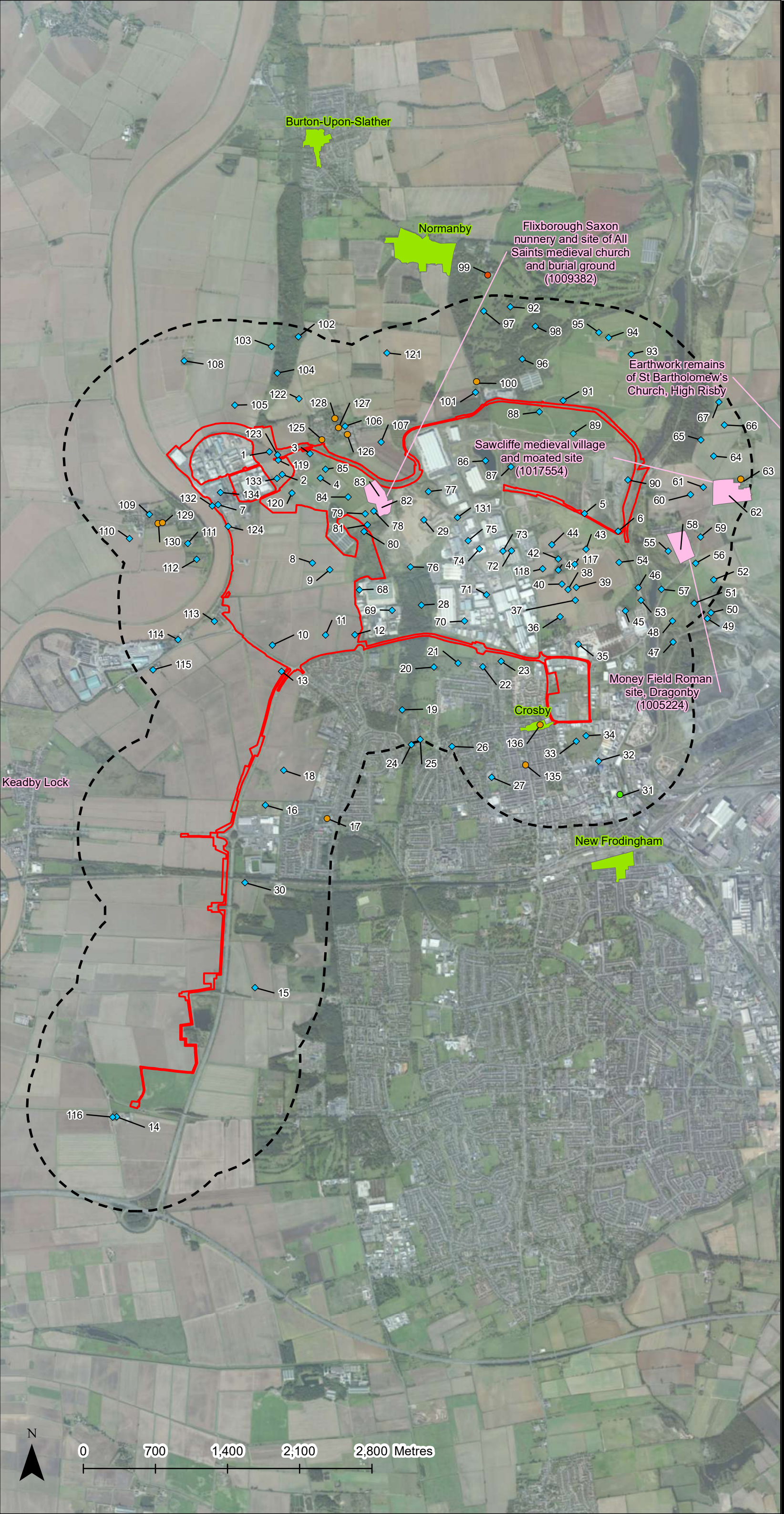
APPENDIX A FIGURES



NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 1a Location map showing project boundary, designated and non-designated heritage assets within 1km of the Order Limits (for details see gazetteer in Appendix B)

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	27/09/2022
Drawn by	MTC
Checked by	CLQ
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	35,001
ArcMap File	

HER_ES_Designated_NonDesignatedAssets_A01

Legend

- Order Limits
- Non-Designated Assets

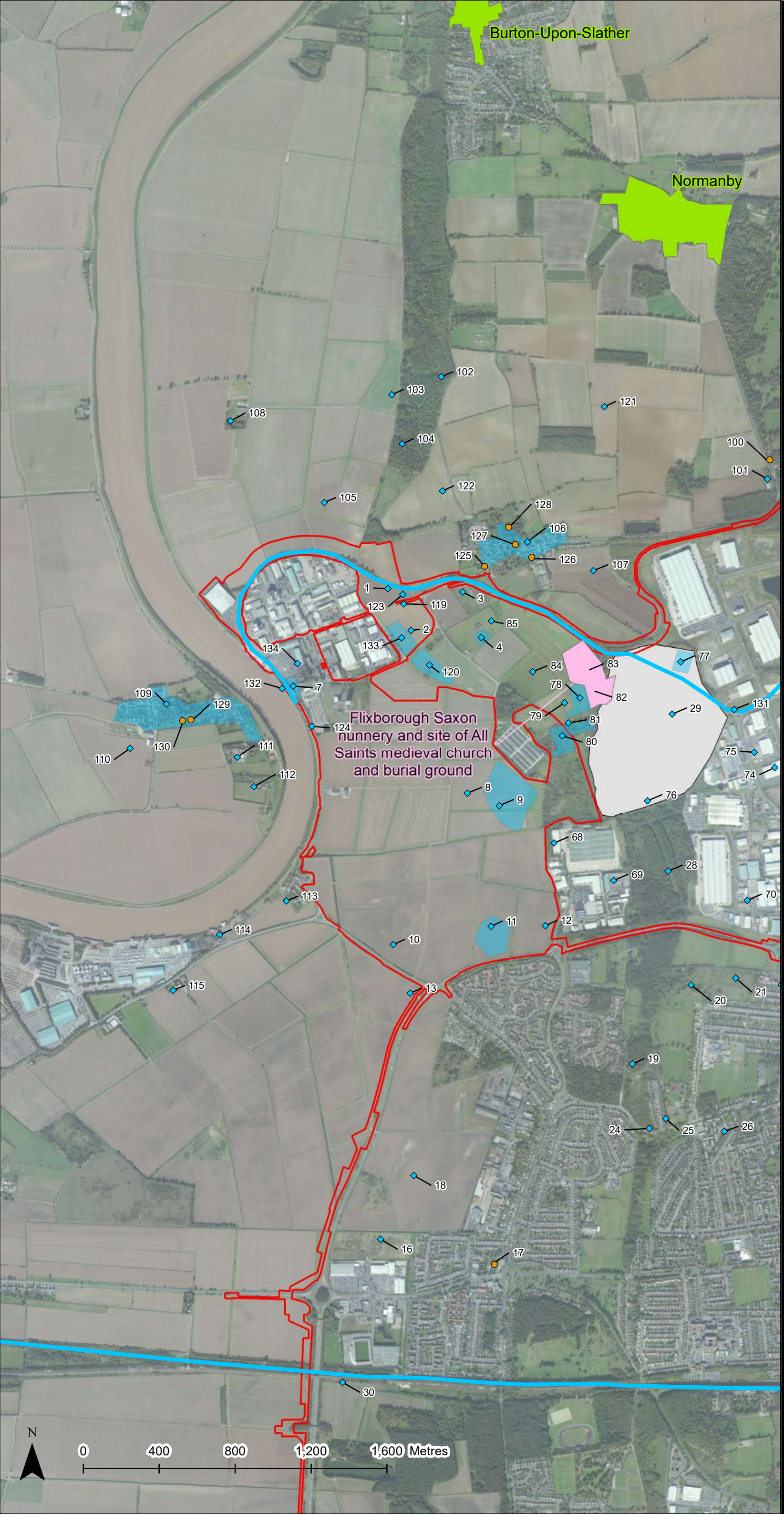
Listed Buildings

- Grade I Listed Building
- Grade II Listed Building
- Grade II* Listed Building
- Scheduled Monuments
- Conservation
- 1km Buffer

Layer Source Information

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

DO NOT SCALE THIS DRAWING



NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 1b Location map showing project boundary, designated and non-designated heritage assets in the vicinity (for details see gazetteer in Appendix B)

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	27/09/2022
Drawn by	MTC
Checked by	CLQ
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	19,001
ArcMap File	HER_ES_LocationMapGazItems_A01

Legend

- Non-Designated Assets
- Gazetteer Lines
- Gazetteer Polygons

Listed Buildings

- Grade I Listed Building
- Grade II Listed Building
- Grade II* Listed Building
- Order Limits
- Scheduled Monuments
- Conservation Area
- Former Spoil Heap

Layer Source Information

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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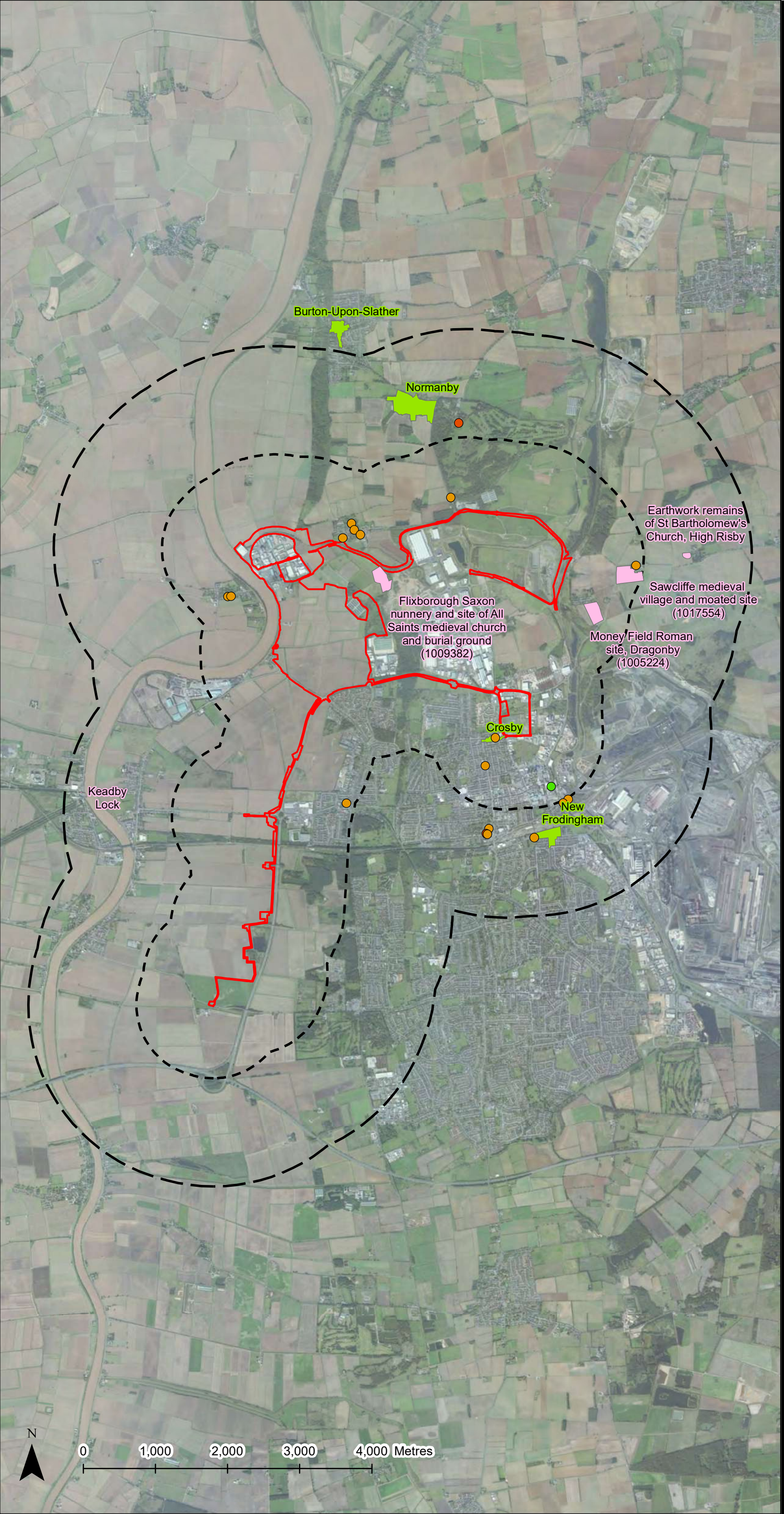


NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 2a Development proposals showing designated heritage assets

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	17/05/2022
Drawn by	MTC
Checked by	CLQ
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	50,001
ArcMap File	\\UKSSMBNAF- HER_ES_DesignatedAssets_1km_2_5km_A01

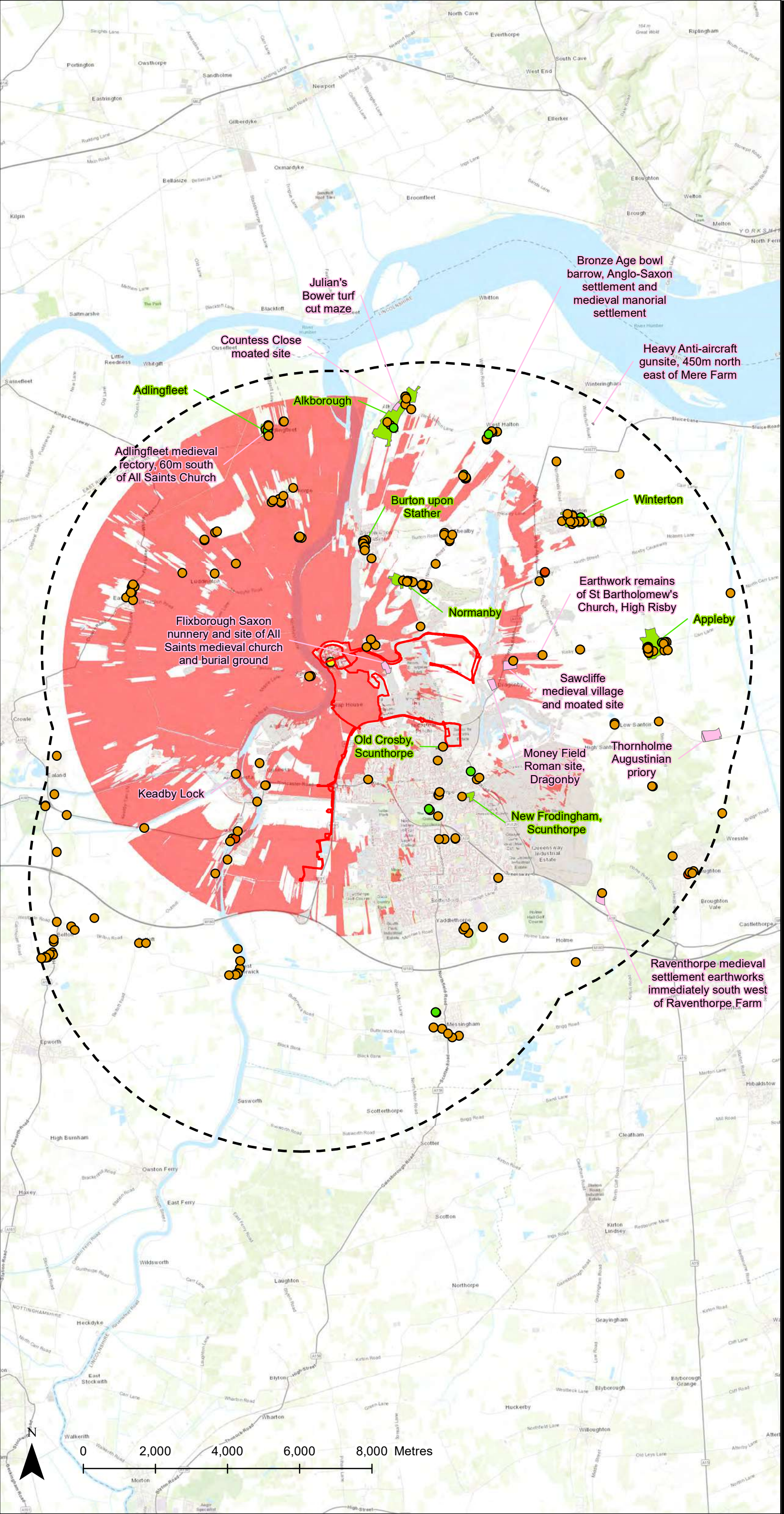
Legend

- Order Limits
- **Listed Buildings**
  - Grade I Listed Building
  - Grade II Listed Building
  - Grade II* Listed Building
- Scheduled Monuments
- Conservation Area
- 1km Buffer
- 2.5 km Buffer

Layer Source Information

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

DO NOT SCALE THIS DRAWING



NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 2b Development proposals showing designated heritage assets within 7.5km of Order Limits

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	11/05/2022
Drawn by	MTC
Checked by	CLQ
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	100,003
ArcMap File	\\UKSSMBNAF-

HER_ES_DesignatedAssets_7_5km_A01

Legend

- Order Limits
- Stack Location

Listed Buildings

- Grade I Listed Building
- Grade II Listed Building
- Grade II* Listed Building
- Scheduled Monuments
- Conservation Area
- 7.5 km Buffer

Stack Visibility

- Visibility of Stack
- Obstructions to Visibility (Buildings and Trees)

Layer Source Information

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User

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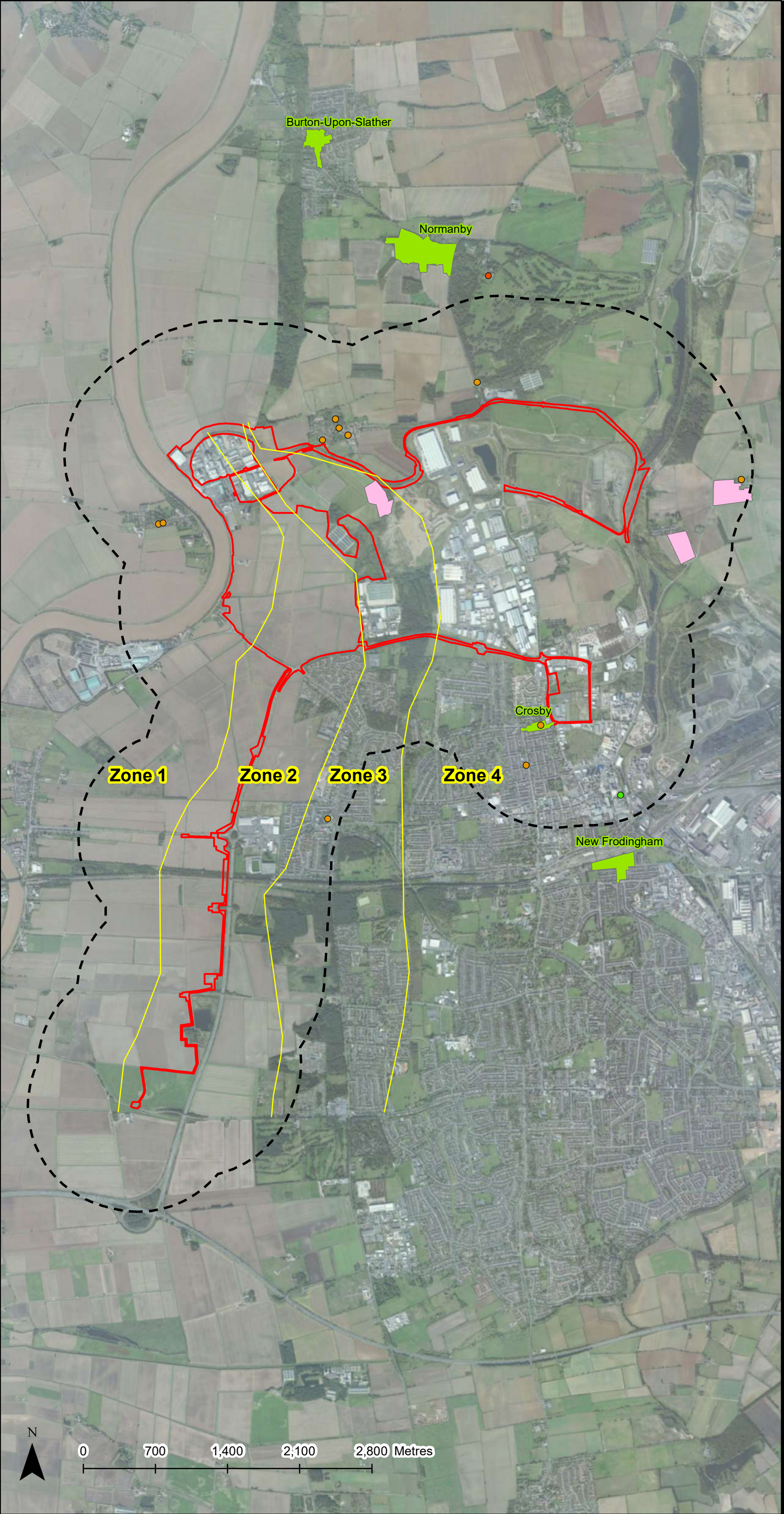

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 3 Map of NGLEP development showing geoarchaeological zones

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	26/09/2022
Drawn by	MTC
Checked by	JM
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	35,000
ArcMap File	HER_ES_GeoArchZones_A01

Legend

Listed Buildings

- Grade I Listed Building
- Grade II Listed Building
- Grade II* Listed Building
- Geoarch Zone
- Scheduled Monuments
- Conservation
- Order Limits
- 1km Buffer

Layer Source Information

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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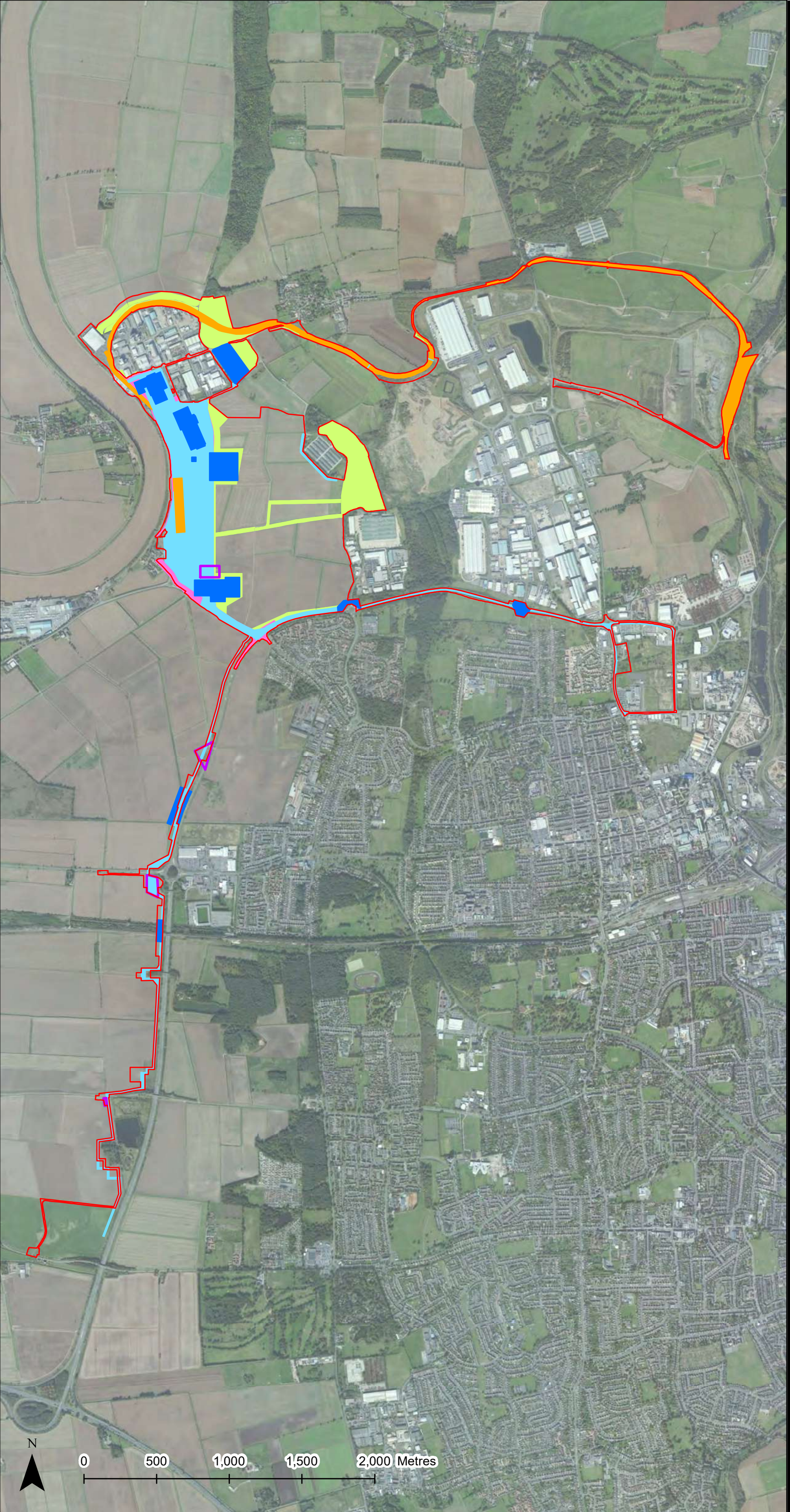

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 4 Map of NGLEP development showing depths of ground disturbance

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	15/03/2022
Drawn by	MTC
Checked by	NW
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	25,001
ArcMap File	HER_ES_ExcavationAreas_A01

Legend

- Order Limits
- Construction Compound
- Deep Excavations - Buildings, Piling & HDD Thrust Boring
- Shallow Excavations (<2m) - Cables, Pipes & Ponds
- Surface Works - Rail
- Surface Works - Roads & Hardstanding
- Surface Works - Vegetation Planting & Enhancement

Layer Source Information

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community© Crown copyright and database rights 2021 OS Licence 100035409

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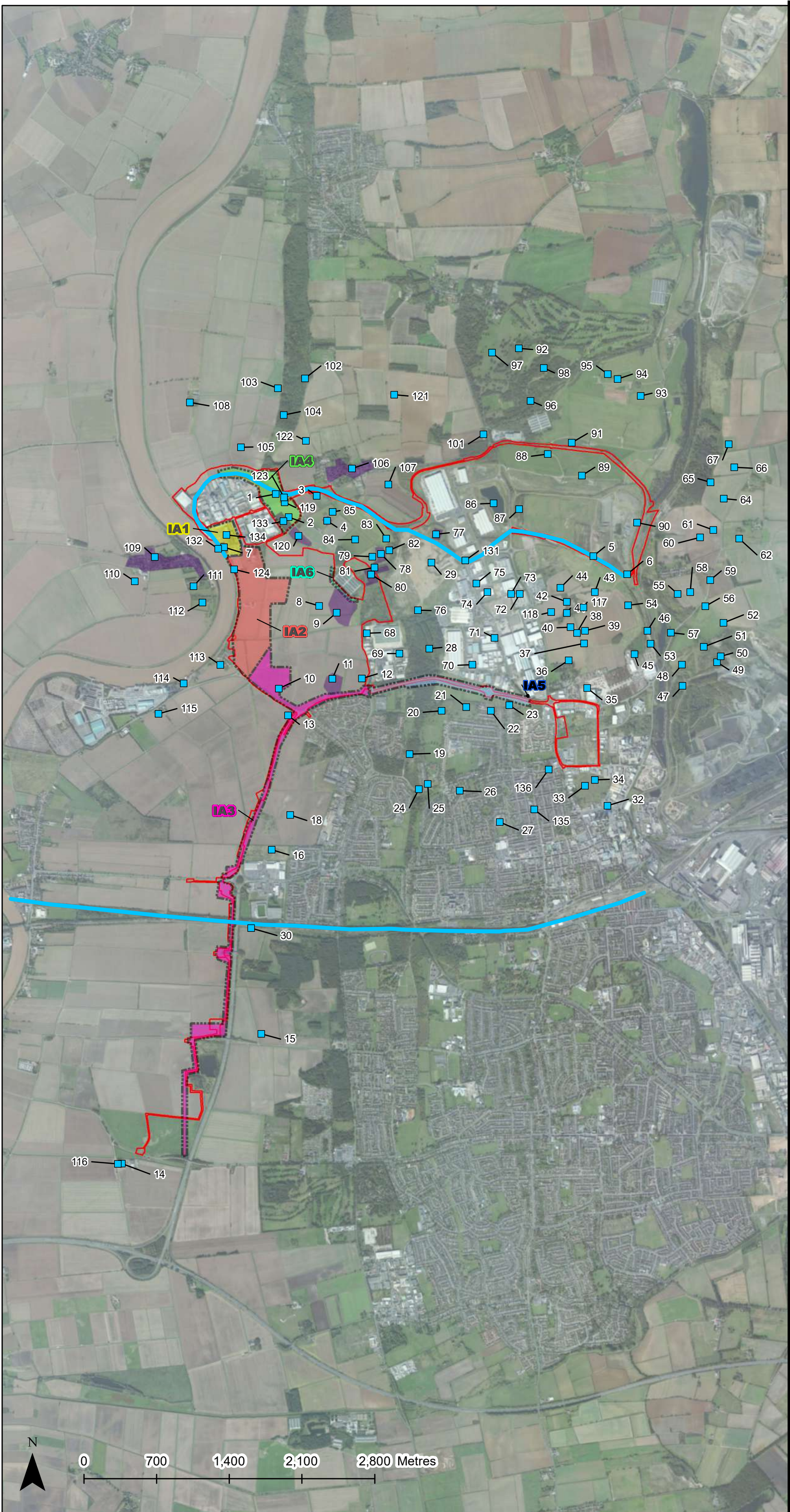

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title Figure 5
Archaeological impact zones

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	27/09/2022
Drawn by	MTC
Checked by	CLQ
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	35,003
ArcMap File	HER_ES_DevProposals_ImpactZone_A01

Legend

- Heritage Assets
- Gazetteer Lines
- Gazetteer Polygons

Impact Areas

- Impact Area 1
- Impact Area 2
- Impact Area 3
- Impact Area 4
- Impact Area 5
- Impact Area 6
- Order Limits

Layer Source Information

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community© Crown copyright and database rights 2021 OS Licence 100035409

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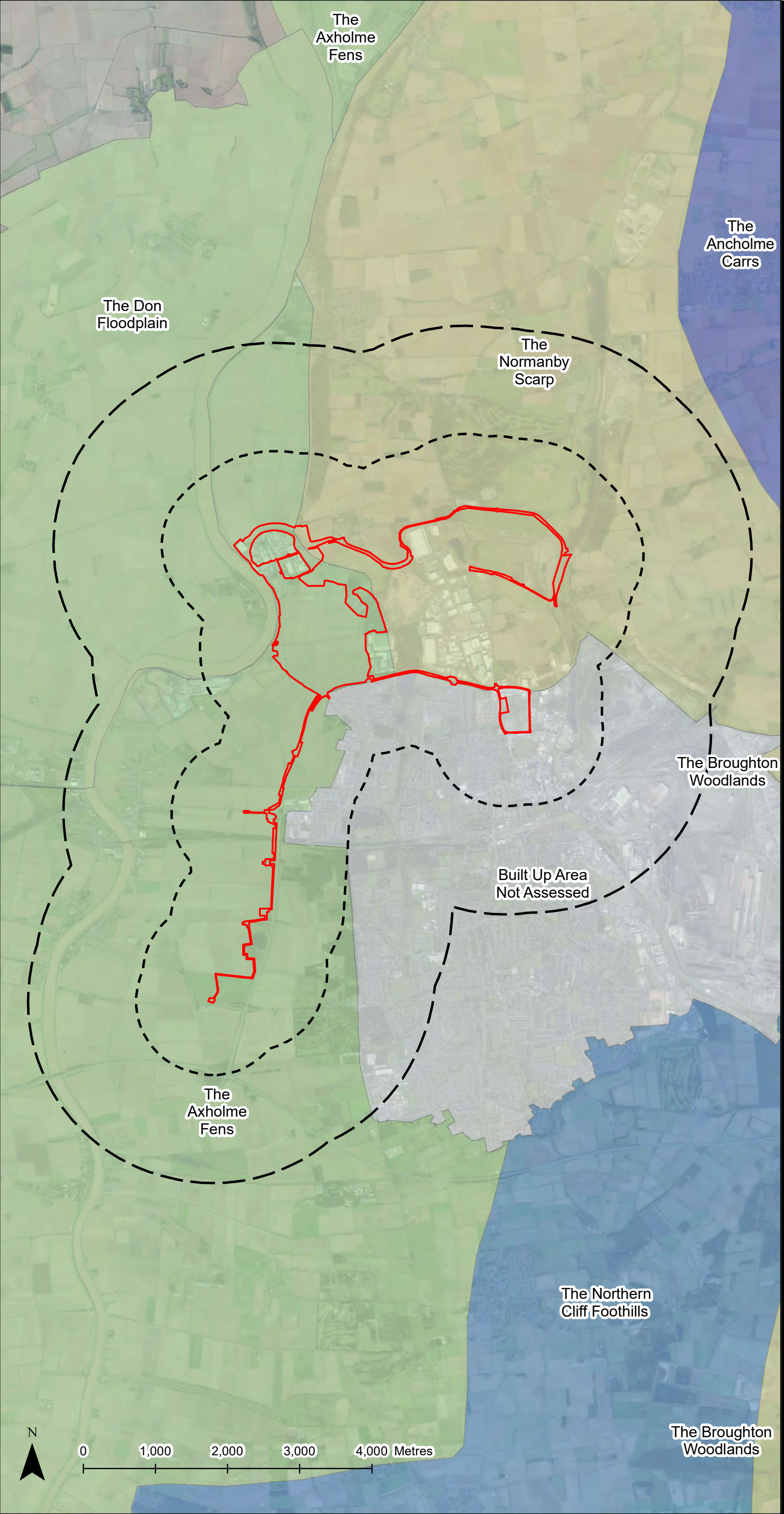

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 6 Historic Landscape Character Areas

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	15/03/2022
Drawn by	MTC
Checked by	CLQ
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	50,001
ArcMap File	

HER_ES_DesignatedAssets_HistoricLandscapeAreas_A01

Legend

- Draft Order Limits
- 1km Buffer
- 2.5 km Buffer

Historic Landscape Character Areas

- Built Up Area Not
- The Clay Vale
- The Confluence
- The Northern Cliff
- The Trent Valley

Layer Source Information

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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APPENDIX B ARCHAEOLOGICAL DESK BASED ASSESSMENT

NORTH LINCOLNSHIRE GREEN ENERGY PARK

Planning Act 2008

Infrastructure Planning (Applications Prescribed Forms and Procedure) Regulations 2009

North Lincolnshire Green Energy Park

Archaeological Desk Based Assessment

October

Pins No.: 000000

The business of sustainability

ERM

Document details	The details entered below are automatically shown on the cover and the main page footer. PLEASE NOTE: This table must NOT be removed from this document.
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Document title	Archaeological Desk Based Assessment
PINS No.	000000
Date	October 2021
Version	1.0
Authors	Derek Cater and Charles Le Quesne
Client Name	Solar 21

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				ERM approval to issue		
Version	Revision	Author	Reviewed by	Name	Date	Comments
Draft	00	Name	Name	Name	00.00.0000	Text
1	1	Derek Cater,	Charles Le Quesne			

Signature Page

October 2021

North Lincolnshire Green Energy Park

Archaeological Desk Based Assessment

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Name	Name
Job title	Job title
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CONTENTS

Table of Figures

1. INTRODUCTION

1.1 Aims and Objectives

This baseline report aims to identify cultural heritage assets that may be affected by the Proposed Development. This includes buried archaeological remains and historic buildings historic landscape. The results of this review will form the basis for the heritage section of the Environmental Impact Assessment. It has been prepared to inform consultation with North Lincolnshire Council.

1.2 Method

1.2.1.1 This desk-based assessment has been prepared in accordance with the appropriate guidance and 'good practice 'advice, including that presented by the Chartered Institute for Archaeologists (CIfA): Standard and Guidance for historic environment desk-based assessment[1].

1.2.1.2 HER data were collected within and within 2.5 km of the Order Limits. This desk-based assessment focusses on heritage information relating to assets located within 1km of the Order Limits, which comprises the core study area.

1.2.1.3 A number of sources were consulted as part of the desk-based assessment:

- Historic England (National Heritage List) for information on World Heritage Sites, Scheduled Monuments, Listed Buildings, Registered Historic Parks and Gardens, and Historic Battlefields;
- The North Lincolnshire Historic Environmental Record (NLHER);
- Historic maps and other documentary evidence from the Lincoln Record Office;
- Publically available Lidar data
- Historical Ordnance Survey mapping; and
- Relevant published and grey literature historic environment reports.

1.2.1.4 These sources have been used as the basis for the gazetteer included as Appendix 1, which forms the basis for Figure 1. The sites in the gazetteer are referred to in the text in bold (eg **site 1**).

[1] Chartered Institute for Archaeologists (IfA), 2014, *Standard Guidance for historic environment desk-based assessment*

1.3 Policy, Legislation and Guidance

1.3.1 Designated Sites

World Heritage Sites

1.3.1.2 A World Heritage Site is a cultural or natural landmark that has been recognized by the United Nations Educational, Scientific and Cultural Organization (UNESCO). These sites are deemed worthy of preservation due to their universal value to humanity, both in the present and for future generations.

1.3.1.3 There are no World Heritage Sites within or with 1km of the Order Limits.

Scheduled Monuments

1.3.1.4 Scheduled monuments (SM) are sites of national importance which are given legal protection by being placed on a list or 'Schedule' by the Secretary of State for Culture, Media and Sport. This protection is enshrined within the Ancient Monuments and Archaeological Areas Act (1979) amended by the National Heritage Act (1983) and National Heritage Act (2002). Current legislation supports a formal system of Scheduled Monument consent for any work which would affect a designated monument.

There are no scheduled monuments within the Order Limits. However, there are three scheduled monuments within 1km of the Order Limits. The nearest of the three is 'Flixborough' Saxon nunnery & site of All Saints medieval church & burial ground at the historic settlement of North Conesby, which is located immediately adjacent to the Order Limits.

Listed Buildings

1.3.1.5 Listed buildings are structures of special architectural and historic interest which are afforded statutory protection under the Planning (Listed Buildings and Conservation Areas) Act (1990) and the Town and County Planning Act (1971). Buildings are classified into three categories according to their importance: Grade I listed buildings are of 'exceptional interest', Grade II* buildings are 'particularly important buildings of more than special interest', and Grade II buildings are of 'special interest'. Listed building consent must be

obtained from the local planning authority in order to make any changes to the structure which might affect its special interest.

1.3.1.6 There are no listed buildings within the Order Limits. The nearest Grade I listed building is located approximately 1.185 km outside the Order Limits, namely Normanby Hall (site 99).

1.3.1.7 There is a single Grade II* listed building within 1km of the Order Limits: Former Church of St John (DBA asset number 106), located within approximately 100m of the Order Limits.

1.3.1.8 There are 11 Grade II listed buildings within 1km of the Order Limits, the nearest of which is The Smithy, in Flixborough village (site 106). It is located approximately 30m outside the Order Limits.

Registered Parks and Gardens

1.3.1.9 Parks and gardens of particular historic significance can be inscribed in the Register of Parks and Gardens of Special Historic Interest in England compiled by Historic England. Registration is a material consideration in the planning process, meaning that planning authorities must consider the impact of any proposed development on the landscapes' special character.

1.3.1.10 There are no registered parks and gardens within the Order Limits or within 1km of them.

1.3.2 National Planning Policy Framework

1.3.2.1 The NPPF states that “heritage assets are an irreplaceable resource”, with “wider social, cultural, economic and environmental benefits” brought about by their conservation (paragraph 126).

1.3.2.2 The NPPF continues the assumption in favour of conservation of heritage assets determined by the Ancient Monuments and Archaeological Areas Act 1979, with paragraph 132 of the NPPF stating that substantial harm to or loss of a Grade II listed building should be exceptional and would require clear and convincing justification, and that substantial harm to or loss of scheduled monuments should be wholly exceptional. Consent can be refused by the Local Planning authority where a proposed development will lead to substantial harm to or loss of a designated heritage asset unless substantial public benefits outweigh that harm or loss. Less than substantial harm may be balanced against the public benefits of the proposal in a planning decision. Preservation in situ is generally the preferred course of action in relation to designated heritage assets unless exceptional circumstances exist.

1.3.2.3 The approach to non-designated assets is different, with paragraph 135 of the NPPF stating 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 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."

1.3.2.4 Where heritage assets are permitted to be damaged or lost, developers are required by paragraph 141 of the NPPF to "*record and advance understanding of the significance of any heritage assets to be lost (wholly or in part) in a manner proportionate to their importance and the impact, and to make this evidence (and any archive generated) publicly accessible)*".

1.3.3 Local Planning Policy

1.3.3.1 North Lincolnshire planning policies relating to the historic environment that are relevant to the current application include the following saved policies from the 2003 Local Plan as follows.

- HE5: Development affecting Listed Buildings states that proposals which will damage the setting of a listed building will be resisted.
- HE8: Ancient Monuments states that development that will result in an adverse effect on Scheduled Ancient Monuments or their settings will not be permitted.
- HE9: Archaeological Evaluation encourages the provision of adequate assessment of the significance of archaeological remains in support of planning proposals and states that sites of known archaeological importance will be protected through the provision by the developer of adequate measures for excavation and recording before and during development.

1.4 Site Description

The NGLEP site is large (the core area extends c.1.6km east-west x 2.3km north-south), with substantial transport and energy distribution corridors extending over 4km to the south and 2.5km to the east of the main site (Figures 1-2). It lies on the floodplain of the Trent Valley to the east of the river at a point where the river meanders to the east and the Scunthorpe mudstone ridge projects to the west at Flixborough.

The core development area is situated on the east bank of the Trent at Flixborough Stathe, Flixborough's historic wharf, which is situated at the south-western corner of Flixborough Industrial Estate. The Energy Recovery Facility (ERF) will be located here, serviced by the restored railway connecting the wharf north and eastwards to the sidings at Dragonby. Extending between the ERF and A1077 along the east bank of the Trent will be a series of secondary facilities including a concrete and polymer manufacturing plant and an energy storage and refuelling station. The area to

the east of this as far as the valley slopes falls within the development redline boundary to allow for flood compensation measures.

The ERF will be connected to a new sub-station and Above Ground Gas Installation (AGI) situated on the lower, west-facing slopes of the valley on the eastern edge of the Flixborough Industrial Estate.

The facility will be connected to the local heating and electricity supply via the District Heat and Private Wire Network (DHPWN), a buried pipe and cable distribution network that will run east into Scunthorpe and south along the A1077 to Burringham Road.

2. Historic Environment Baseline

2.1 Geology

2.1.1.1 The British Geological Survey (BGS) indicates that the Site has an underlying bedrock composed of Mudstone. A north-south aligned mudstone ridge dominates the geology of the study area, lying to the east by, and upon which the historic settlements of Flixborough, Crosby and Scunthorpe are situated. The mudstone and Ironstone bedrocks are shallow to full marine deposits from the Triassic (c. 251-201 Mya) was and Jurassic (c. 201-145 Mya). The mudstone ridge forms the eastern edge of the meandering Trent Valley, which is filled with deep Holocene (12,000 years ago - present) alluvium (clay, silt, sand, and peat) and overall represents uniform to varied riverine deposition across a floodplain. The eastern edge of the valley and west side of the mudstone ridge is characterised by thick drifts of 'windblown sand', which appear to have derived from late glacial sands (BGS 2021) and in some cases are overlain by alluvium. The sand, occasionally classified as Sutton Sand Formation, is a fine silty sand formed during the Devensian to Holocene (115 thousand years ago onwards) and represents an aeolian or wind-blown redeposition of underlying glaciolacustrine deposits or bedrock.

2.2 Geoarchaeology

2.2.1 Palaeoenvironmental Context

2.2.1.1 The drift geology underlying the Proposed Development site comprises a deep sequence of late Pleistocene and Holocene clays, sands, silts and, in places, peats. The latter, and other deposits containing organic remains, are of particular value in that they preserve information about past environments (pollen, palaeobotanical remains, insects etc), can contain well-preserved archaeological remains and provide ideal samples for scientific dating. This sequence reflects the low-lying, wetland character of the surrounding landscape, and the influence of the River Trent which runs along the western side of the project site.

2.2.1.2 During the coldest part of the most recent glaciation, around 18,000 years ago, glaciers extended southwards into the Lower Trent Valley as far SOUTH as Keadby. Because the glaciers also blocked the Humber Gap, ‘Lake Humber’ was created in this area, something which had a major effect on the deeper sedimentary sequence, with the deposition of clays, silts and sands. The melting of the ice, and the re-opening of the Humber Gap, led to the silting up of Lake Humber by around 9,000 BC.

2.2.1.3 The paleoenvironmental record for the earliest part of the Holocene in the Lower Trent valley includes data available from Girton, Bole Ings (Dinnin 1997) and Lake L1 of the Lincolnshire Lakes Project. Radiocarbon dating in correlation with pollen samples from the Lincolnshire Lakes project east of Area 3 dates the lower pollen samples to approximately 7000BP, and upper samples to approximately 300BP. Comparable organic deposits in the lower

Trent Valley began to accumulate around the same time as channel stabilisation approximately 8500BP (Stein 2014). Correlation between the depth and date of deposits at different locations across the Lake L1 Site proved to be somewhat variable, suggesting that either peat accumulated at different rates at different locations, or perhaps material has become truncated through erosion (AOC 2017).

2.2.1.4 Marine environments continued to reach into the Lower Trent Valley throughout the Mesolithic, as evidenced by alternating marine and freshwater deposits as far upstream as Gainsborough (Knight and Howard 2004, 31; Lillie and Neumann 1998, 22). Pollen sequences from this period demonstrate expanding reed swamp and fen carr landscapes, with additional evidence of densely wooded areas on dryer land (Knight and Howard 2004, 31). A similar stabilising riverine environment continued into the Neolithic with dense woodland located on drier land. Evidence of occupation from as early as the Mesolithic has been recovered from the area of Flixborough including a large concentration of Late Mesolithic and Neolithic flint found at Sand Pits, Flixborough in 1928.

2.2.1.5 Coring undertaken at Flixborough as part of the Humber Wetlands Project (Lillie 1998 45-52) revealed a complex stratigraphic sequence of intercalated peats and clays which documented periods of alluvial deposition and periods of stabilisation. Similarly archaeological evaluation and coring at the Lake L1 site, to the east of the NGLEP southern DHPWN alignment, as part of the Lincolnshire Lakes project revealed a complex sequence of interbedded peats and clays overlain by warped sediments. Numerous layers of buried organic peats, and finely laminated sections containing sands and clays were apparent. Changes appeared to be abrupt with no gradual transition between varying deposition types. This was interpreted as a possible indication that the sediments had been truncated or eroded, but it was also considered possible that rapid environmental change took place e.g. inundation of marine waters (AOC 2017).

2.2.2 The Geoarchaeological Sequence at the NGLEP Site

2.2.2.1 This review of the geoarchaeology of the Site and its immediate vicinity is drawn from a number of recent studies including a watching brief of ground investigations (coring) recently undertaken in support of the NGLEP project (AOC 2021). These enable a series of geoarchaeologically distinct zones to be recognised within the area of the Order Limits as set out below (see also Figure 2).

Zone 1

2.2.2.2 This comprises those areas of the proposed development adjacent to the Trent that lie above deep peat deposits. This covers the site of the ERF at Flixborough Staithe, as well as the concrete and polymer manufacturing plant immediately to the south. Ground investigations on the ERF site have identified deep organic/peat sequences, filling a possible palaeochannel, extending from upper levels of 4.7-6.7m below ground level to 11.7-12.3m below ground level. These are similar to the sequence studied a kilometre to

the north at the Flixborough wind farm (Lilllie & Bunting 2016). Here a core indicated dates for the peat development ranging from 3,985-3820 cal BC to 790-540 BC (in broad terms from the Mesolithic/Neolithic transition to the Middle Iron Age). The upper 4-6m of these cores comprised alluvial silt/clay deposits.

2.2.2.3 Such a sequence suggests that prehistoric, Roman or medieval settlement remains are unlikely to exist in these areas as they would simply have been too wet for permanent occupation. However, seasonal activities such as hunting, fishing or grazing are very likely to have occurred, and the remains of structures related to water management/transport could well survive in waterlogged deposits.

Zone 2

2.2.2.4 This zone could be seen as the outer floodplain, where late Devensian/early Holocene sands are covered by relatively thin deposits of peat and alluvium. The slightly drier character of these deposits, combined with their greater proximity to permanent settlement on the high ground, has made this area attractive to seasonal settlement and, in all probability, pastoral agriculture since prehistory.

2.2.2.5 The NGLEP energy storage and refuelling station, as well as flood compensation and landscaping areas and the extensive southern DHPWN alignment, fall within this zone.

Zone 3

2.2.2.6 This area covers the west-facing slopes of the Scunthorpe ridge, covered with wind-blown sands dating to the late Devensian/early Holocene period. Extensive remains of periods dating from the Mesolithic to the medieval period, have been found stratified within these sands.

2.2.2.7 Most of the remaining elements of the NGLEP development fall within this zone, including sections of the reinstated railway, areas of landscaping west of the Foxhills Industrial Estate and sections of the DHPWN.

Zone 4

2.2.2.8 The mudstone ridge/plateau lying to the east of the Trent Valley is where most of the permanent settlements of the Roman, medieval and post-medieval period developed. The historic villages of the area – Flixborough, Crosby, Frodingham, Scunthorpe – are all situated on this higher ground, connected to the lower ground to the west by long lanes/trackways.

2.2.2.9 The development affecting these areas comprises the remainder of the reinstated railway together with the eastern portion of the DHPWN

2.3 Archaeological and Historical Baseline

2.3.1 Palaeolithic (1,000,000 – 10,000 BC)

2.3.1.1 Given the landscape history of the Lower Trent wetlands summarised above, it can be seen that any in situ prehistoric archaeological remains in the vicinity of the Site would be buried beneath post-medieval warping sediments, as well as later Roman and medieval alluviation. For this reason, evidence for prehistoric activity in the area comes largely from higher ground to the east of the NGLEP.

2.3.1.2 The only Palaeolithic artefact found within the study area is a tanged flint blade of Late Upper Palaeolithic date located approximately 580m south-east of Dragonby village and approximately 780m outside the nearest part of the Order Limits (**site 57**).

2.3.2 Mesolithic 10,000 – 4,000 BC

2.3.2.1 During the Mesolithic, as the climate warmed, tundra landscapes that had supported reindeer herds gave way first to birch, hazel and pine forests and later to deciduous woodland supporting deer and pig. For much of the Mesolithic period, sea levels were low, and Britain was joined to Europe by a land bridge.

2.3.2.2 Mesolithic communities comprised mobile hunter gatherers that moved around their territories, utilising relatively permanent base camps at resource-rich locations, and more temporary camps from which more limited resources were exploited in a seasonal round. The Trent wetlands would have been attractive to prehistoric human populations, with its rich resources of food and materials (peat, fish, game, plants, wood), as well as having spiritual significance. The widespread observations of the remains of prehistoric logboats from across the wetlands serves as a reminder that the prehistoric population used water as one of the key means of communication, not to mention its value for fishing, hunting etc.

2.3.2.3 There are 15 Mesolithic heritage assets within the 1km study area, all are non-designated. A number are recorded as ‘occupation sites’ or ‘flint-working’ sites. One of the ‘occupation’ sites is located on Sheffield’s Hill to the north of Dragonby (**site 61**). It comprised an assemblage of flint tools associated with patches of charcoal and poorly preserved animal bone of deer and other small mammals[2]. Similar evidence for Mesolithic occupation sites come from a sand pit at Normanby Park (**site 96**) and Atkinson’s Warren, on the blown sand slopes to the north of Crosby (**site 19**).

2.3.2.4 Most of the remaining known Mesolithic sites are discoveries of single or small groups of worked-flint tools, waste flakes and cores left over from the tool-making process. Some of these (such as **site 64**) could represent small

[2] May 1976, 34.

activity sites in their own right. Others are most likely to represent casual discard during hunting trips.

2.3.2.5 Most of the Mesolithic finds come from or immediately adjacent to deposits of wind-blown sand depicted in BGS data on the high ground overlooking the Trent Valley. This points towards Mesolithic communities occupying temporary camps on the high and dry ground offering views across the Trent Valley, which would have been rich in animal life of all kinds.

2.3.3 Neolithic 4,000 – 2,200 BC

2.3.3.1 During the Neolithic, animals and plants were domesticated for the first time and farming was introduced to Britain. Previously mobile communities gradually became more sedentary. Pottery was produced and used for the first time, and new tool types, such as polished stone axes and leaf-shaped arrowheads, were introduced. Burials become visible in the archaeological record for the first time and took the form of groups of people buried in trapezoidal long barrows made of earth or stone. The Neolithic is also characterised by ceremonial monuments such as circular causewayed enclosures and, later, henges, as well as ditched processional ways called cursus monuments.

2.3.3.2 There are 29 Neolithic sites in the 1km study area, all of them non-designated. Three of these assets could fairly be described as 'occupation' sites. In 1956, Neolithic worked flint and plain and decorated Peterborough ware pottery of Early Neolithic date was recovered during commercial sand extraction in Normanby Park (**site 96**). A shallow circular pit associated with two sherds of Neolithic pottery excavated ahead of commercial extraction at Flixborough Sand Pit (**site 4**), a short distance east of the proposed NGLEP AGI plant, may have been part of more extensive but dispersed occupation. The third known occupation site comprised struck flint of Mesolithic, Neolithic and early Bronze Age date, and Neolithic and Bronze Age pottery, pits and a possible structure, recorded during excavations in Dragonby Money Field (**site 56**). Several pit and hollows were excavated securely dated to the Neolithic by the diagnostic pottery and worked flint.

2.3.3.3 Three other assets possibly represent Neolithic occupation sites. However, the available evidence is insufficient to allow the nature of the activity it represents to be characterised with confidence. One of these comprises the findspots of Neolithic and other prehistoric worked flint on Sheffield's Hill (**site 61**). Another is a group of prehistoric flint implements (which would appear to include Neolithic material) found at Sawcliffe Farm, Dragonby (**site 64**). The third comprises two small clusters of worked flint found during archaeological fieldwalking in 2015 to the north and south of Conesby (**site 37**).

2.3.3.4 Most of the known Neolithic finds in the area are of single flint tools likely to represent loss or casual discard of material by Neolithic communities going

about their every-day activities. Neolithic axe heads have been found at no fewer than eight locations (**sites 20, 23, 26, 27, 71, 81, 94 & 95**).

2.3.3.5 As with Mesolithic sites, a large proportion of Neolithic sites within the study area are located upon wind-blown sand deposits on the high ground overlooking the Trent Valley. As with the Mesolithic period, this implies the exploitation of the hunting and gathering resources of the wetlands. Increasingly, though, the focus would have been upon pastoral farming on the lush riverside pastures, as well the harvesting of rushes and withies and the trapping of wild fowl and eels. The pastoral economy would have been supplanted by arable crops grown on the drier land to the east of the wind-blown sand deposits.

2.3.4 Bronze Age (2,600 – 700 BC)

2.3.4.1 During the Bronze Age, metal (Bronze) was introduced to Britain for the first time. Burial practices changed from communal burial in long barrows to, first, individual inhumations under round burial mounds (barrows) and, from about 1500 BC, cremations in collared urns in flat cemeteries. The change to individual burial would seem to reflect the growing importance of the individual vis-a-vis the community in the Bronze Age. Early Bronze Age settlements are poorly represented in the archaeological record. They become slightly more plentiful in the later Bronze Age, and it is to the later Bronze Age that the first extensive field systems date. The ceremonial monuments that characterised the Neolithic and earlier Bronze Age fell out of use after about 1500 BC, in the later Bronze Age. In the late Bronze Age period (after 1,000 BC), as the climate became wetter, ritual activity is characterised by the deposition of prestige Bronze metalwork in watery places.

2.3.4.2 There are again 34 sites from which Bronze Age material has been recovered within the 1km study area, all of them non-designated assets. There are a number of possible burial mounds of earlier Bronze Age date. The circular ditch around a possible former burial mound was discovered by geophysical survey on Brumby Common West (Cottam 2014, para 4.22; **site 15**). The 1816 Ordnance Survey surveyor's map (Figure 6) shows a large group of mounds in the vicinity of this site on Brumby Common before its enclosure. It seems entirely possible that this represents a group of burial mounds that were lost after the area was enclosed and improved. It seems entirely possible that other such burial mounds may formerly have existed on the lower slopes of Scunthorpe Ridge to the north and south. An upstanding mound named 'Lodge Hill' (**site 55**), destroyed for ironstone mining in 1911, was possibly a Bronze Age burial mound. The remains of a Bronze Age Food Vessel were found to the south-west of Bagmoor Farm (**site 35**). Food vessels were frequently deposited as accessory vessels in inhumations beneath burial mounds in the earlier Bronze Age.

2.3.4.3 Cremation burials, of probable later Bronze Age date, have been recorded three locations. At least three cremation pits, associated with a group of 20 post-holes and other cut features, were excavated south of Phoenix Park in 2008 and 2009 ahead of residential redevelopment (**site 22**). A middle Bronze Age cinerary urn was excavated by staff of Scunthorpe Museum at

Flixborough Sand Pit ahead of commercial sand extraction in 2001 (**site 4**),. These sites were both located on or immediately adjacent to wind-blown sand deposits depicted in the BGS data. Several assets in the study area comprise or contain sherds of beaker pottery, such as **site 8** (within the project area). Nationally, beaker pottery is strongly associated with early Bronze Age burial in circular burial mounds: beakers are frequently accessory vessels in such burials. It is possible that some or all the beaker sherds referenced in the NLHER within the 1km study area relate to early Bronze Age mound burial. However, as Jeffrey May has observed, 'Lincolnshire is unusual in that a high proportion of beaker material comes from occupation sites.'[3]

2.3.4.4 While no explicit evidence for Bronze Age settlement has been found within the study area, some groups of finds point towards this, if only temporary camps. For example, Bronze Age pottery sherds and Neolithic and Bronze Age worked flints were found at Crosby in 1957 (**site 51**); a similar assemblage of material has been recovered from elsewhere on Crosby Warren (**site 45**), and on Atkinson's Warren (**site 68**). Once again, Bronze Age cultural material has been recovered from the scarp-slope crest at Sheffield's Hill (**site 96**), which affords sweeping views across the Trent Valley.

2.3.4.5 The large number of heritage assets and the large volume of cultural material they contain indicates that the 1km study area and the wind-blown sands in particular were of importance to and were much exploited by Bronze Age communities. The nature of that exploitation is not clear. However, the lack of evidence for permanent settlement and the extensive distribution of often small volumes of cultural material suggests the communities may have been itinerant, using the high ground as a vantage point when controlling domestic herds and flocks grazing on the summer pastures in the Trent Valley. That being said, the Bronze Age communities are likely to have exercised a mixed agricultural economy (witness the flint sickle found at Dragonby, **site 6**), even if one perhaps focussed upon pastoralism.

2.3.5 Iron Age (800 BC – AD 43)

2.3.5.1 Settlements within their farming landscapes become plentiful in the archaeological record for the first time in the Iron Age. There was a growth in social and political complexity during this period and communities cohered into tribes. Lincolnshire and the wider East Midlands was occupied by a tribe known as the Corieltauvi. During the succeeding Roman period, the tribal capital was located at Leicester (Ratae). During the Iron Age, however, in Lincolnshire, there were important political centres at Sleaford, Lincoln and Dragonby.

2.3.5.2 The settlement at Dragonby, known as Money Field Roman site, Dragonby (**site 56**) and a scheduled monument, is located approximately 300m outside the Order Limits. It was excavated between 1964 and 1973, and was found to comprise ditched enclosures, some containing roundhouses, in the Iron Age, and an irregular pattern of streets. The inhabitants were engaged in

[3] May 1976, 64.

agriculture, stock keeping, craft or industrial activities and trade. The settlement flourished from well before 100 BC until at least the later 4th century AD, at the end of the Roman period[4].

2.3.5.3 There are several sites visible as cropmarks on aerial photographs which have not been tested by excavation but which, given their form, are likely to be of Iron Age or Roman date. There are a group that fall within the project boundary in an area of relatively shallow alluvium extending out from the mudstone ridge towards Neap House. Cropmarks close to the junction of the B1216 and A1077 (**site 13**) comprise a partially complete sub-rectangular enclosure measuring approximately 44 x 50m. It is uncertain whether it is a stock or a settlement enclosure but does contain at least one pit-like feature. A second cropmark site (**site 11**) is located approximately 340 to its north and comprises parallel linear features, c.20m apart, overlying a possible enclosure. A heart-shaped, cropmark enclosure (**site 12**), a further 200m to the east, located to the west of Skipping Dale Industrial Estate, is also likely to be an Iron Age settlement enclosure. A larger complex of cropmarks located south of Flixborough chicken farm (**site 9**) comprises a rectangular enclosure, trackway, ditches, and other uninterpretable cropmark features. It is also likely on formal grounds to be of Iron Age or Roman date and, given its form and complexity, may well depict a farmstead enclosure in its immediate agricultural landscape.

2.3.5.4 Further east, a fifth cropmark site is Located north of Orb Lane, east of Normanby Distribution Park (**site 36**). It comprises two ovoid and one rectangular enclosure, a ring ditch, possible pit alignments and continuous linear boundary features. The ring ditch has a broken circuit, and measures 7m in diameter. Consequently, it is more likely to be the remains of a round house than a round barrow, and the whole cropmark complex is most likely to depict a settlement of Iron Age or Roman date. The likely Iron Age date of the complex was confirmed in 2015 when archaeological evaluation trenches recorded two ditches containing Iron Age pottery. Finally, a cropmark complex comprising possible rectangular enclosures (**site 107**) and a trackway may indicate an Iron Age or Roman farmstead enclosure south of Flixborough village.

2.3.5.5 Dark occupation layers separated by deposits of wind-blown sand, which yielded large quantities of late Iron Age pottery indicative of a substantial site, were recovered during quarrying at Flixborough sand quarry, where metalworking hearths were visible in the quarry face (**site 4**). A burnt stone and clay feature of indeterminate character and probably of Iron Age date, an Iron Age crouched inhumation burial and clay-lined pits of probable Iron Age date were all found within this small sand quarry. Iron Age pottery sherds recovered from within the bounds of the Flixborough Saxon nunnery & site of All Saints medieval church & burial ground, and Iron-Age pottery and animal bone found immediately outside it (**site 78**), both located approximately 690m

[4] May, J. 1996, *Dragonby, Report on Excavations at an Iron Age and Romano-British Settlement in North Lincolnshire*, Oxbow Books, Oxford, 1.

south-east of the Flixborough sand quarry, may be indicative of wider Iron Age settlement at Flixborough.

2.3.5.6 The marked reduction in the number of assets of Iron Age date compared to those of prehistoric date within the study area derives less from a reduction in activity during this period than to the fact that settlements became more permanent and more rooted in the Iron Age compared to the more mobile communities of the Palaeolithic to Bronze Age periods.

2.3.6 Roman AD43 – 410

2.3.6.1 Throughout the Roman period, Britain, and the study area with it, was part of the Roman Empire. North Lincolnshire lay within the civitas (tribal region) of the Corieltauvi, as it had during the Iron Age. The civitas Corieltauvorum, was administered from Ratae (Leicester). The major settlement in Lincolnshire was Lincoln (Lindum colonia), although Dragonby was the highest-order settlement in the hinterland of the study area. Roman rural settlement was partially characterised by large estates farmed from Romanised farmsteads or villas. The nearest villas to the study area were located at Roxby cum Risby and Winterton.

2.3.6.2 The study area was well connected to the wider world by a prehistoric routeway known as the Jurassic Way. This ran parallel to and to the west of the Lincoln Edge, on lower ground. To the south of Scunthorpe, the line of this trackway survives as Middle Street. Six kilometres east of the Study area is the line of Ermine Street, a Roman road which ran along the top of the limestone escarpment and survives in use today as the B1207 The study area was also well connected to the Roman world via the River Trent, which gave access to the West Midlands, to Doncaster via the Ouse and the Don, to York also via the Ouse, and to Brough, the capital of Roman East Yorkshire, via the River Humber.

2.3.6.3 There are 26 heritage assets within the 1km study area that are in whole or in part of Roman date or possible Roman date. The highest order settlement within the study area during the Roman period, as during the Iron Age, was Dragonby (**site 50**). As described in the Iron Age section above, the settlement was characterised by ditched enclosures, some containing rectangular aisled buildings with stone footings in the Roman period, and an irregular pattern of streets. The inhabitants were engaged in agriculture, stock keeping, craft or industrial activities and trade. The settlement flourished from well before 100 BC until at least the later 4th century AD, at the end of the Roman period. Two figurines of Mars were found by metal detectorists in the early 1970s within the Dragonby site, and two Romano-British pottery kilns were excavated in the field to the east in 1940 (**site 59**).

2.3.6.4 Elsewhere within the 1km study area, a building and a series of ditches containing Roman pottery and animal bone (**site 36**) were recorded within five trenches during an archaeological evaluation west of Conesby Farm in 2015. A Roman settlement site (**site 74**) was disturbed during the construction of the

Normanby Park steelworks, at a location approximately 585m east of the study area.

2.3.6.5 Several assets at Conesby, namely a Romano-British kiln (**site 54**) findspot of Roman pottery (**site 56**), 12 Roman coins (**site 38**), pottery sherds, quern stones, spindle whorls, a seal box and coins (**site 41**), and pottery sherds (**site 44**) are suggestive of a substantial settlement at that location. At Flixborough, a Roman cremation deposit (**site 4**), a burnt clay and stone feature (**site 85**) and a small concentration of Roman pottery surface finds (**site 84**), suggest a concentration of Romano-British activity immediately to the east of the proposed AGI facility.

2.3.6.6 Some of the cropmark sites of possible Iron Age date within the project boundary described above (**sites 10-13**) may be or Roman date or have had a Roman phase of activity. The various findspots of cultural material within the 1km study area suggest a nexus of Romano-British activity between Flixborough industrial estate to the west, Dragonby in the east, and Crosby in the south. There is, as previously, a clear preference for settlement on the blown sands of the west-facing slopes of the Scunthorpe mudstone ridge.

2.3.7 Early medieval AD 410 – 1066

2.3.7.1 At the start of this period, the Roman administration of Britain ceased and within 40 or 50 years, Germanic immigrants from northern Europe came to Britain bringing with them a new culture, new religion, new burial traditions and a new language, English.

2.3.7.2 Across Britain, power initially fragmented into a myriad of small kingdoms, both British and English. By the 7th century, these had fused into seven kingdoms including Mercia, which swallowed up the earlier English kingdom Lindsey, which had comprised all Lincolnshire north of the River Witham. England was unified under the house of Wessex in the 10th century, and eventually fell to William the Conqueror in 1066, which defines the end of this period.

2.3.7.3 Trade expanded in the 7th and 8th centuries leading to a regrowth of a market economy and production for the market. Villages started to coalesce from the previously dispersed settlement pattern between the 9th or 10th and the 12th century. Open field agriculture and its ridge and furrow ploughing grew in tandem with the villages. Christianity was reintroduced to England at the end of the 6th and spread during the 7th century. Churches were founded by local lords from the later 9th or 10th century and proliferated from then until the 12th century, when the parish system was laid out.

2.3.7.4 There are 14 heritage assets within the 1km study area that are in whole or in part of early medieval of which one is a scheduled monument.

2.3.7.5 The scheduled monument is the ‘Flixborough’ Saxon nunnery & site of All Saints medieval church & burial ground of the former/deserted medieval settlement of North Conesby (**site 78**). It is located outside but immediately adjacent to the Order Limits and was partially excavated between 1989 and

1991. Those excavations uncovered parts of 40 buildings, 39 of which were of early medieval date. During the 8th and earlier 9th centuries, two rows of modest buildings arranged end to end stood either side of a shallow depression in which accumulated a large amount of refuse. One building, which was built on a gravel platform, was oriented east-west and was associated with six graves, was interpreted as a possible chapel. During the 8th century, the site would appear to have been used for feasting, hunting and conspicuous consumption. During the first half of the 9th century, the site has been interpreted as a possible nunnery or male monastery, largely due to the character of some of its the artefacts. These included 27 styli (writing implements) made of iron, copper alloy and silver, and a lead plaque inscribed with a cross followed by seven names in Old English, including two female and five male names. The interpretation of this phase of activity being a religious house is far from secure, however. There are no overtly monastic remains, the plaque contained a mix of male and female names, and the assumption that writing and writing implements were the preserve of churchmen and that literate churchmen never worked on secular estates may be unsound. Furthermore, the accumulated refuse in the central depression flanked by the dual row of buildings contained elaborate textiles and dress fittings that do not fit well within a monastic context. After this 'monastic' phase of activity, the site was reconfigured for grain storage during the mid-to-late 10th century and engaged in woodworking, smithing and trade in the later 10th century.

2.3.7.6 It is possible that during the early to mid-9th century that the site was one of the pseudo monasteries that the Venerable Bede complained about in his writings during the earlier 8th century. Bede describes how certain secular noblemen converted their estates to 'monasteries' as a tax dodge, as monasteries had tax-exempt status. Alternatively, it may always have been a secular estate. Martin Carver, the 20th-century re-excavator of the Sutton Hoo burial mounds in Suffolk, doubts it was ever a religious site or even an estate centre, largely on account of the modest form and scale of its buildings. Rather, he thinks it most likely to have been a production centre for a nearby estate centre which remains to be identified.

2.3.7.7 The site was first observed in section in a commercial sand pit. Prior to archaeological excavation, two metres of wind-blown-sand overburden had to be removed my mechanical excavation from above the archaeological remains. This overburden preserved but also concealed the site from view before it was exposed by quarrying.

2.3.7.8 The scheduled monument also contains the site of the church that served the deserted village of North or Little Conesby. A hoard of Middle-Saxon woodworking tools (**site 79**) deposited within two lead tanks was found during sand quarrying at Flixborough in 1994 adjacent to the south-western side of the scheduled monument, adjacent to where early medieval occupation remains were excavated in 1933 ahead of destruction for sand extraction (**site 67**).

2.3.7.9 Two early Anglo-Saxon brooches, which may have accompanied an unidentified pagan burial, were found on the site of Normanby Distribution

Park (**site 72**) and early medieval artefacts of uncertain date and character have been recovered from Great Conesby (**site 41**). Early medieval cremation urns were recovered from Bagmoor (**site 93**). Early medieval pottery sherds have been found on Crosby Warren (**sites 47, 49, 50, 51**), as have two bronze-coated early Irish bells (**site 49**), all located well outside the Order Limits.

2.3.7.10 Most of the early medieval assets described above are located on or adjacent to deposits of wind-blown side recorded by the BGS. It may be that the light soils that develop on that parent material were attractive because they were ready cultivable by the light ploughs prevalent during that archaeological period.

2.3.8 Medieval (1066 -1540)

2.3.8.1 During the medieval period prior to 1348, villages and their cultivated land grew to their maximum extent. Agriculture was focussed upon arable production, and the ploughland was cultivated by means of the open-field system. Given the extensive pastures flanking the River Trent, however, farming within the study area is likely to have a greater pastoral component than was the case with most Lincolnshire villages. Many villages already had a parish church by the time of Domesday Book (1086); those that did not got them prior to 1348. Secular power was frequently administered from castles during the earlier part of the period, and monasteries and nunneries with their large agricultural estates punctuated the landscape.

2.3.8.2 The Black Death of 1348 killed approximately 40% of the population of Britain in one year, and subsequent outbreaks of bubonic plague kept the population low for 150 years or more. Population decline led to a collapse in the demand for and the price of grain. Conversely, population decline fuelled wage growth and peasant demand for meat. Meat prices, therefore, held up. Given that grain production needs an army of labour at harvest time, whereas herds and flocks can be managed by a lone shepherd, there was a collapse in the demand for rural labour and many villages shrank and some were deserted entirely as agricultural land was put down to grass.

2.3.8.3 There are around 17 heritage assets within the study area that are in whole or in part of medieval date or possible medieval date. Four of these assets are designated; two of are scheduled monuments, while one is a Grade I and another a Grade II listed building.

2.3.8.4 The scheduled medieval settlement site at North Conesby (Flixborough Saxon nunnery & site of All Saints medieval church & burial ground, **site 78**) was discussed at some length in the previous section. It is the site of the medieval church and its burial ground that is of interest in this section. The earliest church on this site is believed to be of Norman date. The church served the village of North or Little Conesby, which fell into decline due to the Black Death and became deserted. The chronology of its desertion is not known in detail, but the medieval church was demolished in 1789. It is marked on the Ordnance Surveyor's drawing of 1816 where it is labelled as 'Flixborough Old Church'. This map also indicates the extent of the historic settlement as

extending across the west-facing slope of wind-blown sand as far west as the historic lane that runs along the bottom of the slope at this point. At this point the lane also marks the eastern edge of the Order Limits. Historic aerial photography indicates earthwork traces of the settlement extending beyond this track into the development zone (**site 80**). The date of these remains is unknown but could potentially be medieval in origin

2.3.8.5 East of the Flixborough scheduled monument and immediately west of Normanby Enterprise Park are the remains of North Conesby Moat, which was fully excavated in 2003, having been buried beneath spoil heaps from Normanby Park Steelworks in the post-war period. The excavations recorded the remains of the hall, gatehouse and other ancillary buildings within the moat, which had been built in the 13th/14th-century and had been demolished in the 16th century, and the remains of a bridge and causeway that crossed the southern arm of the moat (**site 77**). The bridge was also of 13th/14th-century construction and the causeway had been built in the 16th century. The bridge was preserved in situ. To the east of these assets lay a medieval deer park (**site 75**) associated with the moated site at North Conesby. The establishment of this park may have been the cause of the depopulation of the village of North Conesby. Most of the former deer park now lays beneath Normanby Enterprise Park.

2.3.8.6 The site of the deserted medieval village of Conesby (**site 42**) surrounds what is today Conesby Farm. A sequence of three square or sub-rectangular enclosures with internal features, visible as cropmarks on air photographs approximately 80m east of the farm, which were confirmed by trial excavations in this area during 2015, which revealed medieval features including wall foundations (**site 43**), suggest the village lay the immediate vicinity of Conesby Farm. Historic mapping predating the development of Normanby Park steelworks shows a trackway – which also formed the parish boundary between Flixborough and Conesby – running directly westwards, crossing the floodplain to meet the east bank of the Trent at Neap House (**site 113**). This is reminiscent of the track connecting Flixborough village with Flixborough Stathe and presumably perfomed a similar function historically.

2.3.8.7 Flixborough (**site 106**) was a medieval settlement listed in the Domesday Book. Amcotts (**site 109**), on the opposite side of the Trent, connected to Flixborough by a ferry, is a shrunken medieval village.

2.3.8.8 A document dated 1347 refers to a place called Troysfontaignes (**site 102**), south of Burton Stather. As depicted in the NLHER, both of these assets are located well outside the Order Limits. However, it should be observed that the site of Troysfontaignes has not yet been identified with confidence. Adjacent to the site identified in the NLHER is the site of St Aniel's Well in Burton Wood. In reality it seems likely that they are one and same place. A healing well is said to have existed at this location and to have been much celebrated in the cure of sores and wounds etc.

2.3.8.9 A second medieval scheduled monument is Sawcliffe medieval village and moated site, to the east of the Order Limits at Dragonby (**site 62**). The monument includes the buried and earthwork remains of the medieval village

of Sawcliffe and the earthworks of a moated site and later house and garden features, all located to the south and west of Sawcliffe Farm. The settlement of Sawcliffe is thought to date from at least early medieval period and is mentioned in Domesday Book. Sawcliffe appears to have been badly affected by the Black Death as it was one of those villages granted over 50 per cent relief from taxation in 1354. It is believed to have been reduced to a single farm by 1600. The asset is of substantial archaeological value. It is located outside but immediately adjacent to the Order Limits.

2.3.8.10 The Grade I listed building is Church of St Lawrence (**site 77**), Scunthorpe, which is principally of 12th-14th century construction. The Grade II listed building is grave slab in the associated graveyard.

2.3.9 Post-medieval (1540-1900)

2.3.9.1 In order to understand the historic landscape of the NGLEP site, it is necessary first to understand the history of the drainage of the floodplain upon which it sits. This is likely to have commenced in the medieval period, with drainage dykes running beside trackways connecting the high ground to the east with the river (such as those connecting Flixborough and Conesby with the Trent). Historic mapping and place-name evidence suggests that much of the floodplain remained unenclosed marshland into the post-medieval period. The Isle of Axeholme to the west of the Trent was drained by Cornelius Vermuyden in the 1620's. It is likely that drainage of the wetlands on the east bank of the river also accelerated in the seventeenth century. The Flixborough Estate map of 1778 (Figure 4) shows that the parish had already been drained and enclosed by that period under the auspices of the forward-thinking Sheffield family of Normanby Park. It also indicates the extent of the former marsh through field names, with many of those lying on the floodplain at the foot of the sandy slopes to the south of Flixborough being labelled as 'car' (=marsh). Further south, the inner portion of the floodplain in the parishes of Scunthorpe, Frodingham and Brumby remained unenclosed common land into the early nineteenth century (Figure 5).

2.3.9.2 Flixborough formed part of the extensive estates of the powerful Sheffield family (of Normanby Park) by the eighteenth century. They were innovators and early industrialists and were consequently early to enclose the open marshland on their estates. In 1778 they commissioned an estate map (Figures 5-6). This of great interest in that it shows the landscape as it was before the industrial development and land management changes of the nineteenth century (including warping). In particular it shows detail of the historic layout of Flixborough Staithe/ferry, where a small group of buildings stood to the east of the ferry wharf (**site 132**). One building stands immediately east of the ferry wharf with two long buildings further east on the north side of Staither Road. Later Ordnance Survey mapping identifies this group of buildings as Ferry Boat Inn, which was situated on and immediately south of the current entrance to the river port from Staither Road.

2.3.9.3 The 1778 map shows a group of small enclosures/'crofts' that had grown up to the north of these buildings (**site 7**). Flixborough Industrial Park today covers almost precisely the extent of these enclosures, although early

Ordnance Survey mapping (Figures 6-8) show that they were integrated into larger fields early in the nineteenth century. The first edition of the Ordnance Survey (Figure 8) shows 'Ferryhouse Inn' and adjacent buildings very much as they were a century earlier. Timbers forming the remains of the ferry wharf survive on the foreshore at Flixborough Staithe.

2.3.9.4 From the ferry, Staither Lane turned south along the river bank, with another smallholding looking onto the river. The close to the south of this contains a 'brickiln' (**site 124**).

2.3.9.5 The 1778 map labels the field within which the AGI/substation will be developed (to the east of the industrial estate) as 'Limekiln Close' and shows a single kiln on its western side. (**site 119**). Opposite this kiln, in the next field to the west – on the opposite side of what is today 'First Avenue' – the map shows a small square quarry c.60m north-south x 45m east-west apparently labelled 'limestone' (**site 123**). A brick kiln on the riverbank further south (**site 124**).

2.3.9.6 By the later eighteenth century, warping had become a widespread technique for the enrichment of soils on low-lying soils in the region. This involved building banks and sluice gates around field to take advantage of the high spring tides, trapping the silt-rich waters of the Trent. As the waters receded, the sluice gates were opened leaving behind a rich deposit of alluvium, very substantially improving the fertility of the land. In this way the ground level could be raised by a metre in as little as two to three years of high spring tides.

2.3.9.7 Evidence of warping drains are found at various locations within the study area, including west of Burton Wood, and in the southernmost part of the study area, on Brumby Common and east of Burringham. The land at Scunthorpe, Frodingham and Brumby shown as unenclosed common land on the 1816 surveyor's drawing was warped as part of the enclosure process in the 1830's. It was only in the 1840's that the Sheffields got round to warping the low-lying fields that had been enclosed a century earlier (Smith 2014).

2.3.9.8 The enclosure of land-holdings and improved land drainage facilitated the creation of new, dispersed farmsteads often on low-lying land in the Trent valley. The styles and layouts of those farms are illustrative of the local vernacular and agricultural practices at the time of their construction. Examples within the study area include North Grange Farm (**site 116**), Sawcliffe Farm (**site 6**) and Crosby le Moor Farm (**site 115**).

2.3.9.9 After Joseph Winn ascertained that the ironstone beneath his land at Appleby, Scunthorpe, Frodingham and Brumby was of suitable quality, he leased land there to the Dawes Brothers, ironmasters of Barnsley. The earliest mines were located at and beneath the sandy warrens of Scunthorpe and Frodingham and spread north and south from there. They started mining in 1860, and initially transported the ore via a new mineral railway and a bridge

across the Trent, whence it was carried by the South Yorkshire Railway from the Trent's west bank to their works in Yorkshire[5].

2.3.9.10 Shortly thereafter, the Trent Iron Works were built for the Dawes Brothers, in 1862-4, and were soon followed by the Frodingham Iron Works, built by Joseph Cliff. These became operational in 1865. In 1888, the Cliff brothers built a steel plant beside their iron works, and in 1912, John Lysaght opened the Normanby Parks works. In 1916, the industry would be nationalised, and these works would become part of British Steel.

2.3.9.11 Before 1860, Frodingham parish, which contained the townships of Brumby, Frodingham, Scunthorpe and Crosby, was thinly populated, and was agricultural in character. After that, the population of the area grew rapidly to supply the various mines and iron and steel works. There was a veritable population boom between 1881 and 1901, when the population increased from 5,758 to over 10,000 (Kendall 1938).

2.3.9.12 In response to the demand for new housing at this time, Rowland Winn designed and built New Frodingham. The agricultural village of Crosby also expanded rapidly at this time. Both contain conservation areas and listed buildings.

2.3.9.13 At the elite social level, the post-medieval period is characterised by its country houses within their landscape parks. The present-day Normanby Hall (**site 99**), a Grade I listed building, was built by Sir Robert Smirke for Sir Robert Sheffield between 1825 and 1830. Built in Ancaster limestone ashlar in the classical style, its symmetrical main façade faces west-north-west into a well-wooded, naturalistic, non-designated landscape park (DBA asset 260). Within the study area, the park contains a non-designated early 19th Century deer barn (**site 98**). The southern entrance to the park is controlled by the classically styled South Lodge Gateway (**site 100**), a Grade II listed building. The present-day hall replaced an 18th-century pile, which in turn replaced a Tudor hall designed by Robert Smythson, the designer of several great houses during the Elizabethan era.

2.3.10 Modern (1900 –Present day)

2.3.10.1 The late-19th-century building boom fused the various independent townships into a single urbanised and industrialised entity. In 1919, this de facto union was recognised legally with the formation of the borough of Scunthorpe. The initial and subsequent population increases of the Scunthorpe area were due to the workers needed to mine ironstone and work at steelworks.

2.3.10.2 In 1905, the Normanby Park works, a steel production plant, was initialized by John Lysaght (Jones 1990). In 1910, a village was established on Elwes land for Roman Catholic steelworkers . This village became known as Dragonby. Lady Winifrede Elwes named it after the nearby 'Dragon' geological outcrop. The plant was served by the Lindsey Light Railway constructed 1906-1913,

[5] In formation on mining and the Iron and steel production in this section has been taken from, Wright, N. 2001, 'Ironstone Mining', in *An Historical Atlas of Lincolnshire*, S Bennet and N Bennet (eds.), Phillimore, Chichester, 115-116.

which included a line connecting it to Flixborough Wharf (**site 131**). This ran from the site of the old Ferry Boat Inn north along the river bank before curving north and then east to pass south of Flixborough village to the steelworks.

2.3.10.3 During WWII, protecting the nation's industries was vital to the war effort. This included the mining and steelworks in the project area. Defences constructed to protect them include an anti-aircraft battery east of Neap House Farm within Order Limits (**site 10**).

2.3.10.4 Post War, in 1948, the Dragonby mines were constructed and tested new ways to extract iron ores (Stace 2015). The Normanby Park steelworks continued to flourish in the post-war period, their spoil heaps spilling westwards across the landscape immediately to the south of North Conesby abandoned medieval settlement, engulfing, among other things, the former moated site. They were shut down in the 1980s.

2.3.10.5 Twentieth century Ordnance Survey mapping (Figure 9) shows the development of Flixborough Wharf from a local ferry crossing to an industrial river port after the construction of the railway. By the middle of the century a nitrogen fertiliser works had been constructed inside the loop of the railway to the north of the historic ferry crossing. A group of large settling tanks stood immediately north of the Ferry Boat Inn. In 1974, the Flixborough explosion at chemical plant killed 28 people and devastated most of the buildings at Flixborough Staithe, including many of the historic buildings.

3. CONCLUSIONS

It is very clear from the chronological review above that the site of the NGLEP falls into two very different types of historic landscape: the floodplain and the high ground to the east. With few exceptions, all of the evidence for pre-modern human settlement comes from the higher ground. Prehistoric settlement, in particular, is striking concentrated on the wind-blown sands of the west-facing slopes of the Scunthorpe mudstone ridge. It is clear, therefore, that development in these areas does face considerable risk of encountering significant buried archaeological remains.

This does not mean that significant archaeology does not exist in the floodplain. It is, though, likely to be quite different in nature and, in most cases, more deeply buried. Until the large-scale drainage projects of the seventeenth century onwards, human activity in the floodplain is likely to have been seasonal and focussed on the Trent and the smaller waterways running into it. Analysis of organic deposits from cores in the vicinity of the site has demonstrated the presence of buried land surfaces/palaeochannels dating from the Mesolithic to the Iron Age. However these are typically found at depths greater than 2m below ground level (Lillie & Bunting 2014, i-ii), partly as the result of warping.

While ongoing surveys will certainly provide greater clarity, the desk-based sources considered above allow some preliminary conclusions to be drawn about the potential for the discovery of buried archaeology in different parts of the NGLEP. These are considered on the basis of different landscape zones.

3.1.1 Zone 1: Trent Floodplain

This comprises that portion of the Trent floodplain that lies immediately east of the current river channel and within which deep deposits (up to c.12-13m deep) of peat and/or peaty clay have been recorded in boreholes. Until the drainage and warping schemes of the seventeenth century onwards, this zone would have been too wet for cultivation and intermittently flooded for much of the year. It is unlikely that significant remains of settlement will be encountered in this area, with the possible exception of Flixborough Stathe itself (**site 7**) where medieval riverside activity is known to have occurred. There is potential for earlier prehistoric activity and material (eg flint scatters, wooden revetments, boats, votive deposits of metalwork) to occur, although this is likely to be buried beneath overlying warp deposits.

The ERF plant, concrete manufacturing, polymer plant and associated laydown areas/haul roads fall within this zone. Geotechnical ground investigations on the site of the ERF plant have identified peat deposits at depths of between 4.70-6.70m to 11.70-12.30m below ground level. These would be impacted by the proposed fuel bunker, which will be excavated to an estimated depth of 10m.

3.1.2 Zone 2: Trent Valley Fringe

This zone lies to the east of Zone 1 and runs up to the base of the west-facing slopes of the higher ground. Here, on the floodplain fringe, the alluvial deposits are much shallower, as the underlying blown sand rises up, forming small islands in places. Much of this zone was historically occupied by uncultivated and unenclosed common land, including areas of sandhills on Brumby Common, at the southern end of the scheme. There is the potential for significant archaeological remains to occur in this zone, from settlement of the Neolithic or Bronze Age periods, to potentially seasonal occupation in the Iron Age, Roman and medieval periods. In particular, there are a number of cropmark sites (**sites 8-13**) in the area to the west of the Foxhills Industrial Estate which could well be Iron Age or Roman in date.

The energy storage and refueling facilities, pipeline corridor running alongside the M181 and associated laydown/construction areas fall within this zone.

3.1.3 Zone 3 – Blown Sand Slopes

The sandy slopes to the east of the valley are rich in archaeological remains, including the mid-late Anglo-Saxon settlement at Flixborough. The sand and gravel quarry at Willow Holt (**site 4)**, south-east of the Flixborough Industrial Estate, has produced significant multi-period remains of Neolithic, Bronze Age, Iron Age and Roman date. Similarly, 500m further south are the former medieval settlement of North Conesby, within which the scheduled remains of the medieval church and earlier Anglo-Saxon remains of the 'Flixborough nunnery' lie (**Sites 78-84**). Iron Age and Roman remains have also been found in this area.

The Gas AGI and electricity substation to the east of the Flixborough Industrial Estate and a portion of the pipeline corridor running beside the A1077 are the two elements of the project which will impact this zone. Where the ground has not previously been disturbed, it seems highly likely that buried archaeological remains exist in these areas. These may be deeply buried by deposits of blown sand in places.

3.1.4 Zone 4 – Mudstone Ridge

There are widespread traces of past settlement high ground to the east of the windblown sand slopes of the Trent Valley, with Dragonby, situated on a second ridge further east, being the most important Roman site in the region. The village centres of many of the medieval parishes that ran down to the west bank of the Trent (Flixborough, Conesby, Crosby, Brumby) were also situated on the high ground, connected to riverside wharves by a series of east-west trackways.

NGLEP impacts in this zone will be largely limited to historic or existing transport routes: the railway connecting Flixborough Staithe to the Normanby steelworks and the A1077 running east into Frodingham. Where previously

undisturbed areas are affected, there is the potential for remains of all periods to be encountered.

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APPENDIX A GAZETTEER OF HERITAGE ASSETS

Asset Number	Asset Name	HER/NHLE No	Designation & Grade	NGR	Period	Description
1	Flint findspot	MLS19396	N/A	486628E 414867N	Prehistoric	Flint scraper and seven flakes, found north of Stather Road, 1996.
2	Flint findspot	MLS19350	N/A	486720E 414620N	Prehistoric	Flint flake, found north of Stather Road, 1996
3	Roman coins	MLS19645	N/A	487040E 414830N	Roman	At least four Roman coins recovered in Bridge Field during metal detecting in 2000. Brought to North Lincolnshire Museum by the finder. One coin of Tetricus I (270-273), two coins of the House of Constantine (330-335AD), one of Constans (343-348). Scatter of lead melt also reported in the same field. Coins retained by the finder.
4	Flixborough sand quarry, 2001	MLS19691/19694/19695/19681/19693/19690	N/A	487060E 414679N	Neolithic, Roman, IA, BA	Flixborough Sand Quarry, excavations 2001: i) Pit containing Neolithic sherds ii) MBA cinerary urn; iii) Iron Age inhumation and occupation; iv) clay lined pits, possibly Iron Age v) Roman ?cremation
5	RB quern, E end of Conesby mine	MLS1977	N/A	489720E 414220N	Roman	Romano-British gritstone quern found complete in ironstone mine on Flixborough-Scunthorpe boundary.
6	Flint sickle, Dragonby	MLS1923	N/A	490020E 414090N	Bronze Age	A complete Early Bronze Age flint sickle, found near Dragonby in 1935. On display at North Lincolnshire Museum.
7	Med/PM settlement, Stather	MLS19737	N/A	486109E 414301N	Medieval	A document (an Inquisition post mortem) dating to 1299 references contemporary settlement at Flixborough Stather. The 1778 map shows a small group of buildings beside the ferry crossing to Amcotts including what is later identified as Ferryhouse Inn (now demolished – on the site of the entrance to the modern wharf). 2021 GPR survey identified the remains of the former inn and other structures under the entrance to the wharf (Wessex Archaeology 20220)
8	BA pottery, flint implements, SW of Flixborough	MLS1968	N/A	487045E 413764N & 487100E 413600N	Mesolithic; Neolithic; Bronze Age	Surface finds of Mesolithic microliths, flint scrapers, two Neolithic leaf-shaped arrowheads Beaker pottery and Bronze Age pottery sherds.
9	Cropmarks, Atkinsons Warren	MLS17778	N/A	487200E 413700N	Iron Age; Roman	Cropmarks depicting a rectangular enclosure, trackway and ditches south of Flixborough chicken farm. Undated but its

						morphology suggests a settlement enclosure of Iron Age or Roman date within its contemporary agricultural landscape.
10	Heavy anti-aircraft battery (site of), east of Neap House Farm	MLS21394	N/A	486700E 413000N	Modern	Site of Second World War heavy anti-aircraft battery east of Neap House Farm, designated 'Scunthorpe H6' or 'Scunthorpe E'. It was manned by 221 Battery of the 91st Royal Artillery Regiment in 1941, and was listed as unarmed in 1942.
11	Linear cropmarks and possible enclosure	MLS21377	N/A	486895E 413001N	Iron Age; Roman	Multiphase cropmarks including parallel linear features, a possible enclosure, widespread pitting and a later access track lading to a possible extraction pit. The described form of the asset suggests an Iron Age or Roman stock or settlement enclosure within its immediate farming landscape.
12	Enclosure, W of Holyrood Drive	MLS20573	N/A	487455E 413065N	Iron Age	A heart-shaped enclosure, visible as a cropmark on an aerial photograph taken in 1989, is located immediately west of Holyrood Drive. The described and depicted form of the asset suggests a date centring on the Iron Age.
13	Enclosure, S of Ferry Road West	MLS20572	N/A	486748E 412716N	Bronze Age; Iron Age	A fragmentary sub-rectangular enclosure is visible as a cropmark on aerial photographs taken in 1989. The enclosure is located on a discrete area of sand immediately south of Ferry Road West. It measures approximately 44m x 50m and appears to have a conjoined section of ditch on its western side. At least one internal pit is visible in the southern half of the enclosure. Recent Environment Agency Lidar survey information indicates that this enclosure is located on a slightly raised area 1m above the surrounding land.
14	Semi-circular cropmark, west of North Grange Farm	MLS21095	N/A	484636E 408295N	Unknown	A large undated and uncharacterised cropmark of semi-circular ditched feature c.180m in diameter, plotted from an aerial photograph.
15	Ring ditch, Brumby	MLS25906	N/A	486464E 409575N	Bronze Age	A ring ditch was detected during a geophysical survey on Brumby Common West, 2014-15. It was interpreted as the remains of a potential Bronze Age round barrow.

	Common West					
16	Undated hearth	MLS22698	N/A	486600E 411383N	Unknown	An undated hearth structure was recorded beneath a layer of peat during an archaeological evaluation on land north of Doncaster Road, 2007. There were no associated finds and no scientific dating was carried out, but the hearth may have been prehistoric.
17	The Berkeley Hotel	HHLE 1426932 MLS26047	Grade II listed building	487170E 411260N	Post-medieval	Large roadhouse, opened in 1940, designed by Scott & Clark of Wednesbury. Mellow red brick with buff brick and faience dressings, hipped pantiled roofs, brick chimneystacks. Mainly 2-storeys plus basement. Exterior with Neo-Georgian, Moderne, Art Deco and Oriental influences. Interior incorporates classical and Art Deco influences.
18	Flint, pm pottery and slag	MLS20327	N/A	486761E 411752N	Neolithic; Bronze Age; Post-medieval; Modern	A field walking survey undertaken in advance of a proposed residential development recovered 16 pieces of flint, as well as post-medieval and modern material. The flint comprised two early Neolithic blades, a Neolithic or Early Bronze Age end scraper, Two primary flakes, a tertiary flake, two retouched flakes and 8 pieces of unworked flint. he majority of the flints were located near a small copse on the western edge of the site, a slightly elevated area which was the largest of three areas of wind-blown sand within the fieldwalked area.
19	Flint implements, pottery, RB phallus, Atkinson's Warren	MLS1916	N/A	487900E 412300N	Neolithic; Bronze Age; Iron Age; Roman	Flint implements, pottery, Romano British phallus, found on Atkinson's Warren.
20	Stone axe & flints, Crosby, Scunthorpe	MLS1939	N/A	488200E 412730N	Mesolithic; Neolithic; Bronze Age	Flint artefacts comprising microliths flint flake, scrapers, leaf-shaped arrowhead, flint knife, small roughly flaked stone axe with ground cutting edge found at Vicker's Sandpit in 1949. The site was not used for commercial sand extraction.

21	Flint microliths, other implements, Crosby	MLS1940	N/A	488450E 412750N	Mesolithic; Neolithic; Bronze Age	Flint microliths, scrapers, leaf-shaped arrowhead found at this approximate location in 1935.
22	Bronze Age/Iron remains, S of Phoenix Parkway	MLS21264	N/A	488677E 412743N	Neolithic; Bronze Age	Bronze Age linear features, cremation pits and post holes; Iron Age enclosure ditches were recorded during excavations on land south of Phoenix Parkway in 2008 and 2009.
23	Neolithic axe, Crosby Allotments	MLS22399	N/A	488853E 412801N	Neolithic	A Neolithic polished stone axe was found in allotments gardens and donated to North Lincolnshire Museum in 1996.
24	Rectangular enclosure (cm)	MLS1872	N/A	488000E 412000N	Unknown	Rectangular cropmark enclosure photographed in the summer of 1961 and measuring approximately 50-60m square
25	Flints & beaker sherds, Crosby	MLS1910	N/A	488090E 412050N	Neolithic; Bronze Age	Flints & Bronze Age beaker sherds, Ferry Road bowling green area, 1957.
26	Stone axe, Diana Street, Crosby, Scunthorpe	MLS1921	N/A	488390E 411980N	Neolithic	Stone axe found at Diana Street, Diana Street, Crosby, Scunthorpe, in 1961.
27	STONE AXE, THEODORE GARDENS, CROSBY, 1942	MLS1937	N/A	488710E 411890N	Neolithic; Bronze Age	A prehistoric stone axe, found at Theodore Gardens, Crosby, 1942. In North Lincolnshire Museum.
28	Linear bank and square enclosure, Foxhills Plantation	MLS22821	N/A	488068E 413270N	Unknown	An undated square earthwork enclosure within Foxhills Plantation. It may relate to other prominent linear earthworks nearby.

29	Watercourse or ditch, Normanby Enterprise Park	MLS21312	N/A	488117E 414132N	Medieval	A north-south watercourse or ditch was recorded in two trial pits during archaeological observations at Normanby Enterprise Park, 2008. It was associated with the moat at Little Conesby, and the line still forms the boundary between Flixborough and Scunthorpe.
30	Former Barnsley to Barnetby Railway	MLS8828	N/A	489690E 410839N	Post-medieval	TheTrent, Ancholme & Grimsby Railway line (M.S. & L.R.), later the Barnsley to Barnetby line (G.C.R.).
31	Former Church of St John	NHLE 1083612; MLS5848	Grade II* listed building	490012E 411492N	Post-medieval	Former church, now in use as an arts centre. Built 1890 by J S Crowther for Rowland Winn, 1st Lord St Oswald. Rock-faced blocks of local Frodingham ironstone with Ancaster limestone ashlar dressings and carved details, slate roof. Gothic Revival style.
32	Roman coins, Glebe Ironstone Mine	MLS1874	N/A	489790E 411830N	Roman	Two Roman coins of Carausius, AD 287-293, and Constantine II, AD 317-340, found near the Winterton Road, Glebe Mine.
33	RB coarseware beaker	MLS1934	N/A	489570E 412030N	Roman	A Romano British coarseware indented beaker, was found by workmen c. 1952. In North Lincolnshire Museum.
34	Finds, Glebe Ironstone Mine	MLS1891	N/A	489670E 412080N	Neolithic; Bronze Age; Roman	Leaf-shaped, barbed and tanged arrowheads, RB indented beaker found 30ft. beneath blown sand, RB greyware jar found 1949, alabaster candlestick with entwined dolphin decoration, lead spindle-whorl.
35	Food vessel, Redbourne mine	MLS1925	N/A	489600E 412970N	Bronze Age	Findspot of a Bronze Age food vessel found in Redbourne Mine, Brosby, in 1941. On display at North Lincolnshire Museum, 2012.
36	Cropmark complex, Orb Lane	MLS20611	N/A	489401E 413254N	Bronze Age; Iron Age; Roman; Post-medieval	Cropmark complex visible across agricultural land on aerial photographs taken in 2003. It comprises two ovoid and one rectangular enclosure, a ring ditch, possible pit alignments and continuous linear features. Two ditches, one containing Iron Age pottery, were recorded during an archaeological evaluation in 2015. The pottery

						sherds were mainly calcite tempered. Some were decorated with roller stamped lines, including chevron patterning and circular impressions. Pottery with similar decoration was found during excavations at the Dragonby site, 1.2km to the north-east, in the 1970s.
37	Roman, Medieval and Post-Medieval Pottery, Conesby Farm	MLS25898	N/A	sheffield	Roman; Medieval; Post-medieval	Findspots of pottery and ceramic building material, found by Archaeological Project Services during fieldwalking in 2015, in the fields around Conesby Farm. There were four pieces of Roman greyware beaker fragments, one stamped. 18 sherds were medieval, with a broad range of fabric types and dates including Torksey ware of mid-9th-11th century date, Early Medieval Beverley ware of the 12th-early 13th century, North Lincolnshire Fine Sandy ware, and Humberware. They had no particular concentration and were thought to have been distributed through manuring the land.
38	12 ROMAN COINS, CONESBY, 1962	MLS1440	N/A	489500E 413500N	Roman	Findspot of 12 Roman coins with a wide date range, Conesby area, donated to North Lincolnshire Museum in 1962
39	Round barrow (CM)	MLS20612	N/A	489565E 413481N	Bronze Age	The circular ditch, 15m in diameter, of a possible round barrow, was visible on air photographs taken in 2000. It was also detected as a magnetic anomaly during a geophysical survey in 2015.
40	Worked flint, Conesby Farm	MLS25897	N/A	489436E 413556N	Neolithic; Bronze Age	Findspot of two small clusters of worked flint found during archaeological fieldwalking in 2015, to the north and south of Conesby Farm.
41	RB and AS finds, Great Conesby	MLS4650	N/A	489400E 413700N	Roman; Early medieval	Findspot of Roman finds consisting of numerous fragments of pottery, pieces of quern stones, earthenware spindle whorls, and incomplete fibula, the lid of a Roman seal box and a few coins, ranging from Domitian (AD 81-96) to Constantius II (AD 324 -361). A complete RB quern was found at the east end of Conesby mine. A Saxon girdle-end (sic) of fine workmanship was also found.

42	Great (South) Conesby DMV	MLS1854	N/A	489400E 413800N	Medieval; Post-medieval	Great (South) Conesby Deserted Medieval Village. Mentioned in Domesday. The asset is depicted as extending 575m east of Conesby Farm when the evidence suggests the village was located in the fields immediately adjacent to Conesby Farm.
43	Bronze Age urn, Conesby iron mine, 1915	MLS1912	N/A	489670E 413900N	Bronze Age	Findspot of a Bronze Age 'bucket' urn was found at Conesby iron mine, 1915. Other Bronze Age pottery and Mesolithic-Bronze Age flint finds have been reported from this mine. On display at North Lincolnshire Museum, 2012.
44	Roman, medieval and post-medieval pottery, Conesby Farm	MLS25898	N/A	489341E 413936N	Roman; Medieval; Post-medieval	Findspot of four pieces of Roman pottery, found with larger quantities of medieval and post-medieval pottery during fieldwalking at Conesby Farm, 2015. They had no particular concentration and were thought to have been distributed through manuring the land.
45	Mesolithic-BA occupation, W of railway line, Crosby Warren	MLS1945	N/A	490050E 413300N	Mesolithic; Neolithic; Bronze Age	Findspot of Mesolithic-Bronze Age occupation, west of railway line, Crosby Warren
46	Flint implements, prehistoric pottery, Crosby Warren	MLS1693	N/A	490500E 413000N	Neolithic; Bronze Age	Findspot of flint implements, prehistoric pottery, Crosby Warren
47	Marginal RB, Emed finds, Crosby Warren	MLS1933	N/A	490500E 413000N	Roman; Early medieval	Findspot of Romano British and early medieval finds (RB mortarium sherds, AS sherds, bone implement
48	Perforated axe hammer, Crosby Warren	MLS1931	N/A	490500E 413200Nm	Bronze Age	Findspot of a Bronze Age perforated axe hammer, found during ironstone quarrying, Crosby Warren. On display at North Lincolnshire Museum, 2012.

49	Anglo Saxon iron bell	MLS1857	N/A	490830E 413220N	Early medieval	Findspot of one of two bronze-coated iron bells found on Crosby Warren. They are similar to those associated with early Irish monasteries and may be relics of missionary activity in the 7th century, when St Paulinus and St Chad brought Christianity to the Anglian Kingdom of Lindsey.
50	Flint implements, RB & AS sherds, Keeper's Cottage	MLS1929	N/A	490870E 413280N	Mesolithic; Neolithic; Roman; Early medieval	Findspot of flint implements, Romano British & Anglo-Saxon sherds, Keeper's Cottage
51	Pottery, intaglio, flints & beaker, Crosby Warren	MLS1871	N/A	490710E 413370N	Neolithic; Bronze Age; Roman; Early medieval	Findspot of flint implements and Beaker ware, flint sickle fragment, RB pottery, RB nicolo intaglio of Mars with Victory on right arm, spear in left, probably 3rd cent, AS pottery sherds. Found in 1934.
52	Palaeolithic tanged blade	MLS22649	N/A	490900E 413600N	Palaeolithic	Findspot of a flint tanged blade of Late Upper Palaeolithic date, said to have been found by AL Armstrong at Risby Warren/Crosby Warren, along with a cache of obliquely backed points. Jeffrey May regards these artefacts as potentially indicative of the location of a Late Upper Palaeolithic hunting camp (May 1976, 28).
53	Bronze Age urn, ironstone workings, Crosby, 1932	MLS1810	N/A	490200E 413400N	Bronze Age	Findspot of the lower half of a large Middle Bronze Age urn. Found at the former Midland ironstone workings, Crosby, 1932
54	RB kiln (site of), Conesby,1931	MLS1865	N/A	490160E 413520N	Roman	Site of Romano British kiln (site of), Conesby, 1931. It was destroyed before it could be examined.
55	`Lodge Hill' tumulus (site of)	MLS1884	N/A	489990E 413770N	Bronze Age	`Lodge Hill' was a possible tumulus (burial mound). Destroyed by ironstone mining, 1911

56	Romano-British pottery	MLS4641	N/A	490730E 413760N	Roman	Findspot of Romano-British pottery. The pottery is likely to be associated with the scheduled site at Money Field (asset 170).
57	Mesolithic - Bronze Age Activity, Dragonby Money Field	MLS20698	N/A	490458E 413880N	Mesolithic; Neolithic; Bronze Age	Findspot of Mesolithic flint, Neolithic - Early Bronze Age flint and pottery, pits and a possible structure, recorded during excavations in Dragonby Money Field, 1964-1973.
58	Money Field Roman site, Dragonby	NHLE 1005224; MLS1851	Scheduled monument	490605E 413909N	Iron Age; Roman	Money Field' IA/RB settlement site, Dragonby. Parts of the site were excavated in the 1920s, 1960s and 1970s. These excavations revealed Iron Age roundhouses and associated ditches of 2nd and 1st century BC date. During the Roman period, rectangular ditched enclosures were located adjacent to a metalled road. The cropmark data shows they are beside a junction of three roads. The enclosures have been found to contain stone and timber buildings, wells and ovens. A pottery kiln was found to have operated in the late-first century. Other, unexcavated, and undated pottery kilns are present on site. The enclosures date to the second and third centuries. A building tentatively interpreted as a temple was excavated to the north of the settlement in 1927. The asset's name derives from the exceptional number of coins recovered from the site (Whitwell 1992). It is thought that In the Iron Age, the settlement may have been a major sub-tribal or clan centre. Findspot of two Roman bronze figurines of Mars, found within Money Field, Dragonby in the early 1970s. Both are in North Lincolnshire Museum.
59	Roman pottery kilns, E of Dragonby, 1940	MLS2010	N/A	490773E 414008N	Roman	Two RB kilns found 1940 in field to E of Dragonby "Money Field". Both kilns excavated by H E Dudley, 1940; one damaged, other well preserved with arched flue leading to circular oven. No pottery found in kilns, sherds of 2nd cent. pot found nearby. The better-preserved kiln was covered and

						reburied Cropmarks on APs show enclosures, continuation of road from Money Field
60	Cropmarks, Dragonby	MLS19311	N/A	490676E 414425N	Unknown	Cropmark enclosures north east of Dragonby village. They would appear to link to and be contemporary with the cropmarks comprising asset 181
61	Flint scatter, Sheffields Hill	MLS2042	N/A	490800E 414500N	Neolithic; Bronze Age; Medieval	Southernmost extent of flint surface finds along brow of escarpment - flint scrapers, cores, flakes, possible knife fragment, large barbed and tanged arrowhead. There are also medieval pottery sherds, including curfew fragments
62	Sawcliffe medieval village and moated site	NHLE 1017554; MLS1996	Scheduled monument	491120E 414380N	Medieval	The monument includes the buried and earthwork remains of the medieval village of Sawcliffe and the earthworks of a moated site and later house and garden features, all located to the south and west of Sawcliffe Farm. The settlement of Sawcliffe is thought to date from at least the Saxon period and is mentioned in Domesday Book. Sawcliffe appears to have been badly affected by the Black Death as it was one of those villages granted over 50 per cent relief from taxation in 1354. Sawcliffe is believed to have been reduced to a single farm by 1600.
63	Sawcliffe Farmhouse	NHLE 1260343; MLS8506	Grade II listed building	491184E 414556N	Post-medieval	Farmhouse. Late C18 north front probably for Robert Holgate, with rear wing of C17 or earlier origins raised to 2 storeys in C19.
64	Worked flint, prehistoric sherd	MLS2041	N/A	490900E 414800N	Mesolithic; Neolithic; Bronze Age; Medieval	Findspot of flint microliths, points, cores, scrapers, burin, point of flint dagger, prehistoric sherd, and ploughstone.
65	Mesolithic occupation, Sheffield's Hill	MLS1995	N/A	490780E 414970N	Mesolithic	A site at Sheffield's Hill was investigated 1927-1931. The worked flint was thought to be Upper Palaeolithic at that time but is now known to be Mesolithic.
66	Prehistoric finds, Sheffield's Hill	MLS18084	N/A	491000E 415100N	Mesolithic; Neolithic; Bronze Age	Continuation of surface finds along Sheffield's Hill. Many flint implements have been found in the two fields surrounding this location, particularly along the western slope of Sheffield’s Hill, including frequent micro-burins, shouldered

						points, end scrapers. Occasional Beaker sherds have been found.
67	Anglo-Saxon cemetery	MLS15987	N/A	490948E 415320N	Early medieval	Anglo Saxon double cemetery containing 6th and 7th century AD (final-phase) burials. It was excavated by Kevin Leahy and David Williams between 1993 - 1998
68	Flints, Bronze Age pottery Atkinson's Warren	MLS1917	N/A	487500E 413500N	Neolithic Bronze Age	Findspot of flints, Atkinson's Warren, 1933. Bronze Age pottery is said to have been found in the same area by HE Dudley.
69	Flint implements, former area of Atkinson's Warren, 1933.	MLS1918	N/A	487800E 413300N	Mesolithic; Neolithic	Findspot of 'several microliths, cores, flakes, scrapers and 2 leaf-shaped arrowheads.'
70	Two circular features (cm), pre implements, Old Park Farm	MLS1878	N/A	488500E 413200N	Unknown; Prehistoric	Two circular features (cropmark), prehistoric implements, Old Park Farm
71	Flints, Old Park Farm	MLS4651	N/A	488700E 413400N	Neolithic	Findspot of flint microliths, flakes, (some retouched), scrapers, leaf-shaped arrowhead and fragment of another, core, flake from polished flint axe, plough pebble, found in the earlier 20th century.
72	Anglo-Saxon brooches, Normanby Park Steelworks	MLS1616	N/A	488950E 413880N	Early medieval	Findspot of two early Anglo Saxon brooches, Normanby Park steelworks area, 1909. A third was found in the area in 1963, with a pottery cup.
73	BA socketed axe, Normanby Park Steelworks	MLS1935	N/A	488880E 413880N	Bronze Age	Findspot of a Bronze socketed axe found during construction of steelworks in 1911.

74	RB occupation site, Normanby Park Steelworks	MLS1901	N/A	488660E 413900N	Roman	Site of a Romano British occupation site disturbed during the construction of the Normanby Park steelworks
75	Medieval Deer Park, North Conesby	MLS21737	N/A	488542E 413981N	Medieval	Site of a medieval deer park associated with the moated site at North Conesby. The establishment of this park may have been the cause of the depopulation of the village of North Conesby.
76	Mesolithic flintworking site	MLS22815	N/A	487988E 413721N	Mesolithic	Site of a collection of Mesolithic worked flint retrieved from Atkinson's Warren between December 2013 and January 2014. The appear to indicate that knapping and toolmaking was carried out on the site. Test pitting in September 2014 recovered further flint but did not identify a palaeo-surface.
77	Bridge and causeway, North Conesby Moat	MLS20216	N/A	488149E 414403N	Medieval	13th/14th-century wooden bridge across the moat and later (16th century) causeway, North Conesby moat, excavated in 2003. Hall, gatehouse and other ancillary buildings within North Conesby Moat, excavated in 2003. The buildings were principally of 13th/14th-century date and were demolished in the 16th century.
78	Flixborough Saxon nunnery & site of All Saints burial ground.	NHLE 1009382; MLS5018; MLS0158; MLS19738; MLS1971	Scheduled monument	487663E 414373N	Early medieval; Medieval	Anglo Saxon occupation site, excavated 1989-91 by Humberside Archaeology Unit, funded by English Heritage. A rural settlement, in use from the middle to late Anglo-Saxon periods. Six main phases of occupation were identified, dating from the 7th to the 11th centuries. The greatest period of activity was during the 8th to early 11th centuries. The remains of 40 buildings were excavated. These were situated on two parts of a windblown-sand spur separated by a depression that filled with 'rubbish'. The 'rubbish' included 10,000 recorded finds, including many luxury artefacts that were associated with elite lifestyles and activities, including

						literacy. The scheduled area also contains the medieval church of All saints and its burial ground. The Middle Saxon site was tentatively interpreted as a monastery or nunnery in one of its phases, even though its excavator found its nearest parallels in continental high-status secular sites. Also a findspot of a small amount of late-Iron Age pottery and animal bone was recovered during archaeological recording works at Normanby Enterprise Park in 2008. The finds appear to indicate settlement of that date in the area. Martin Carver (2019) has observed that the evidence for this site being monastic in character is not compelling. Carver interprets it as a production site supplying agricultural produce and manufactured goods to a nearby, but currently unidentified, ecclesiastical or secular estate centre.
79	Hoard of Middle Saxon woodworking tools, 1994	MLS17283	N/A	487555E 414253N	Early medieval	A hoard of Anglo-Saxon woodworking tools, deposited within two lead tanks, found during sand quarrying at Flixborough in February 1994. The tools included axes, adzes, spokeshaves, spoon bits and a bill hook. A copper-coated iron bell and the iron shoe from a hoe were also present. The hoard of tools was contained in two large lead vessels. One vessel was inside the other. The hoard consisted of a bell, 12 carpenter's tools and two cultivation tools. The hoard dates to the period of the 8th-10th century.
80	North Conesby - earthwork remains of settlement visible on	Traces of possible settlement plots visible on 1948 aerial image accessed via	N/A	487604E 414073N	Medieval, post-medieval	Earthwork remains of building plots facing onto track running along the west side of North Conesby DMV. Potentially dating back to the medieval period. The 1948 shows a single standing building - Rose Cottage on historic OS maps

	aerial photographs	Britain from Above website: EAW018599H ENGLAND (1948)				
81	Stone axehead, debitage	MLS19431	N/A	487558E 414143N	Mesolithic; Neolithic	Findspot of stone axehead, core and blade-like flake, north of Atkinson's Warren. The finds are likely to be contemporary and could date to the late Mesolithic or the Neolithic.
82	Former site of All Saints Church and graveyard	MLS1965	N/A	487650E 414200N	Early medieval	During 1988 an emergency excavation was carried out at Flixborough, when human remains were encountered during the extraction of sand; 11 skeletons were recorded. All these were extended burials aligned east-west and without grave goods. With one of the burials, however, were iron fittings from a mid or later Saxon coffin. As some graves were cut into earlier burials it appears that the cemetery was in use for some time.
83	Little or North Conesby Deserted Medieval Village , south east of Flixborough. Mentioned in Domesday.	MLS1964	Scheduled Monument	487780E 414330N	Medieval	Little or North Conesby Deserted Medieval Village , south east of Flixborough. Mentioned in Domesday. The site of its church and some other parts of the village are contained within the Flixborough early medieval scheduled monument (NHLE 1009382; asset 218).
84	Flint findspot	MLS19352/19403	N/A	487400E 414400N	Neolithic; Bronze Age	Flint core and three flakes, six sherds of Roman pottery, north east of Willow Holt, 1996
85	Burnt clay and stone, Willow Holt quarry extension	MLS21442	N/A	487142E 414645N	Iron Age; Roman	A burnt clay and stone feature was recorded during an archaeological evaluation in 1997 at Willow Holt quarry extension. There was no direct dating evidence, but Iron Age or Romano-British pottery was found in the vicinity.
86	Mesolithic-Anglo Saxon	MLS1970	N/A	488700E 414700N	Mesolithic; Neoilithic;	Mesolithic-Anglo Saxon finds, `Grangebeck North'

	finds, `Grangebeck North'				Bronze Age; Iron Age; Roman; Early medieval	
87	Anglo Saxon urn, medieval pottery, mine north of steelworks	MLS1972	N/A	488900E 414700N	Early medieval	Anglo Saxon urn, medieval pottery, mine north of steelworks
88	Linear cropmark, south of Bagmoor poultry farm	MLS20984	N/A	489219E 415251N	Unknown	At least one linear cropmark, measuring approximately 50m and visible on a 1973 aerial photograph. Date uncertain, but not aligned with modern field boundaries.
89	EBA notched flint dagger, Flixborough mine, 1928	MLS1966	N/A	489550E 415020N	Bronze Age	A perfect Early Bronze Age notched flint dagger, found during mining in 1928. On display at North Lincolnshire Museum.
90	Possible enclosure (CM)	MLS2006	N/A	490000E 414700N	Post-medieval	Possible enclosure (cropmark).
91	Site of (Flixborough Warren Farm), Flixborough	MLS25307	N/A	489465E 415357N	Post-medieval	Site of (Flixborough Warren Farm), Flixborough. Demolished 19th century unlisted farmstead. Regular courtyard of U plan. The farmhouse was detached from the main working complex. Isolated location.]
92	Anglian cinerary urn, possible burial mound	MLS1982	N/A	489640E 415800N	Early medieval	An Anglian cinerary urn was recovered from a 'low mound' during ironstone quarrying, some time before 1949. In North Lincolnshire Museum.
93	Anglo-Saxon urn, Bagmoor	MLS1083	N/A	490100E 415800N	Early medieval	Anglo-Saxon urn, Bagmoor.

94	Flint scatter & stone axes, Bagmoor	MLS14083	N/A	489880E 415960N	Mesolithic; Neolithic	Flint implements including 3 polished axes and an adze have been found at Bagmoor.
95	Occupation site, Bagmoor	MLS14085	N/A	489800E 416000N	Palaeolithic; Mesolithic; Neolithic	Finds from mine, "Lysaght's West Face", S of Bagmoor Lane. A ?Palaeolithic flint implement, flint points, scrapers, cores, flakes - some retouched, knives, leaf-shaped arrowheads and fragments. Ground flint axe or adze, nearly triangular section, pointed butt. Portion of polished flint axe, butt and cutting edge missing, both ends show signs of use as hammerstone, found 1945. Cutting end of ground stone axe, fractured surface ground down through use as rubber, Group 1,section no. 126. Roughly flaked stone axe, cutting edge and one face polished, tuff, section no. 128. Prehistoric sherds, some decorated.
96	Mesolithic-BA occupation site, Sand Pit, Normanby Park	MLS1979	N/A	489050E 415750N	Mesolithic; Neolithic; Bronze Age	Prehistoric flints and pottery from commercial sand pit near S boundary of Normanby Park. Surface finds since 1928, excavation by D N Riley and members of Hunter Arch. Soc. Sheffield, 1956. Flint microliths, micro-burin, scrapers, transverse, leaf-shaped, barbed and tanged arrowheads, serrated flake, fabricator, flakes (some retouched), polished flint and stone axe fragments. Two bifacially polished flint flake knives. Flint dagger found 1 970 during mechanical extraction of sand, Normanby Park; SM, BS N P. Plain Early Neolithic (Grimston ware?) sherds, Peterborough ware sherds with a variety of decoration. Beaker sherds.
97	Ring ditch, Normanby Hall Park	MLS20988	N/A	488687E 416208N	Unknown	A faint ring ditch, 30m in diameter, visible on an aerial photograph. Period uncertain.
98	Normanby Park	MLS3421	N/A	488900E 416300N	Post-medieval	A landscape park serving Normanby Hall was in existence by the 18th century. The western boundary was a public road that ran immediately west of the hall; an estate plan dated 1724 shows the hamlet of Normanby extending further eastwards towards the Hall. In 1815, the estate was inherited

						by the 4th Baronet, Sir Robert Sheffield, who built the present hall. The park was enlarged c. 1818 to its present size and surrounded by a stone wall at a cost of c. £1,000. The public road became the south drive to the hall, and a new road was constructed around the western edge of the park; houses at the eastern end of Normanby village were cleared in the area of what became the west drive, south of the walled garden.
99	Normanby Hall	NHLE 1103752; MLS19729	Grade I listed building	488730E 416534N	Post-medieval	Country house built between 1825 and 1830 by Sir Robert Smirke for Sir Robert Sheffield. Built in Ancaster limestone ashlar in the classical style. It is approximately square in plan with projecting bays and corner wings. The house faces west-north-west into well-wooded naturalistic parkland. The current house replaced an earlier Georgian house that was preceded by a Tudor Mansion designed by Robert Smythson. NB. Normanby Hall is located approximately 1.3km from the proposed development area i.e., outside the 1km study area adopted for this report. Nevertheless, it has been included in this gazetteer as it is the focal point of Normanby Park, which is itself located partially within the 1km study area.
100	South Lodge Gateway	NHLE 1103718; MLS4834	Grade II listed building	488620E 415500N	Post-medieval	Gates, gate-piers, flanking wall and railings. Between 1820 and 1830; for Sir Robert Sheffield, with C20 replacement gates. Wrought iron, coursed ironstone rubble piers and walls with ashlar coping. Semi- circular on plan with central entrance. Ornate double gates hung on square piers with plinth and cornice bands. Dwarf flanking walls with railings extend to similar outer piers. Included for group value.
101	Normanby Lodge Farm, Flixborough	MLS25306	N/A	488602E 415420N	Post-medieval	Normanby Lodge Farm, Flixborough. Redeveloped 19th century unlisted farmstead. Regular courtyard of U plan. The farmhouse is detached from the main working complex. Isolated location. Large modern sheds are located to the side of the site.
102	'Troysfontaignes', between	MLS22630	N/A	486892E 415959N	Medieval	A document dated 1347 refers to a place called Troysfontaignes, south of Burton Stather.

	Burton Stather and Flixborough					A healing well is said to have existed at this location and to have been much celebrated in the cure of sores and wounds etc.
103	Possible ovoid enclosure, W of Burton Wood	MLS20751	N/A	486614E 415775N	Unknown	An ovoid shape, possibly an enclosure, was detected by a geophysical survey, west of Burton Wood, 2008.
104	Sand pit (site of), Burton Wood	MLS20672	N/A	486700E 415600N	Post-medieval	An 'Old Sand Pit' within Burton Wood is shown on the Ordnance survey 25" second edition map of 1906
105	Cropmarks, SW of Burton Wood	MLS15755	N/A	486300E 415300N	Unknown	Aerial photographs taken in 1994 show extensive cropmark ditches, on a different alignment to modern field boundaries. Possibly prehistoric.
106	Flixborough historic settlement	NHLE 1161472/1161486/1103757; MLS4829/25174/4827/21885/19740/22117/19741/4830/25304/25305	x4 Grade II listed buildings	487244E 415144N	Medieval, post-medieval	Historic core of Flixborough village, including Grade II Listed Buildings (Lilac Cottage, The Smithy, Church of All Saints, Dovecote approximately 30 metres south east of Church Farmhouse)
107	Cropmark complex, East Farm	MLS21126	N/A	487700E 414938N	Iron Age; Roman	Cropmark complex, visible on an aerial photograph. Rectangular enclosures and a trackway leading to the eastern side. Possibly Iron Age or Romano-British.
108	Flixborough Grange Farmhouse	MLS20670; MLS25173	N/A	485808E 415721N	Post-medieval	Flixborough Grange was probably established while the field boundaries to the north-east were realigned as part of a substantial agricultural improvement of the area. The farmstead probably dates to the mid-19th century. The farmhouse is of brick, with two storeys and three bays, with the principal elevation facing to the west. A contemporaneous range of farm buildings forming a fold yard are located on the north side of the farmhouse. A smaller group of buildings is shown on the 1889 Ordnance Survey 25" map in area SE85851590, but do not survive.

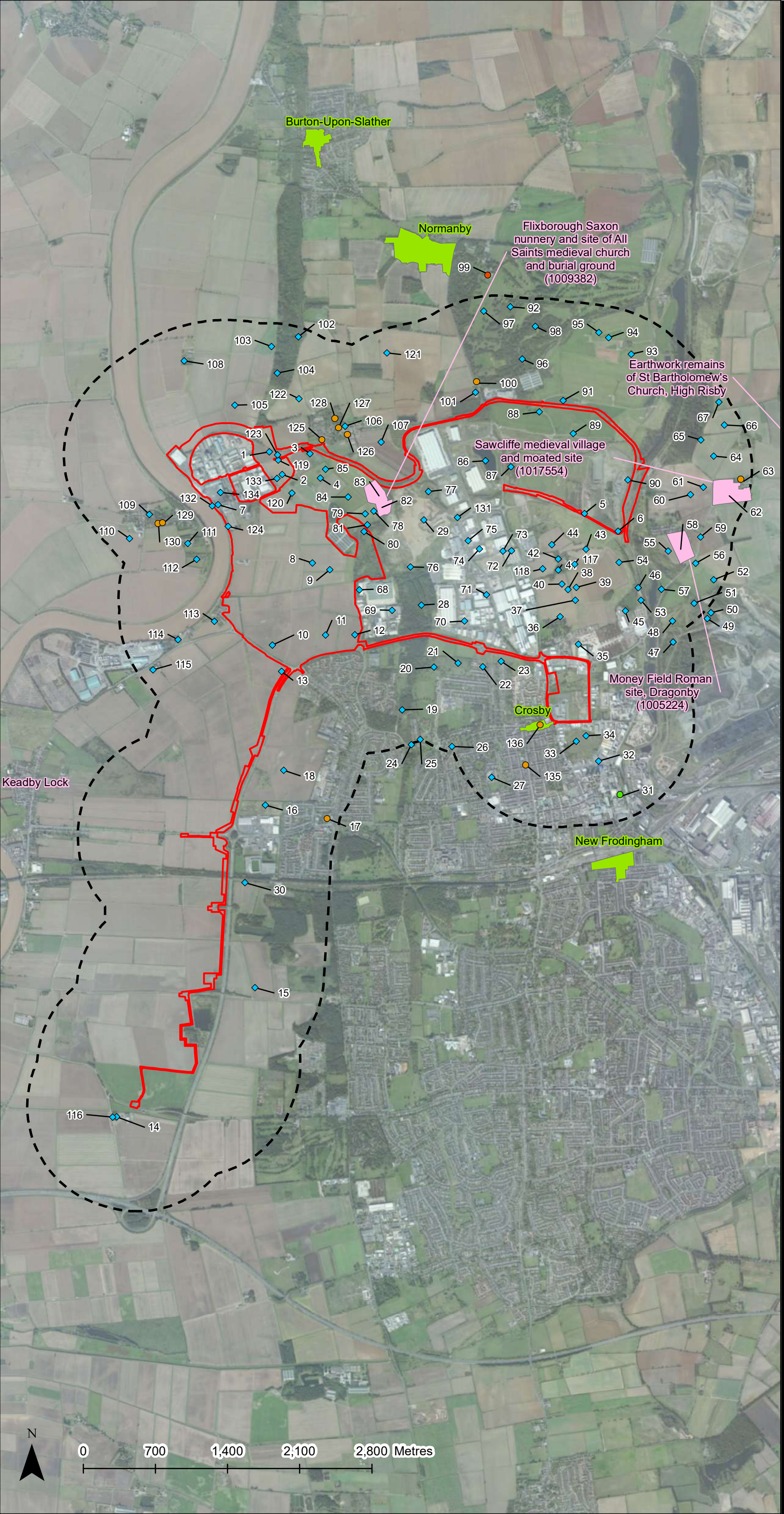
109	Amcotts historic settlement	NHLE 1083283/1083282; MLS21890/21890/25317/22333/21891/25319/9529/21692/6372/6952/25320/25321	N/A	485234E 414213N	Post-medieval	Historic core of Amcotts village, including Grade II Listed Buildings (Church of St Mark and the Rectory)
110	Flint findspot	MLS19345	N/A	485280E 414000N	Neolithic; Bronze Age	Findspot of a flint chunk, south of Hook House Farm, 1996
111	White House, Amcotts	MLS25322	N/A	485847E 413954N	Post-medieval	Partially extant 19th-century unlisted farmstead. Regular courtyard with linked working buildings to all
112	Chapel, High Street (site of)	MLS21762	N/A	489609E 411441N	Post-medieval	four sides of the yard. The farmhouse is detached from the main working complex. There has been a partial loss (less than 50%) of traditional buildings. Large modern sheds are located to the side of the site.
112	Trent Side Farm, Amcotts	MLS25323	N/A	485930E 413793N	Post-medieval	Partially extant 19th century unlisted farmstead. Dispersed clustered plan. The farmhouse is detached from the main working complex. There has been a partial loss (less than 50%) of traditional buildings. Large modern sheds are located on the site.
113	Neap House Farm (Neap House), Flixborough	MLS25308	N/A	486097E 413193N	Post-medieval	Partially extant 19th century unlisted farmstead. Regular courtyard with L-plan range plus detached buildings to the third side of The yard. The farmhouse is detached from the main working complex. There has been a partial loss (less than 50%) of traditional buildings. Isolated location.
114	Primitive Methodist chapel (site of), Gunness Lane	MLS21730	N/A	485752E 413008N	Post-medieval	Site of Primitive Methodist chapel demolished at an unknown date. The land is now used for Neap House Wharf.
115	Crosby le Moor Farm, Flixborough	MLS25312	N/A	485510E 412732N	Post-medieval	Crosby le Moor Farm, Flixborough. Partially extant 19th century unlisted farmstead. Regular courtyard of E plan. The farmhouse is attached to a range of working buildings. There has been a partial loss (less than 50%) of traditional buildings. Isolated location. Large modern sheds are located to the side of the site.

116	North Grange Farm (Burringham North Grange), Burringham	MLS25438	N/A	485162E 408370N	Post-medieval	Partially extant 19th century unlisted farmstead. Regular courtyard of E plan. The farmhouse is detached from the main working complex. There has been significant loss (greater than 50%) of traditional buildings. Isolated location. Large modern sheds are located to the side of the site.]
117	Square enclosures, east of Conesby Farm	MLS21180	N/A	489564E 413751N	Medieval	A sequence of three square or sub-rectangular enclosures with internal features, visible as cropmarks on air photographs. Trial excavations in this area during 2015 revealed medieval features, including wall foundations, probably associated with South Conesby village.
118	Romano-British settlement, west of Conesby Farm	MLS26092	N/A	489247E 413704N	Roman	A building and a series of ditches containing Roman pottery and animal bone were recorded within five trenches during an archaeological evaluation west of Conesby Farm in 2015, carried out in advance of a proposed residential development.
119	Lime kilns (site of), east of Flixborough	MLS21375	N/A	486705E 414635N	Post-medieval	The placename 'Limekiln Close' is shown on the Flixborough tithe map of 1840. The field contains linear cropmarks that may be old land divisions.
120	Former gravel pit, south of Stather Road	MLS21376	N/A	486815E 414408N	Post-medieval	A large gravel pit is shown on the Ordnance Survey 25" first edition map. The field is named as Gravel Pit Close on the tithe map of 1840.
121	Ditches, NE of Flixborough	MLS21271	N/A	487756E 415777N	Unknown	Description Three areas of fragmentary ditches and possible rectangular enclosures were visible on Google Maps aerial photographic cover, 2009. None were aligned to modern field boundaries.
123	Site of limekilns	1778 Estate map	N/A	486678E 414777N	Post-medieval	South-facing quarry containing lime-kilns north of First Avenue, Flixborough Industrial Estate shown on 1778 estate map
124	Site of former brick kiln	1778 Estate map	N/A	486175E 14145N	Post-medieval	Brick kiln to the south of Flixborough Stahe shown on 1778 estate map
125	The Smithy	NHLE 1161486; MLS4827	Grade II listed building	487119E 414938N	Post-medieval	House and smithy. Mid C19 with earlier origins, for the Sheffield Estate. Red brick, with side and rear walls of shoeing shop in coursed ironstone rubble; pantile roofs. The forge is complete and in use.

126	Dovecote approximately 30 metres south east of Church Farmhouse	NHLE 1103757; MLS4830	Grade II listed building	487366E 414986N	Post-medieval	Dovecote. Probably 1770. Roughly coursed ironstone rubble with brick strings and brick dressings, re-used ashlar blocks for lower quoins, pantile roof. Square on plan. 2 storeys. Church Farm, Flixborough, with which it had a functional relation, is the key element of its setting. It makes a positive contribution to the experience of the asset's illustrative historical value.
127	Church of All Saints, Flixborough	NHLE 1103756; MLS19739; MLS2554	Grade II listed building	487280E 415054N	Post-medieval	Church. 1886 by C Hodgson Fowler. Rock-faced ironstone with ashlar dressings, slate roof, stone-coped gables and wooden bellcote with lead roof. Gothic Revival style
128	Lilac Cottage,	NHLE 1161472; MLS4829	Grade II listed building	487244E 415144N	Post-medieval	House. C17 or earlier, with C19 extensions and C20 alterations. Timber framing and random ironstone rubble, with kitchen extension of squared ironstone rubble with brick dressings.
129	Church of St Mark	NHLE 1083283; MLS6372	Grade II listed building	485528E 414125N	Post-medieval	Parish church. 1853. Rock-faced ashlar with rusticated and tooled ashlar dressings.
130	The Old Rectory	NHLE 1083282; MLS6952	Grade II listed building	485571E 414131N	Post-medieval	Rectory, now house. 1862 by James Fowler of Louth, Diocesan Architect. Red brick in English bond with ashlar and polychrome brick dressings. Welsh slate roof
131	North Lindsey Light Railway (site of)	MLS17658	N/A	490140E 411530N and 490670E 415600N	Modern	Construction of the North Lindsey Light Railway began in 1904; it was opened in 1907. Passenger traffic ceased in 1925, and the northern section closed completely in 1950. The track infrastructure remains in situ.
132	Flixborough Ferry	OS maps	N/A	486056 414283	Post-medieval	The historic location of Flixborough Ferry, which continued to operate until after the Second World War. The remains of the wooden wharf survive on the river bank
133	Land east of Flixborough Industrial Estate	Wessex Archaeology 2022	N/A	486705E 414679N	Prehistoric	Geophysical anomalies identified during magnetometry survey in a field east of Flixborough industrial estate in an area of blown sand geology indicating the former presence of straight-side enclosures and possible prehistoric settlement
134	Flixborough Wharf – ERF	AOC, January 2021	N/A	486109E 414408N	Later Mesolithic	Ground investigations on the ERF site have identified deep organic/peat sequences, filling a possible

	site: deep alluvial/peat sequence				to Middle Iron Age	palaeochannel, extending from upper levels of 4.7-6.7m below ground level to 11.7-12.3m below ground level. These are similar to the sequence studied a kilometre to the north at the Flixborough wind farm (Lilllie & Bunting 2016). Here a core indicated dates for the peat development ranging from 3,985-3820 cal BC to 790-540 BC (in broad terms from the Mesolithic/Neolithic transition to the Middle Iron Age). The upper 4-6m of these cores comprised alluvial silt/clay deposits.

APPENDIX B FIGURES



North Lincolnshire Green Energy Park

Title	Figure 1a Location map showing project boundary, designated and non-designated heritage assets in the vicinity (for details see gazetteer, Appendix A)

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	27/09/2022
Drawn by	MTC
Checked by	CLQ
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	35,001
ArcMap File	

HER_ES_DBA_Designated_NonDesignatedAssets_A01

Legend

- Order Limits
- Non-Designated Assets

Listed Buildings

- Grade I Listed Building
- Grade II Listed Building
- Grade II* Listed Building
- Scheduled Monuments
- Conservation
- 1km Buffer

Layer Source Information

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

DO NOT SCALE THIS DRAWING

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 1b Location map showing project boundary, designated and non-designated Heritage Assets in the Vicinity (for details see gazetteer, Appendix A)

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	27/09/2022
Drawn by	MTC
Checked by	CLQ
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	19,001
ArcMap File	HER_ES_DBA_LocationMapGazItems_A01

Legend

- Non-Designated Assets
- Gazetteer Lines
- Gazetteer Polygons

Listed Buildings

- Grade I Listed Building
- Grade II Listed Building
- Grade II* Listed Building
- Order Limits
- Scheduled Monuments
- Conservation Area
- Former Spoil Heap

Layer Source Information

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

DO NOT SCALE THIS DRAWING

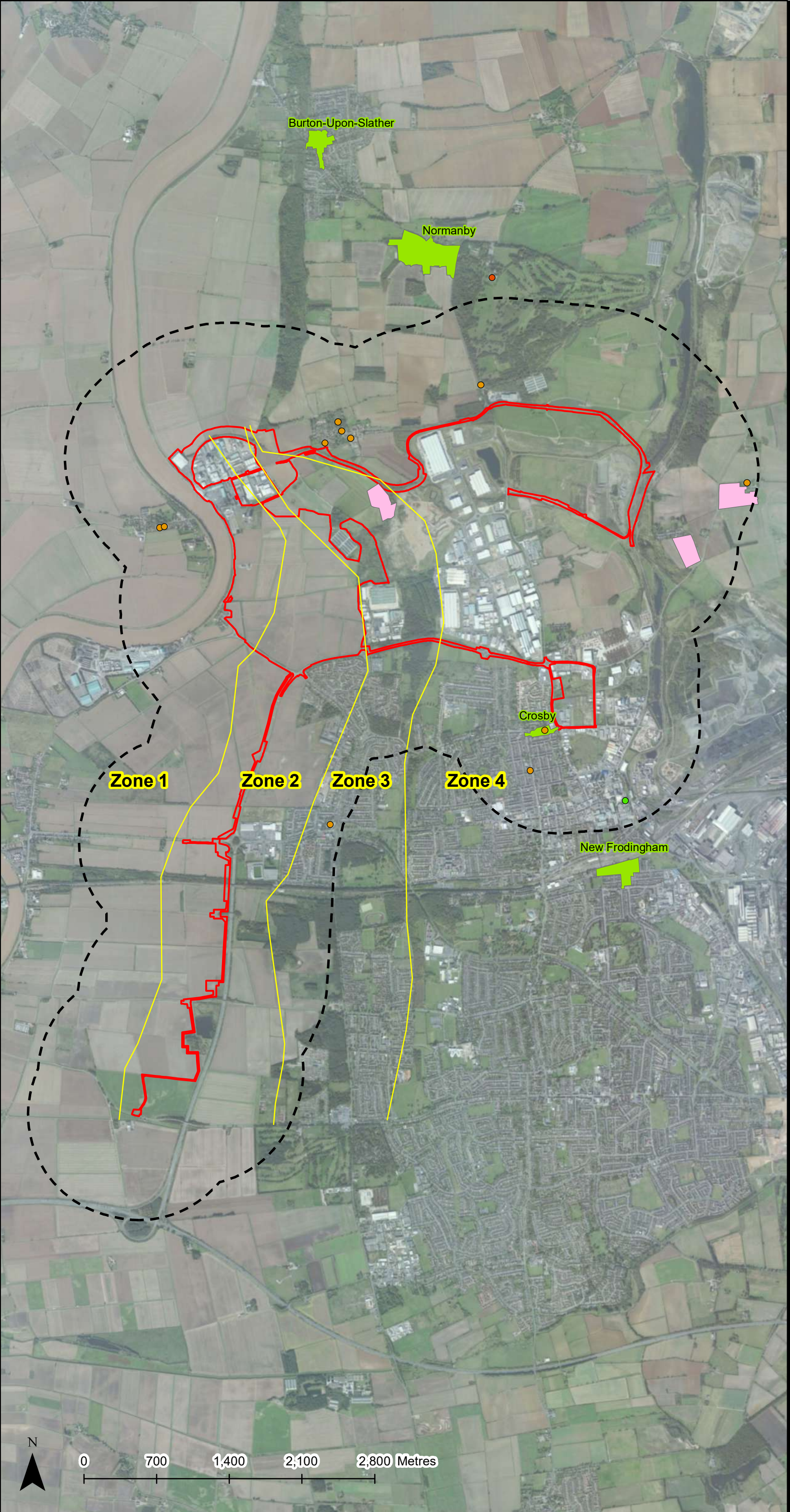
Burton-Upon-Slather

Normanby

Flixborough Saxon nunnery and site of All Saints medieval church and burial ground

N

0 400 800 1,200 1,600 Metres



NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 2 Map of NGLEP development showing geoarchaeological zones

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	26/09/2022
Drawn by	MTC
Checked by	JM
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	35,000
ArcMap File	HER_ES_DBA_GeoArchZones_A01

Legend

Listed Buildings

- Grade I Listed Building
- Grade II Listed Building
- Grade II* Listed Building
- Geoarch Zone
- Scheduled Monuments
- Conservation
- Order Limits
- 1km Buffer

Layer Source Information

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

DO NOT SCALE THIS DRAWING

Figure 3

Projected thickness plot of the Holocene organic deposits (AOC)

Legend

- Site Boundary
- Data Point

Deposit thickness (m)

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11

FOR

ERM
2nd Floor Exchequer Court,
33 St Mary Axe,
London
EC3A 8AA

Drawn/checked:	LR/VY
DWG no:	01/25864/DSR/10/01
AOC Project No:	25864

AOC Archaeology Group

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:25,000 @ A3

SCALE

0 1,000 m

Folder: C:\Users\lynne.roy\AOC Archaeology Group\Data Portal - 25864 - Solar 21, North Lincolnshire\Graphics\GIS\Draft figures\

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	1778 Flixborough Estate map
Figure 4	

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	15/03/2022
Drawn by	MHW
Checked by	CLQ
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:19,000

ArcMap File

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Order Limits

Layer Source Information

World Imagery: Maxar, Microsoft
Hybrid Reference Layer: Esri UK, Esri,

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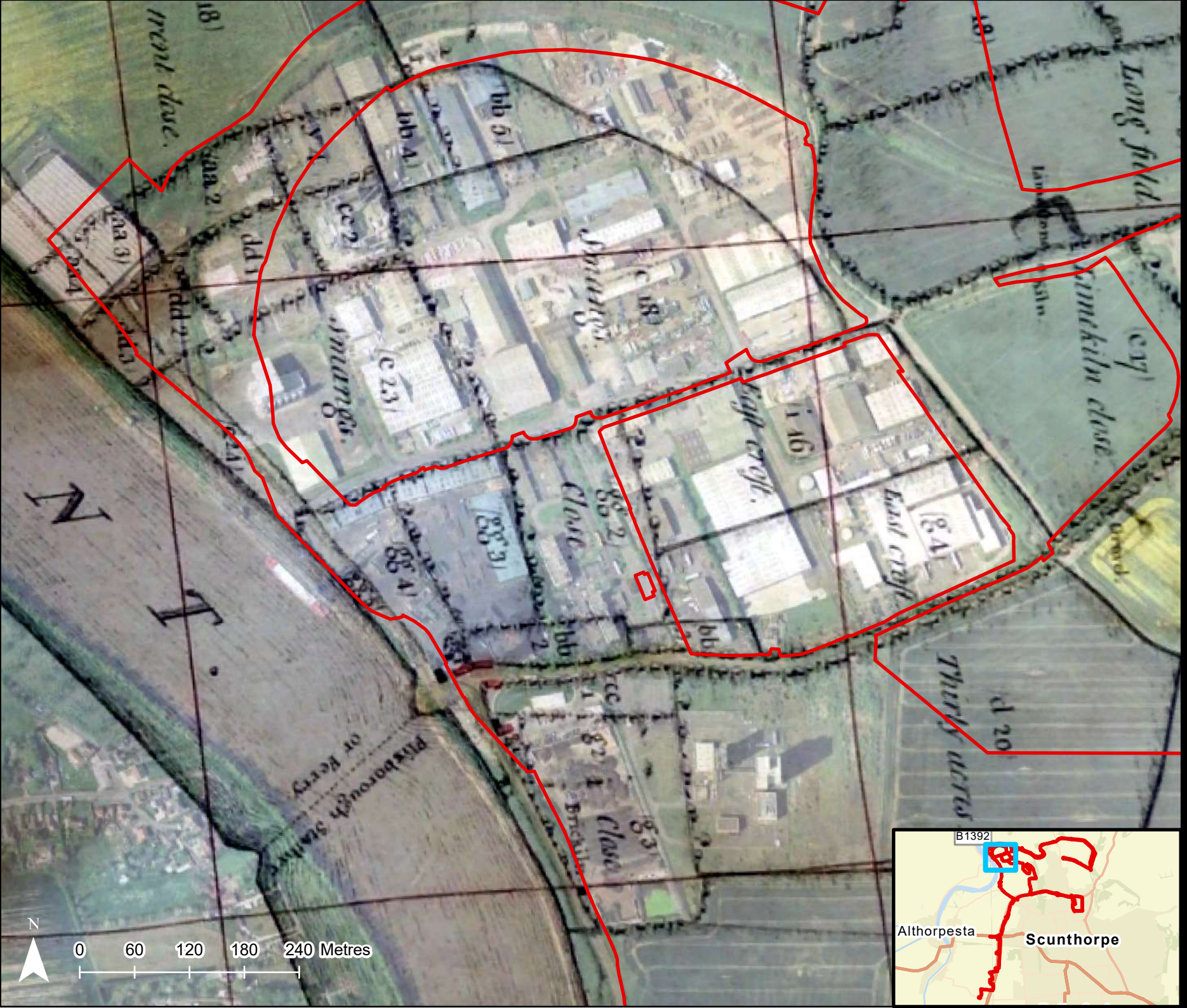

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Close-up of 1778 Estate map showing Flixborough Staithe

Figure 5

Client Information

Client	North Lincolnshire Green Energy Project Ltd.
PINS Proj No	EN010116
Date	15/03/2022
Drawn by	MHW
Checked by	CLQ
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:5,250

ArcMap File

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Legend

Order Limits

Layer Source Information

World Street Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS© Crown

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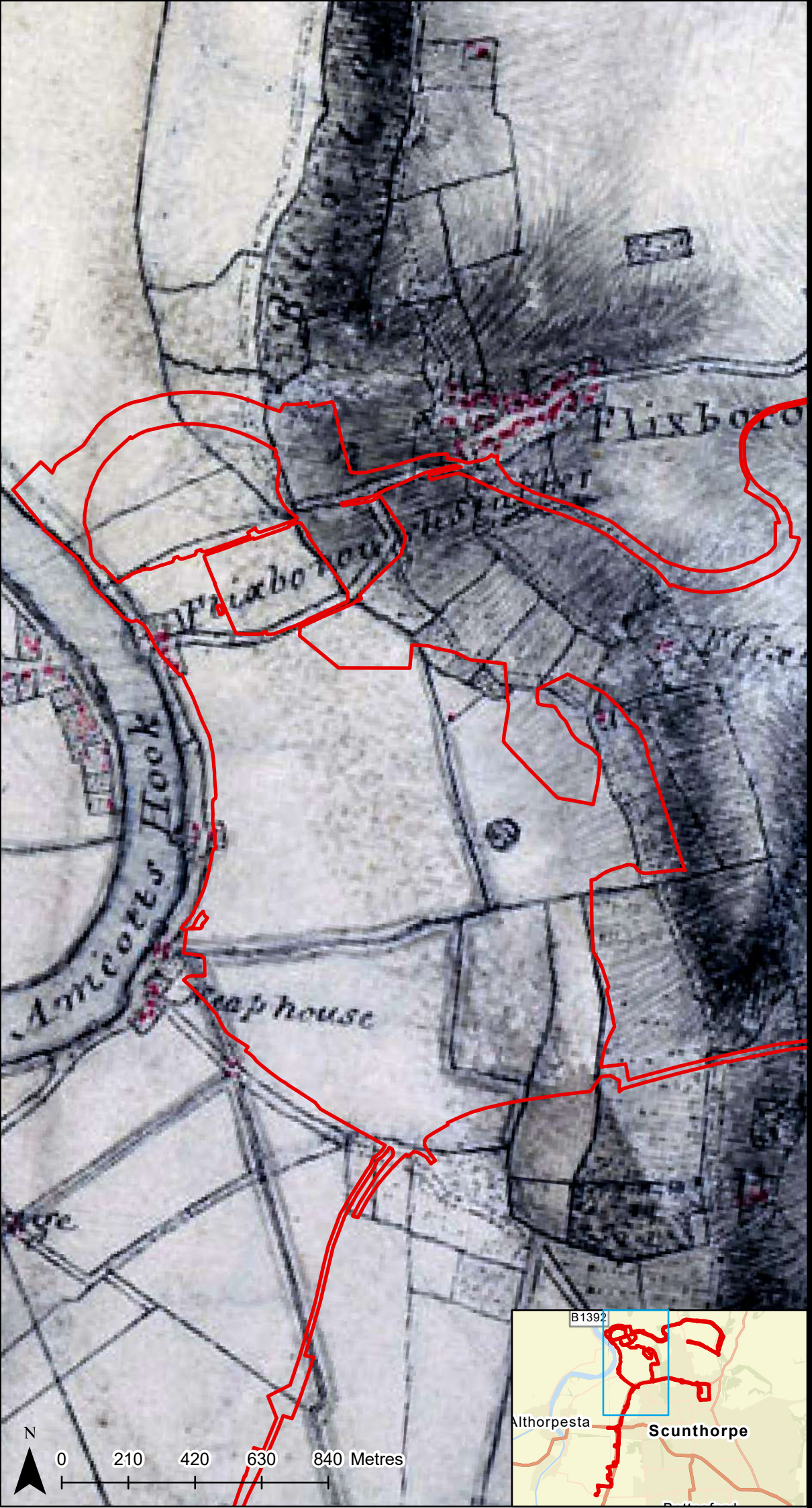

North Lincolnshire Green Energy Park

Title	1816 OS surveyor's map of Keadby

Figure 6 - 1 of 2

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	16/03/2022
Drawn by	MW
Checked by	CLQ
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:16,000

ArcMap File

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Legend

Order Limits

Layer Source Information

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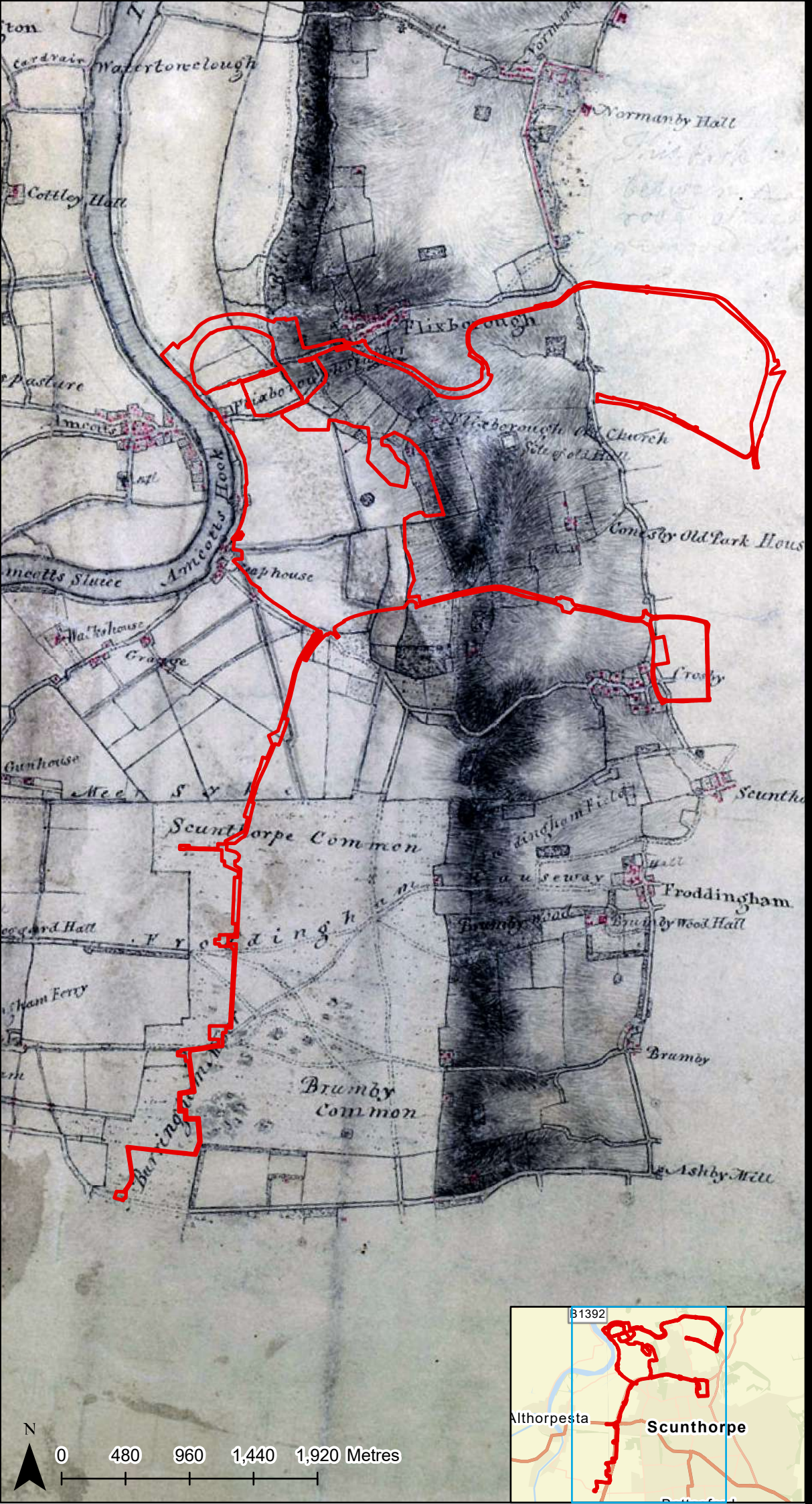

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	1816 OS surveyor's map of Keadby

Figure 6 - 2 of 2

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	16/03/2022
Drawn by	MW
Checked by	CLQ
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:38,000

ArcMap File

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Order Limits

Layer Source Information

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North Lincolnshire Green Energy Park

Title	1875 Sewer Map

Figure 7

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	16/03/2022
Drawn by	MW
Checked by	CLQ
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	50,500

ArcMap File

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Layer Source Information

Hybrid Reference Layer: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
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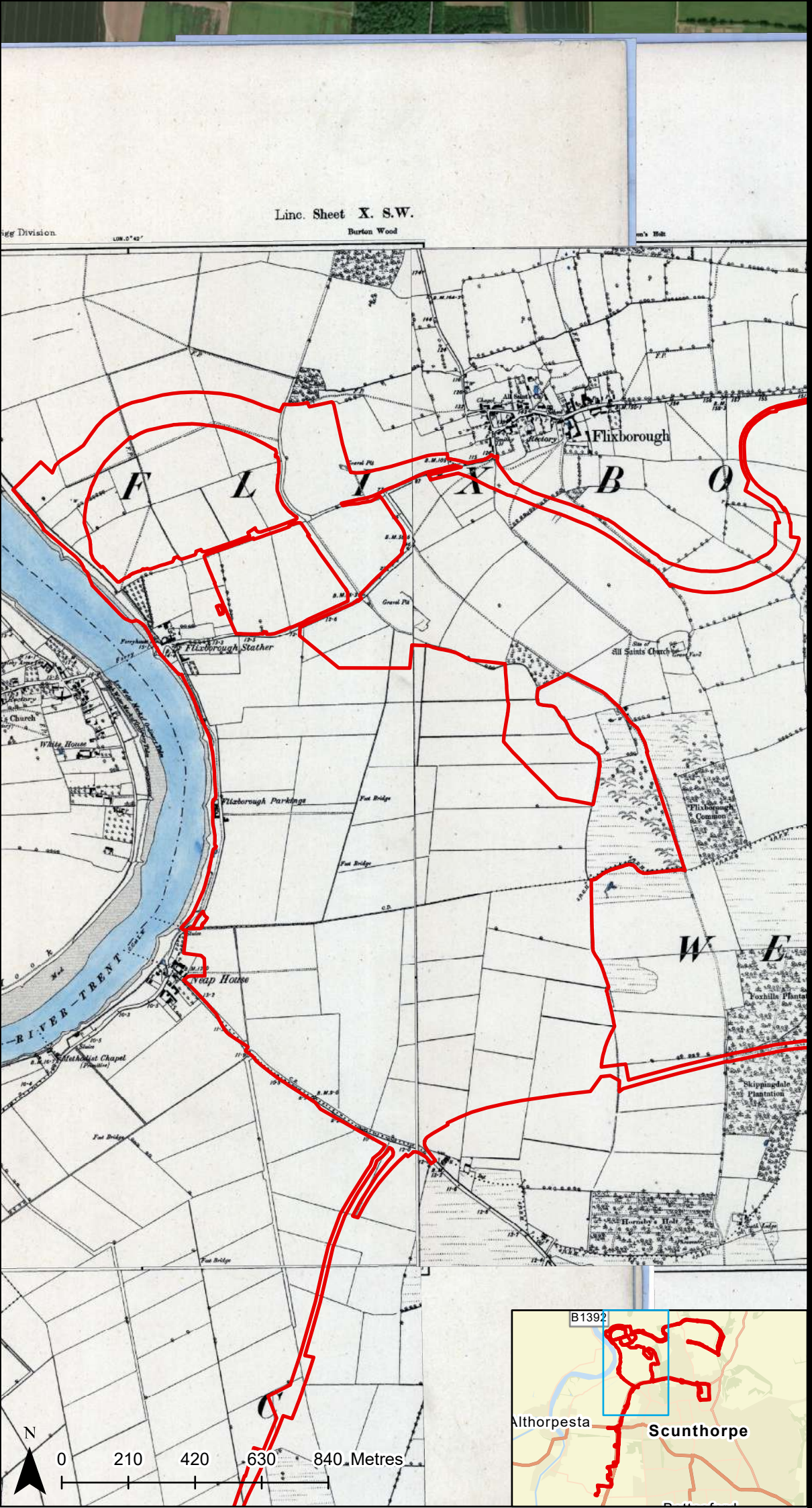

North Lincolnshire Green Energy Park

Title	First Edition OS map- 1885 - 1886

Figure 8 - 1 of 2

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	15/03/2022
Drawn by	MW
Checked by	CLQ
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:198,500

ArcMap File

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Order Limits

Layer Source Information

World Street Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
Hybrid Reference Layer: Esri Community Maps Contributors, Esri UK, Esri, HERE, Garmin, GeoTechnologies, Inc., METI/NASA, USGS
World Imagery: Maxar, Microsoft© Crown

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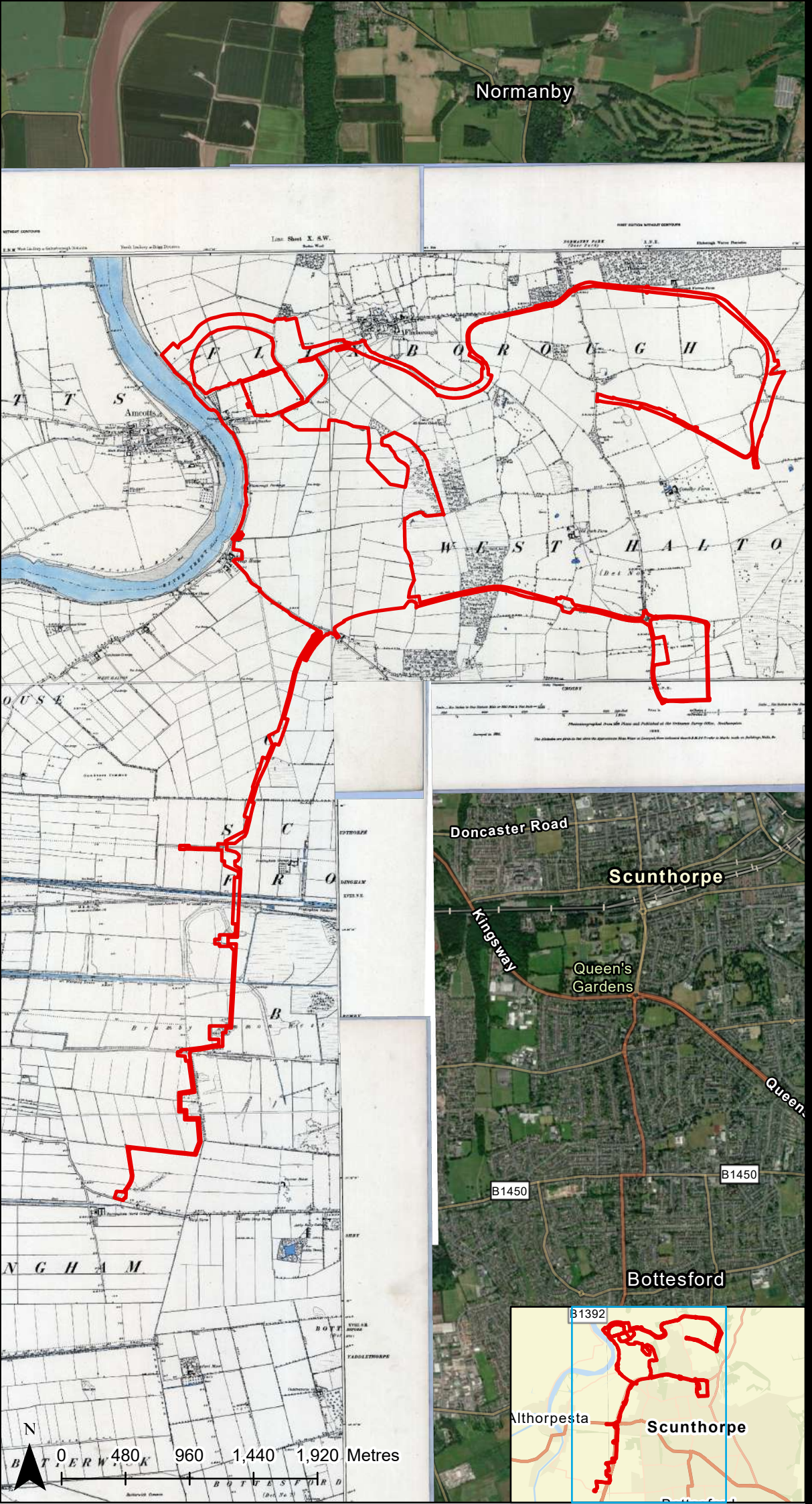

North Lincolnshire Green Energy Park

Title	First Edition OS map- 1885 - 1886

Figure 8 - 2 of 2

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	15/03/2022
Drawn by	MW
Checked by	CLQ
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:198,500

ArcMap File

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Legend

Order Limits

Layer Source Information

Hybrid Reference Layer: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
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World Imagery: Maxar, Microsoft© Crown copyright and database rights 2021 OS Licence

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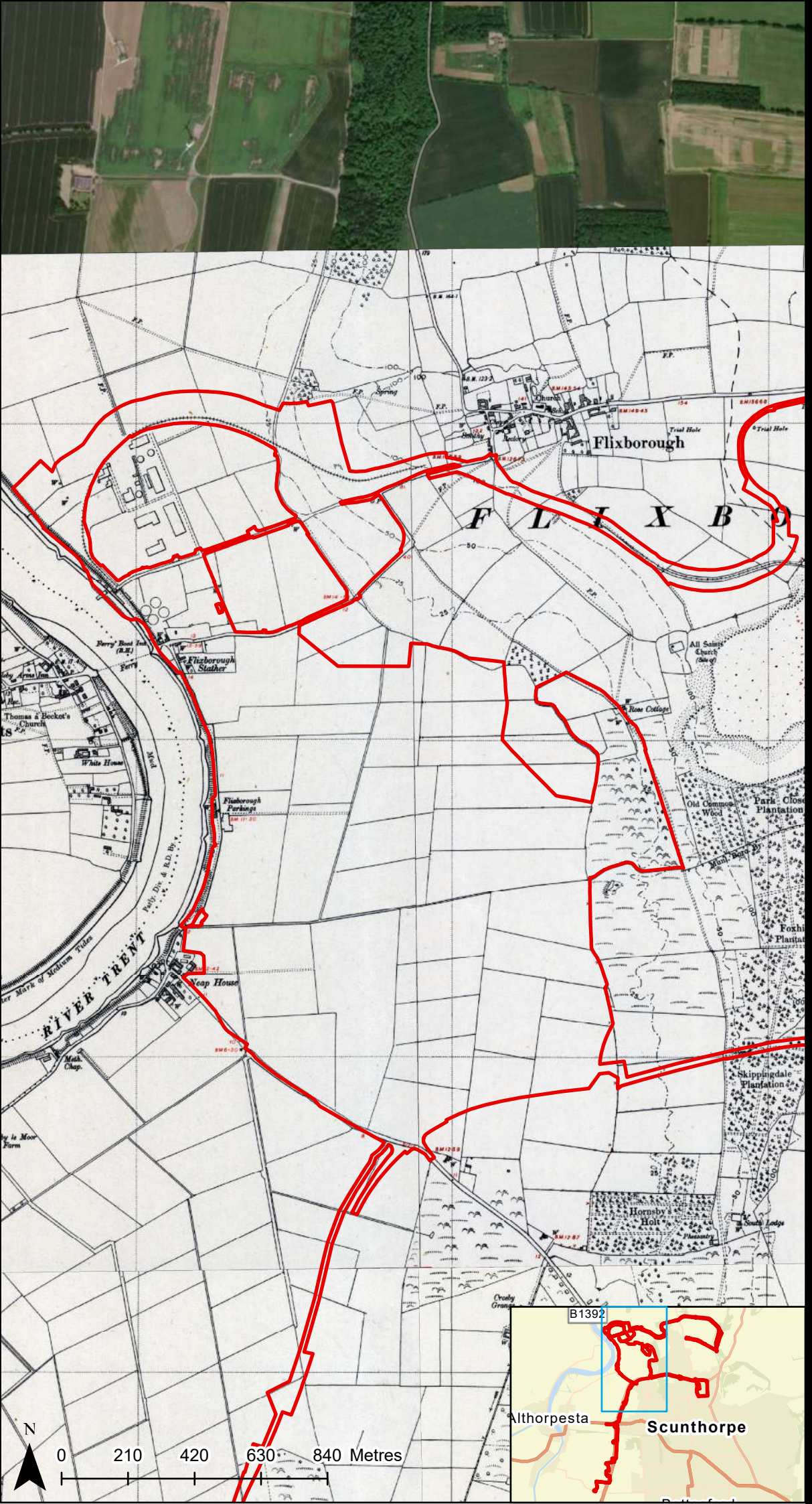

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	OS map- 1948 - 1951

Figure 9 - 1 of 2

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	16/03/2022
Drawn by	MW
Checked by	CLQ
	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:16,000

ArcMap File

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Legend

Order Limits

Layer Source Information

World Street Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
Hybrid Reference Layer: Esri Community Maps Contributors, Esri UK, Esri, HERE, Garmin, GeoTechnologies, Inc., METI/NASA, USGS
World Imagery: Earthstar Geographics© Crown

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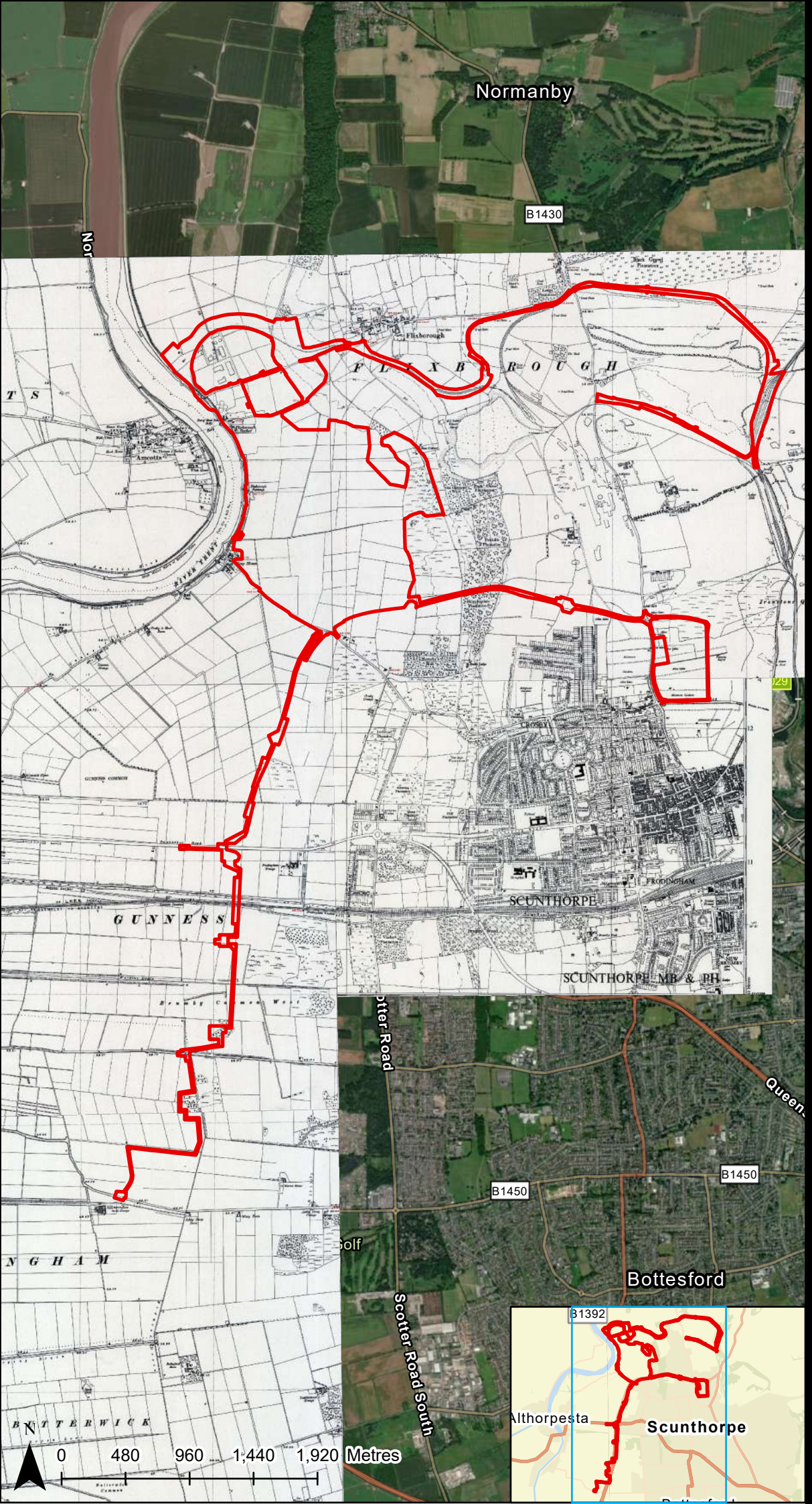

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	OS map- 1948 - 1951

Figure 9 - 2 of 2

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	16/03/2022
Drawn by	MW
Checked by	CLQ
	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:38,000

ArcMap File

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Legend

Order Limits

Layer Source Information

Hybrid Reference Layer: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
World Street Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
World Imagery: Earthstar Geographics© Crown copyright and database rights 2021 OS Licence

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APPENDIX C GEOARCHAEOLOGICAL WATCHING BRIEF AND DEPOSIT MODEL

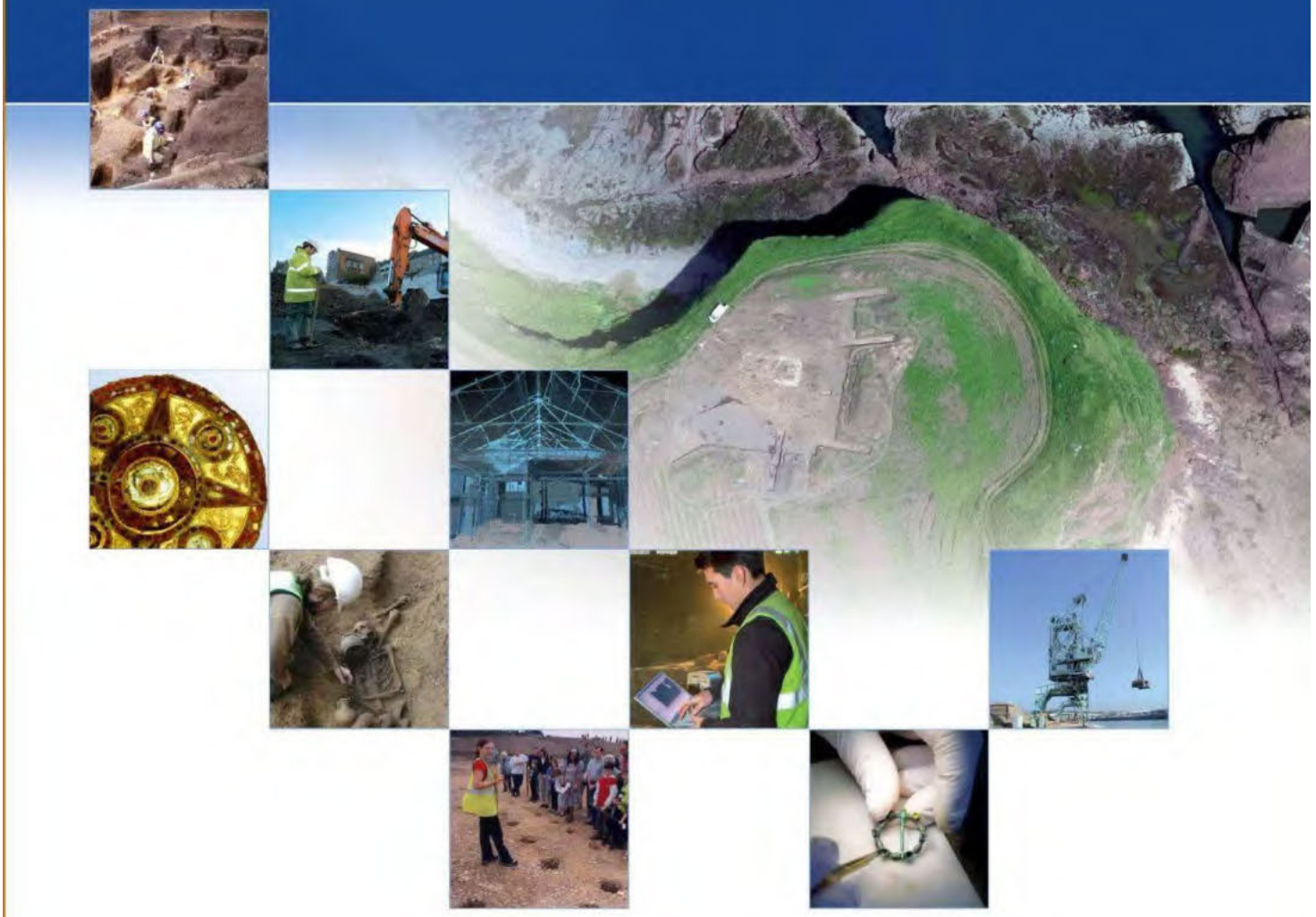
Solar 21: Geoarchaeological Watching Brief and Deposit Model Report

National Grid Reference Number: 486862 413617

AOC Project No: 25864

Site Code: AOC SOL21

November 2021



AOC Archaeology Group

ARCHAEOLOGY | HERITAGE | CONSERVATION

Solar 21:

Geoarchaeological Watching Brief

and Deposit Model Report

Surveyed and Prepared for:	**ERM** **2nd Floor Exchequer Ct** **33 St Mary Axe,** **London** **EC3A 8AA**
National Grid Reference (NGR):	**TA 1676 6108 (centre)**
AOC Project No:	**25864**
Fieldwork:	**Kim Hosking**
Prepared by:	**Lynne Roy,** **Jessica Taylor**
Illustrations by:	**Lynne Roy** **Jessica Taylor**
Date:	**November 2021**

This document has been prepared in accordance with AOC standard operating procedures.

Author: Lynne Roy, Jessica Taylor	**Date: 11** November **2021**
Approved by: Virgil Yendell	**Date: 11** November **2021**
Report Stage: Final	**Date: 11** November **2021**

Enquiries to: AOC Archaeology Group
The Raylor Centre
James Street
York
YO10 3DW

Tel. 01904 413404
e-mail. york@aocarchaeology.com

NON-TECHNICAL SUMMARY

AOC Archaeology Group was commissioned by ERM to undertake a programme of geoarchaeological works during the implementation of the first phase of a multiphase Contamination Testing and Geotechnical Investigation works at the North Lincolnshire Green Energy Park (NLGEP). These works form part of a broader programme of archaeological works within the NLGEP and follow a Preliminary Environmental Impact Report (PEIR). The works were monitored and recorded by geoarchaeologists to establish the presence / absence, character, and extent of any archaeological or palaeoecological deposits.

The Contamination Testing area is centred at NGR: TA 1676 6108 and located within the local authority area of North Lincolnshire Council. The Site is located on land adjacent to the existing Flixborough Industrial Estate, situated at Stather Rd, Flixborough, Scunthorpe.

The results of the borehole and test pit monitoring alongside reviews of other nearby geotechnical works have been used to create a series of Projected Profiles across the Site and showing the main deposits encountered. These have been used to further discuss and understand the geoarchaeological and palaeoenvironmental potential of the Site.

The borehole and test pit monitoring in combination with previous work undertaken on the Humber Wetlands project revealed basal deposits of fine sand of probable aeolian origin which was likely deposited during the late glacial period. The sands were encountered intermittently across the boreholes and could not always be distinguished from alluvial deposits. Overlying the sands and in some case cut into the sands are a series of organic deposits which likely represent the presence of a number of Late Glacial to Early Holocene infilled channels. The channels are infilled with between 0.5m to 7m of peat and intercalated organic silts and clays which are indicative of stable periods of vegetated wetland development along the floodplain of the late glacial/early Holocene River Trent. The organic deposits are overlain by up to 8m of silty sand to clay representing natural overbank deposition or human induced floodplain accretion (Warp).

Development impacts may affect buried Holocene horizons or deposits of archaeological or palaeoenvironmental significance. Although it is difficult to ascertain with certainty the potential of the deposits to contain archaeological remains, the nature of the deposits observed suggests any archaeological remains present within the alluvial floodplain areas may take the form of prehistoric localised dryland activity (i.e. short-lived flint and/or faunal 'camp site' assemblages) to floodplain exploitation (i.e., brushwood trackways and platforms, fish traps, etc). Archaeological remains are more likely to be found in the sandier drier areas to the east of the floodplain.

CONTENTS

LIST OF FIGURES

LIST OF PLATES

LIST OF TABLES

1 INTRODUCTION

1.1 AOC Archaeology Group undertook a programme of geoarchaeological works and have prepared this report for ERM. It details the results of a geoarchaeological watching brief during the implementation of the first phase of a multiphase Contamination Testing and Geotechnical Investigation works at the North Lincolnshire Green Energy Park (NLGEP). These works form part of a broader programme of archaeological works within the NLGEP and follow a Preliminary Environmental Impact Report (PEIR). The works were monitored and recorded by geoarchaeologists to establish the presence / absence, character, and extent of any archaeological or palaeoecological deposits.

1.2 The geoarchaeological monitoring and reporting of the Ground Investigation (GI) works were undertaken in accordance with the Written Scheme of Investigation (WSI) (AOC 2021).

1.3 The Site lies within the administrative area of North Lincolnshire Council. Alison Williams provides archaeological advice to North Lincolnshire Yorkshire Council.

1.4 The geoarchaeological works were managed to the standards laid down in the Historic England guideline publication Management of Research Projects in the Historic Environment (MoRPHE): Project Managers Guide (Historic England, 2015). It also met the requirements of the National Planning Policy Framework (NPPF, 2019; Chapter 16: 'Conserving and enhancing the historic environment').

2 PLANNING BACKGROUND AND PROPOSED DEVELOPMENT

2.1 The Applicant is proposing a new Energy Recovery Facility (ERF) and Associated Development (the Project) which constitutes a thermal combustion combined heat and power plant with a potential power output capacity of up to 100 MWe from a total thermal capacity of 316 MWth together with Associated Developments. The location of the project is illustrated on Figure 1.

2.2 The NLGEP will be located on land adjacent to the existing Flixborough Industrial Estate, situated at Stather Rd, Flixborough, Scunthorpe. The associated District Heat and Private Wire Networks (DHPWN) will run from the NLGEP site and terminate at two locations; the first located in Scunthorpe town centre, at the offices of North Lincolnshire Council, and the other at land adjacent to the M181, to the west of Scunthorpe. Full details on the project description are presented within the Preliminary Environmental Impact Report (PEIR), specifically in Volume 1, Chapter 3: Project Description.

2.3 The Site lies within the administrative area of North Lincolnshire Council. Alison Williams provides archaeological advice to North Lincolnshire Yorkshire Council.

2.4 The Written Scheme of Investigation (WSI) (AOC 2021) sets out the methodology for geoarchaeological monitoring of the Contamination Testing in order to assess the presence or absence of archaeological remains and palaeoenvironmental deposits, and to investigate their extent, nature, quality, date, and character.

3 LOCATION

3.1 The Site is centred at NGR: TA 1676 6108 and located within the local authority area of North Lincolnshire Council (Figure 1).

3.2 The NLGEP will be located on land adjacent to the existing Flixborough Industrial Estate, situated at Stather Rd, Flixborough, Scunthorpe. The associated District Heat and Private Wire Networks (DHPWN) will run from the NLGEP site and terminate at two locations; the first located in Scunthorpe town centre, at the offices of North Lincolnshire Council, and the other at land adjacent to the M181, to the west of Scunthorpe. Full details on the project description are presented within the Preliminary Environmental Impact Report (PEIR), specifically in Volume 1, Chapter 3: Project Description.

3.3 For the purposes of the geoarchaeological watching brief on the Site Investigation (SI) works, and specifically this first phase of those works, the Contamination Testing, the area has been split into four areas (Figure 3):

- The main ERF plant (Areas 1 and 2)
- The southern utilities corridor (Area 3)
- The AGI plant (Area 4)

3.4 The main ERF plant area is centred at NGR: 486126 414447 and bounded to the north by First Avenue and the continuation of the Flixborough Industrial Estate, the west by the River Trent, the east by Belwin Drive, and the south by Stather Road. The area is approximately 5 km north-west of the centre of Scunthorpe. Existing infrastructure at the site includes roads, a rail spur, a 155m long wharf, weigh bridge, cranes, warehousing and stock sheds, workshops and portable offices. This part of the Site incorporates Areas 1 and 2 as shown on Figure 3

3.5 Area 3 incorporates the development area between the ERF plant and the B1216 centred at NGR: 486562 413650 and the southern utilities corridor and associated construction/laydown areas centred at NGR: 486041 410274 Currently most of Area 3 is in use as arable land, with limited structures related to this usage, apart from the north-west where concrete manufacturing and polymer plants are situated.

3.6 The AGI plant area (Area 4) is centred at NGR: 486682 414918 and is bounded to the west by the Flixborough Industrial Estate, the east and south by Stather Road, and to the north by First Avenue. The area is approximately 4.5 km north-west of the centre of Scunthorpe. Currently most of the site is arable usage.

4 GEOLOGY

4.1 The British Geological Survey (BGS) indicates that the Site has an underlying bedrock composed of Mudstone. A north-south aligned mudstone ridge dominates the geology of the study area, lying to the east by, and upon which the historic settlements of Flixborough, Crosby and Scunthorpe are situated. The mudstone and Ironstone bedrocks are shallow to full marine deposits from the Triassic (c. 251-201 Mya) was and Jurassic (c. 201-145 Mya). The mudstone ridge forms the eastern edge of the meandering Trent Valley, which is filled with deep Holocene (12,000 years ago - present) alluvium (clay, silt, sand, and peat) and overall represents uniform to varied riverine deposition across a floodplain. The eastern edge of the valley and west side of the mudstone ridge is characterised by thick drifts of 'windblown sand', which appear to have derived from late glacial sands (BGS 2021) and in some cases are overlain by alluvium. The sand, occasionally classified as Sutton Sand Formation, is a fine silty sand formed during the Devensian to Holocene (115 thousand years ago onwards) and represents an aeolian or wind-blown redeposition of underlying

glaciolacustrine deposits or bedrock.

4.2 The British Geological Survey (BGS 2021) indicates that the main ERF plant area (Areas 1 and 2), and the development area between the ERF plant and the B1216 (Area 3), are underlain by bedrock of Mercia Mudstone. This is a predominantly red siltstone, of a semi-terrestrial to shallow marine origin, which formed approximately 52 to 247 Mya in the Early Triassic Period, and now rises to form the north-south ridge.

4.3 The AGI plant area (Area 4) is underlain by the Scunthorpe Mudstone and Penarth Group limestones (c. 206-201 Mya, BGS 2021), of brackish and fully marine origin, and Scunthorpe Mudstone of marine origin (also c. 206-201 Mya).

4.4 The superficial deposits across main ERF plant area (Areas 1 and 2), and the development area between the main ERF plant and the B1216, mostly consist of alluvial deposits and are identified as being in the region of 3 to 17m thickness (BGS borehole SE81SE21), limited deposits of windblown sands are identified as being approximately 3m in thickness and lie in the south of the development area between the ERF plant and the B1216 (BGS borehole SE81SE77).

4.5 In the area of the AGI plant (Area 4) the superficial deposits mapped by the BGS include some limited Hemingbrough Glaciolacustrine Formation as shown on Figure 2. This was probably deposited in a low energy, pro-glacial lake environment that developed during the Devensian (c. 0.116 to 0.0118 Mya), ahead of the southward advancing ice sheet (Ford et al 2003). The mapped areas of Hemingbrough Glaciolacustrine Formation lie beyond the areas of GI that form the focus of this report.

4.6 The British Geological Survey (BGS 2021) indicates that Areas 3 is entirely underlain by Mercia Mudstone Formation. The superficial deposits across the southern Laydown area includes mostly Warp with some pockets of blown sand and Sutton Dans Formation and very limited alluvial survival in the south.

4.7 Soils in the Site are mapped by the SSEAW (1984) as brown soils which comprise deep, well drained coarse loamy brown earth soils overlying glaciofluvial and terrace drift. The soils are relatively free draining due to the high warp content and artificially improved drainage (Ellis 1998, 13).

5 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

5.1 The following is a summary extract from Chapter 12 of the PEIR Archaeology and Cultural Heritage Assessment and the DCO (pers. Comms. ERM 04/08/21). This should be read in conjunction with these documents.

Prehistoric and Roman (pre AD410)

5.2 A single Palaeolithic asset is located approximately 780m outside the nearest part of the Order Limits. It comprises the findspot of a tanged flint blade of Late Upper Palaeolithic date, i.e., from the end of the Palaeolithic period. It was said to have been found on wind-blown sand at Risby Warren/Crosby Warren, along with a cache of obliquely backed points. These artefacts may indicate the site of a temporary hunting camp. Early prehistoric activity is known within the region through pollen analysis, which indicates that forests were beginning to be cleared during the Mesolithic period. Evidence for seasonal occupation during the Mesolithic and Neolithic period is

also evident in environmental remains and flint scatters. Many of the Mesolithic flint scatters in the vicinity of the Site, are located on or immediately adjacent to (and reference sandy contexts in their descriptions) deposits of wind-blown sand depicted in BGS data. These sandy deposits mantle the high ground overlooking the Trent Valley. Notable Neolithic to Bronze Age flints and Roman pottery have been found in Willow Holt Sand Quarry, immediately to SE of the AGI plant area (PEIR Chapter 3). There is considerable evidence of human activity dating from the Mesolithic onwards, comprising findspots, evidence of occupation sites and the potential for significant peat deposits and palaeoenvironmental remains to be buried under alluvium.

Early Medieval and Medieval (AD410 – AD 1485)

5.3 The scheduled monument of Flixborough Saxon nunnery and site of All Saints medieval church and burial ground is located adjacent to the Order Limits and was partially excavated between 1989 and 1991. Excavations uncovered parts of 40 buildings, 39 of which were of early medieval date. During the 8th and earlier 9th centuries, two rows of modest buildings arranged end to end stood either side of a shallow depression in which accumulated a large amount of refuse. This asset was first observed in section in a commercial sand pit. Prior to archaeological excavation, two metres of wind-blown-sand overburden (aeolian reworking of post-glacial sands) had to be removed my mechanical excavation from above the archaeological remains. This overburden preserved but also concealed the site from view before it was exposed by sand quarrying. The scheduled monument also contains the site of the church that served the deserted village of North or Little Conesby. A hoard of Middle-Saxon woodworking tools (DBA asset 221) deposited within two lead tanks was found during sand quarrying at Flixborough in 1994 adjacent to the southwestern side of the scheduled monument, adjacent to where early medieval occupation remains were excavated in 1933 ahead of destruction for sand extraction.

5.4 During the late medieval period, a worsening climate (known as the 'Little Ice Age') and poor rural economic stability, along with outbreaks of the Bubonic Plague, reduced the quantity and quality of grain production, leading to land being lain to pasture and creating opportunity to encourage peasant migration to urban centres. Deserted settlements are relatively common within the region, including those found at the village of North or Little Conesby and Swalcliffe. Flixborough Stathe was the historic river port linked to Flixborough on the high ground to the east by road. Shallow buried remains of the medieval port are likely to have been destroyed by twentieth century development of the wharf.

Post Medieval and Modern (1485 – Present)

5.5 The study area comprises areas of 20th century light industrial activity, agricultural activity, including evidence of historic agricultural practices; including field patterns, hedgerows, tracks, and post-medieval and modern housing; including commercial buildings and road and rail infrastructure; and Flixborough Staithe river port.

5.6 On 1 June 1974, an explosion in a cyclohexane plant at Nypro UK (a chemical plant) occurred at the Flixborough industrial estate, resulting in the deaths of 28 people, with 36 people seriously injured. At the time of the disaster, Nypro UK produced the chemical caprolactam, used in the production of nylon, from cyclohexanone. Cyclohexanone was produced by partially oxidising hot liquid. The HSE website summarises the incident 'The cyclohexane formed a flammable mixture and subsequently found a source of ignition. At about 16:53 hours there was a massive vapour cloud explosion which caused extensive damage and started numerous fires on the site". Fall-out

from the explosion is a potential source of historical contamination.

5.7 The ERF facility is being developed on a site at Flixborough Stathe, formerly occupied by a series of large round storage tanks, which are likely to have contained fuels, other process chemicals, and where large quantities of coal and other solid fuels were also formerly stored.

6 GEOARCHAEOLOGICAL AND PALAEOENVIRONMENTAL BACKGROUND

6.1 The character and distribution of past human activity can be better understood through the consideration of the past landscape or environmental context. The topography and nature of the ancient land surface during the early Holocene, the current geological epoch and equivalent to the early Mesolithic (c. 11,500 BP or 10,000 BC), is dictated by and inferred from the surface of the Pleistocene superficial deposits (the previous epoch) and older solid geology (e.g. gravel or chalk). Overlying the Pleistocene - or older - deposits, Holocene deposits may preserve palaeoenvironmental evidence (e.g. pollen, diatoms, ostracods) of landscape development, from local channel migration and vegetation change to regional effects of climate and relative sea level change. In combination, likely preservation of palaeoenvironmental remains and deposit data (e.g. depth and character) provides a comparative framework to assess archaeological potential. Peat represents vegetated and waterlogged landscapes (e.g. marshland) which developed, within local or regional fluctuations of hydrology. The anaerobic and acidic conditions of the deposit are particularly conducive to organic preservation. Palaeoenvironmental remains from floodplain deposits, especially peat, provide information on the nature and timing of environmental change and the interplay with past human activity (HE 2015a, 2015b).

6.2 During the latter stages of the last (Devensian) Ice Age (18000BP), Lincolnshire was covered by an ice lobe (North Sea Lobe) extending down the eastern margins of the North Sea Basin as far as North Norfolk, depositing extensive till and glaciofluvial sands and gravels across the region. The ice lobe blocked the Humber Gap and thus the natural drainage eastwards and northward to the North Sea was prevented. This prevention of drainage into the sea resulted in the formation of a large ice-dammed lake known as Lake Humber within which deposits of lacustrine clays, silts and sands were laid down some of which are mapped by the BGS to extend into the north-east of the Site. The cold dry conditions of the late Devensian period also resulted in the aeolian (windblown) transportation of fine-grained silt sized material which was deposited on to the Lincoln Edge east of the Site. The melting of the ice sheet at the end of the Devensian led to the gradual silting up of Lake Humber. By c11000BP the flow of the River Trent north across the lacustrine deposits towards the North Sea was re-established. The River Trent was initially characterised by braided channels. There was limited vegetation cover and the sediments on the floodplain were susceptible to wind erosion which in turn led to the deposition of aeolian sands. At the start of the Holocene as sea level began to rise, rivers incised through the lake deposits to reach base level. The channels thus transformed from wide braided stream to narrow single channels. As sea levels continued to rise the river channels aggraded and the deeply incised river valleys became infilled with the alluvium which now covers the Trent valley floor (Ellis 1998 10-12). Gaunt (1994) estimates the depth of channel incision and fill to be in excess of 20m in the area. Climatic amelioration and continued rising sea levels results in the development of wetlands at about 5000BP. A combination of impeded runoff and overbank flooding led to the development of extensive floodplain peats during the later prehistoric and early historic periods. No absolute dates are currently available for the onset of peat development in the lower Trent valley north of Gainsborough. Extensive areas of floodplain mire

peats and alluvium would have characterised the Trent floodplain from the mid-Holocene until the introduction of drainage and warping on the post-medieval periods.

6.3 The study area lies at no more than 4.5m AOD and the wider area is notable for its vast expanses of flat featureless terrain.

6.4 There is a paucity of securely dated paleoenvironmental analyses from the lower Trent valley. Limited detailed information exists about the nature extent and depth of the depositional sequences in the lower Trent valley. The influence of riverine alluviation and the exact location of abandoned meanders required further elucidation. The spatial and temporal development of the wetlands and the nature of the pre-wetland landscape remain poorly understood. The paleoenvironmental record for the earliest part of the Holocene in the Trent valley is sparse, with data available from Girton, Bole Ings (Dinnin 1997) and Lake L1 of the Lincolnshire Lakes Project. Radiocarbon dating in correlation with pollen samples from the Lincolnshire Lakes project east of Area 3 dates the lower pollen samples to approximately 7000BP, and upper samples to approximately 300BP. Comparable organic deposits in the lower Trent Valley began to accumulate around the same time as channel stabilisation approximately 8500BP (Stein 2014). Correlation between the depth and date of deposits at different locations across the Lake L1 Site proved to be somewhat variable, suggesting that either peat accumulated at different rates at different locations, or perhaps material has become truncated through erosion (AOC 2017).

6.5 Bole Ings, located towards Nottinghamshire provides a comparable early Holocene pollen record (Brayshay and Dinnin 1999; Dinnin 1997) dating from 8240 ± 60 BP to 2780 ± 60 BP. Zone 1 of the sequence (8240±60 BP to 6280 ±70 BP) provides evidence of a landscape dominated by Pinus, Ulmus, and Corylus with some Quercus. These species represent a wooded environment, with a dense deciduous woodland canopy (Brayshay and Dinnin 1999, 119). A similar landscape dominated by woodland is also found in the sequences from Lake L1 (AOC 2017).

6.6 The presence of Corylus, and gradual rise in Alnus at Bole Ings, also indicates an increasingly wet environment. Corylus frequently inhabits dry and basic pH level soils suggesting that Corylus was occupying drier areas of the wetland margin and the surrounding landscape (Brayshay and Dinnin 1999, 119). Alnus and Corylus were found to be consistently present at Lake L1 and gradually increase throughout the sequence suggesting a similar wet environment (AOC 2017).

6.7 Marine environments continued to reach into the Lower Trent Valley throughout the Mesolithic, as evidenced by alternating marine and freshwater deposits as far upstream as Gainsborough (Knight and Howard 2004, 31; Lillie and Neumann 1998, 22). Pollen sequences from this period demonstrate expanding reed swamp and fen carr landscapes, with additional evidence of densely wooded areas on dryer land (Knight and Howard 2004, 31). A similar stabilising riverine environment continued into the Neolithic with dense woodland located on drier land. Evidence of occupation from as early as the Mesolithic has been recovered from the area of Flixborough including a large concentration of Late Mesolithic and Neolithic flint found at Sand Pits, Flixborough in 1928.

6.8 Coring undertaken at Flixborough as part of the Humber Wetlands Project (Lillie 1998 45-52) revealed a complex stratigraphic sequence of intercalated peats and clays which documented periods of alluvial deposition and periods of stabilisation. Similarly archaeological evaluation and coring at the Lake L1 site east of Area 3 as part of the Lincolnshire Lakes project revealed a

complex sequence of interbedded peats and clays overlain by warped sediments. Numerous layers of buried organic peats, and finely laminated sections containing sands and clays were apparent. Changes appeared to be abrupt with no gradual transition between varying deposition types. This was interpreted as a possible indication that the sediments had been truncated or eroded, but it was also considered possible that rapid environmental change took place e.g. inundation of marine waters (AOC 2017).

6.9 It is possible that occupation of the lower areas of the Trent valley was intermittent prior to the post-medieval period due to the nature of the wetland environment and the rise and fall in sea level, and therefore settlements of medieval or earlier date would often be situated on slightly higher ground. However, periods of low sea level allowed regular cultivation and exploitation of this resource-rich environment which can be seen from previous finds of tools and pottery. Palaeoenvironmental survey undertaken as part of the Humber Wetlands Project indicated that some of the wetlands dried out during the Mesolithic period (Van de Noort et. al., 1995: 359) allowing for a wider range of land use, and woodland clearance during the Bronze Age indicates a shift towards agriculture (ibid). A bog-body is known from the Amcotts area (Lillie 1998,45)

6.10 Roman occupation of the area is known from various finds including Romano British pottery on the modern surface of the floodplain at Amcotts (Lillie 1998, 52)

6.11 The Early Medieval site at Flixborough provides ample evidence for the exploitation of the River Trent floodplain into the historical period. Historically there have been brick and tile manufacturers operating at various scales along the Trent and the nearby Keadby Canal.

6.12 Fletcher writing in 1858 about the course of the River Trent in the vicinity of the Site notes that it had considerably altered its course in the 18th century noting that 'in earlier times' it was at this point a large expanse of water that during the ebb of the tide occupied more than one channel. In 1836, between Hook Staithe and the Amcott windmill, on the western side of the modern River Trent, an old staithe was excavated and removed. It appears that this staithe and associated embankment were built to alter the course of the river and reclaim the land for the estate as farmland. A borehole transect excavated as part of the paleoenvironmental survey of the lower Trent valley revealed deposits relating to alluvial channel infill near Amcott and thus likely relate to this earlier channel (Lillie 1998, 48). Pollen and diatom samples taken from deposits within this channel provide some evidence of the channel environment and diatoms indicate that both freshwater and brackish flow was present in this channel from the middle Mesolithic until 1858.

6.13 Sir Cornelius Vermuyden, born Tholen, Netherlands in 1590, was a Dutch engineer who carried out the initial drainage and recovery of the land in the vicinity of the Site. This was started in 1626, by means of digging drainage dykes and leading them to nearby rivers, in order to drain the land. The land was more workable but swampy and boggy areas remained in many places. Makin Durham was commissioned under the first Dun Drainage Act of the 1830s, to warp certain areas of Yorkshire and Lincolnshire, as he had perfected the adequate and technical procedure of 'warping' (Armstrong 1981, 20).

6.14 Large-scale drainage of the area was undertaken during the post-medieval period and by the nineteenth century, with the construction of drains such as the Burton and Flixborough Drain and the Lysaght's Drain along with the warping of fields, the area was successfully transformed from wetland into farmland (Lillie, 1998b 103). Warping was the practice of letting turbid river water flood

onto arable land, so that its suspended sediment could settle to form a fertile layer, before letting the water drain away. In this way poor soils were covered with fine silt, and their rentable value was increased (Smith 2014, 83). Two types of warping were employed within the vicinity of the Site; flood warping and cart warping. Floodwarping involved enclosing the fields within embankments and allowing flooding of the field over several years in order to deposit silt and raise the level of the land to reduce the flood risk (Shephard, 1976). Cart warping involved the manual excavation of alluvial sources such as an infilled palaeochannel and its deposition or spreading across the ground surface. Warping in the vicinity of the Site was commenced in 1835 from the inlet of the Neap House drain, with warping on the south side of the drain carried out between 1840 and 1845, and on thenorth side between 1845 and 1850 (Lillie 1998b 110). Further records for the Flixborough area record evidence of the Sheffield family employing additional cart warping to further improve higher ground within the Site to the north of Neap House in 1869 (Lillie 1998b 104).

6.15 Deposits of warp also served to mask the peaty and acidic soils that had developed on the alluvial deposits either side of the Trent. The warping also helped to reduce the impact of waterlogging that resulted from seasonal tidal regimes (Lillie 1998b 103). Deposits up to 2.5m in depth have been recorded between Flixborough and the Flixborough Industrial Estatewith deeper deposits extending eastwards within the Site towards the modern channel where depths of up to 6m of warp have been recorded.

6.16 Drainage and ploughing within the Site in the post medieval and modern periods resulted in changing water regimes and likely desiccation of Holocene organic deposits. To date, the most recent part of the paleoenvironmental record spanning the last 200 years has received only limited investigation (Lillie and Neumann 1998).

6.17 The flat land adjacent to the Trent with ample cooling water and excellent communication links with the Yorkshire coalfields provided ideal sites for the large power station at Keadby and also the chemical plant at Flixborough which in 1974 was the site of Britain's worst industrial explosion.

Previous works

6.18 During the course of the Humber Wetland project, a borehole transect was placed across the Trent and extended into the north part of the Site. A total of 24 boreholes were excavated over a distance of just over 5km from borehole SE827140 north-west of Amcotts Grange to Flixborough at SE875142 (Lillie 1998, 45). Where sufficient data on depth and character of deposits in the Humber Wetland project is available these have been added to the deposit model and are discussed with reference to the results of the monitoring below. On the western side of the River Trent near Amcott the boreholes excavated revealed evidence for the aforementioned earlier channel of the Trent. On the eastern side of the modern course of the River at Flixborough 13 boreholes were excavated and provided insight into the nature of the floodplain.

6.19 The BGS has recorded a wide range of boreholes in the vicinity of the Site. Boreholes SE81SE41-SE81SE53 located between Area 2 and Area 3 were all sunk to depths of less than 5m and revealed a topsoil overlying organic clays with some peat which in tun overlay medium to fine sand deposits. Boreholes sunk at the jetty at Flixborough Stather (SE81SE214- SE81SE217) revealed a stratigraphy of peaty clay and sand with a basal gravel resting on Mercia Mudstone at c -15m AOD.

6.20 Further works were undertaken in the vicinity of Flixborough Stather within Area 1 by Ian Farmer Associates in 2018. Six boreholes, designated BH1 to BH6 were sunk in this area. Made Ground

was encountered in all boreholes to a maximum thickness of 2.10m and consisted of a gravelly sand/ sandy gravel with brick, concrete, slag, sandstone and mudstone content. The alluvial deposits consisted of soft laminated sandy clays often found to contain peat fibres and were occasionally organic. These upper laminated clays were underlain in boreholes BH3, 4 and 6 by a peat deposit at depths of between 4.70 to 6.70mbgl extending to depths of between 11.70 to 12.30mbgl. The peat and organic clays were underlain by a gravelly sand deposit at 11.70 to 12.50mbgl and for a thickness of between 4.90 to 7.10m. Weathered Mercia Mudstone was encountered at 17.10 to 19.40mbgl generally as a red brown sandy gravelly clay. Mercia Mudstone bedrock was encountered at depths of between 20.10 to 22.60mbgl (IFA 2018, 7-8).

7 SCOPE OF WORKS AND STRATEGY

7.1 The programme of geoarchaeological works was separated into multiple stages, summarised below but covered more fully in the WSI (AOC 2021).

i) Watching brief of contamination ground investigation

ii) Desk based review, deposit model and watching brief report on contamination ground investigation

iii) Further monitoring of future ground investigation and/or purposive geoarchaeological machine coring / hand augering

iv) Additional deposit model or geoarchaeological evaluation report

7.2 This report consists of stage ii) of the sequence outlined above.

8 RESEARCH AIMS AND OBJECTIVES

8.1 The specific aims and generic objectives of the monitoring of geotechnical works within the Site were:

- To identify and characterise the Pleistocene and Holocene geoarchaeological and palaeoenvironmental potential of deposits within the Site.
- To use this information to provide a Site wide understanding of landscape evolution and human activity across the area through time.
- Produce a comprehensive site archive and report.
- To enable the archaeological advisor to North Lincolnshire Council to make an informed decision on the requirement for any further work.
- To make available to interested parties the results of the investigation.

8.2 The specific aims of the stage i) and ii) investigation at the Site are defined as:

- To create a preliminary deposit model for the Site mapping areas of alluvial deposits and potentially areas of peat or waterlogged material within the deeper areas of the Trent Valley.
- To create a preliminary deposit model for the Site mapping areas of windblown sand on the rising mudstone ridge and edge of the Trent Valley, and record potential old land surfaces that may highlight horizons of possible past human activity buried by, within, or atop those sequences.
- Inform the potential for, and likely location of, archaeological remains within the Site.

- To set out recommendations for onsite sampling required in order to provide a chronologically robust understanding of the palaeoenvironmental sequence affected by the development
- To produce a site archive for deposition with an appropriate local museum service and to provide information for accession to the Lincolnshire Historic Environment Record (LHER).

9 METHODOLOGY

Onsite Watching Brief

9.1 The geoarchaeological watching brief consisted of the monitoring of 11 window sample boreholes, six monitoring well locations and one test-pit. Twelve locations (TP11, TP12, TP14, TP 16, TP 21-26, TP32 and TP35) originally intended for test-pitting had to be changed to window sample boreholes owing to on site conditions and excavation practicalities. The locations of the interventions (Figure 3) were designed to investigate the engineering and hydrological properties of sediments and overlying the mudstone.

9.2 Each borehole location was hand excavated to a depth of 1m prior to drilling. The hand excavation and borehole drilling was monitored by the geoarchaeologist on Site. Geoarchaeological monitoring took place between 24th August 2021 and 9th September 2021. Monitoring of the borehole excavations ceased once it was judged by the geoarchaeologist that the base of the Holocene organic deposits had been reached and/or when the limit of the geotechnical excavations had been reached.

9.3 An onsite overview of the lithology and stratigraphic character was obtained from review of upcast material and the cores and used to identify formation processes and palaeoenvironmental/ archaeological potential. Metadata for each borehole were entered on the recording sheet including borehole number and date, prior to commencing.

9.4 Descriptions followed standard geological criteria (Troels-Smith 1955; Tucker 2003) on pro-forma logs sheets (Appendix A).

9.5 A scale was placed beside each length of core and each core was then examined to identify the presence of any distinct layers, or boundaries between deposits so far as possible from the upcast and visible through the core casing. The depth of each deposit was recorded.

9.6 As a minimum all recording sheets contain:

- Sample Unique Identification Number
- Location (XY coordinates)
- Level of the top of the sample (e.g. m OD)
- Depth for top and bottom of each lithological unit
- Depths for poor / no sediment retrieval
- Description of each lithological unit, follow conventional standards (see Historic England 2015) and including sediment structure;
- Colour;
- Texture; and

- Sorting and boundary characteristics

9.7 A digital photograph, containing an appropriate scale, was taken of each core, using a camera with a resolution of at least 10 megapixels. A digital photographic register was maintained

9.8 Direct access to the boreholes and CPTs extracted for geotechnical investigations was not possible. The core samples were removed for testing by the geotechnical contractor and access was not possible for sub-sampling for archaeological / palaeoenvironmental purposes. Borehole logs were obtained from the contractor following completion of the survey and were reviewed and used to inform the deposit model.

9.9 The term 'deposit modelling' describes any method used to provide visual representations of the spatial and stratigraphic relationships between sediments and provide an effective strategy for investigating the subsurface stratigraphy and the potential for the preservation of associated palaeoenvironmental and archaeological remains (see Carey et al 2018).

Deposit Model

9.10 In order to create the deposit model, the geotechnical data was entered into a digital database (Rockworks 20). All data derived in direct relation to this project is prefixed with the AOC project number 'AOC25864'. The boreholes subject to geoarchaeological monitoring were given the prefix 'WS' for window sample boreholes 'MW' for monitoring well locations and 'TP' for test-pits (although as noted above some of the original test-pit locations were excavated as window samples. Logs form the Humber Wetland project are also prefixed with the AOC project number and 'HW' to denote their origin. BGS logs (BGS 2021) added to the database were given a prefix relating to the two-letter grid square of the associated national grid reference e.g. SE. Geotechnical logs obtained from works undertaken in the south of the Site to inform the Lincolnshire Lakes projects are prefixed with the originator of the data set 'e.g. AECOM or FWS. Boreholes obtained by previous AOC works in this area are prefixed with the AOC project number 'AOC52033'. A total of 111 sedimentary logs were included in the deposit model. The distribution of this data set is presented in Figure 3 and the data references for the sedimentary logs are presented in Appendix B.

9.11 Each lithology type (gravel, sand, silt, clay etc.) was given a unique colour (primary component) and pattern (secondary component) enabling correlation of the sediment components of deposits across the Site. By examining the relationship of the lithology types (both horizontally and vertical) in preliminary and iterative transects, correlations can inform the site-wide deposit groups. The grouping of these deposits is based on the lithological descriptions, which represent distinct depositional environments, coupled with a wider understanding of the local sedimentary sequences. Thus, a sequence of stratigraphic units ('facies'), representing certain depositional environments, and/or landforms can be reconstructed both laterally and through time.

9.12 An inverse distance weighted (IDW, weighting =2, number of points =12) digital elevation model (DEM) plot was produced for the surface of the Mercia Mudstone. This plot (Figure 10) gives an approximation of the topography of the Site as it existed at the end of the Devensian. The development of the overlying deposits is likely to have been influenced by the topography inherited from the Pleistocene/Late glacial period.

9.13 The overlying deposit sequence across the Site depicted by the stratigraphic units, as representative of specific depositional environments and/or landforms laterally and through time for the Site and immediate vicinity, is illustrated in profile or transect form (Figures 4-9). Such transects

present a straight-line correlation between the data points, extrapolating the stratigraphic units identified within each borehole.

9.14 The reliability of the model is dependent upon the data upon which it is founded. The borehole logs used for the model within the Site have been interpreted by a geoarchaeologist but interpretations were limited to observations made on site with no opportunity for sub-sampling and detailed laboratory based descriptions. Interpretation of deposits from boreholes beyond the Site boundary rely upon the accuracy of the original observations. Furthermore, while the borehole data are relatively well distributed over the north and south parts of the Site where extensive previous geotechnical works have been focused, availability of datasets within the centre and to the east of the Site was very limited and as such the reliability of the model decreases north and west of the Site. Modelling also extrapolates and smooths between the data sets and as such the modelled levels of stratigraphic contexts vary slightly from the levels recorded in each individual geotechnical log.

10 RESULTS

10.1 Each borehole location was hand excavated to a depth of 1m prior to drilling after which boreholes were excavated using a Dart 2 Cable Percussion Rig (Plate 1).

Plate 1: Dart 2 rig working shot from south

10.2 Conditions on site prevented excavation of the majority of planned test-pits. Test-pits TP11, TP12, TP14, TP 16, TP 21-26, TP32 and TP35 were excavated as window sample boreholes.

10.3 No significant archaeological deposits or artefactual material was encountered during the monitoring of the geotechnical works.

Area 1 (Figure 4, Figure 7)

10.4 Interventions MW5, MW6, MW7, WS104 and TP28 were located within Area1. Test-pit TP28 was excavated by machine to a depth of 0.45m (Plate 2) at which point a concrete slab was encountered and no further excavation took place.

Plate 2: Test-pit 28 section from north-west

10.5 Peat, within a clayey alluvial sequence, was encountered but not bottomed in interventions MW1 and MW5 (Plate 3). The deposits encountered within MW1 and MW5 are consistent with those seen during geotechnical investigations in 2018 and indicate that thick and deep organic clay and peat deposits survive within Area 1. These deposits have the best potential for a long sequence of good paleoenvironmental potential.

10.6 Interventions MW6 and WS014 were terminated at less than 1m depth and recorded Made Ground.

Plate 3: MW5 core from 2m-3m below ground level

10.7 The log tables for the geoarchaeological interventions monitored in Area 1 are provided below (MW5, MW6, MW7, WS104 and TP28).

Table 1 Deposit log for MW05

Intervention	Easting	Northing	Elevation	Description
AOC25864_MW05	486199.44	414370.7	3.68	

Top elevation (m OD)	Base elevation (m OD)	Top depth (m bgl)	Base depth (m bgl)	Thickness (m)	
3.68	3.28	0.00	0.40	0.40	mid yellowish greyish brown sandy CLAY with moderate rooting and modern debris, including concrete and gravel. Mixed. Firm and slightly moist.
3.28	2.98	0.40	0.70	0.30	dark greyish brown sandy CLAY with moderate subangular stones and gravel up to 40mm, as well as occasional larger stones up to 70mm. Mixed. Firm and slightly moist.
2.98	2.78	0.70	0.90	0.20	a layer consisting of broken up subangular chunks of concrete.
2.78	2.48	0.90	1.20	0.30	mid yellow greyish brown sandy CLAY with moderate subangular chunks of concrete and stone. Compact and dry. Mixed.
2.48	2.08	1.20	1.60	0.40	mid orange greyish brown sandy CLAY with occasional subangular stones and flint up to 30mm, and rare chunks of concrete. Firm and dry. Homogenous.
2.08	1.18	1.60	2.50	0.90	mid orange grey brown slightly sandy CLAY with rare rooting. Compact and slightly moist, homogenous.
1.18	0.08	2.50	3.60	1.10	mid grey brown CLAY with occasional subrounded gravel up to 10mm and black mineral staining. Compact, plastic and slightly moist. Homogenous with a diffuse boundary.
0.08	-0.32	3.60	4.00	0.40	mid brownish grey silty CLAY with occasional black mineral flecks towards 4m but no other inclusions. Compact, plastic and slightly moist. Homogenous.
-0.32	-0.62	4.00	4.30	0.30	Empty case

-0.62	-0.82	4.30	4.50	0.20	mid brownish grey silty CLAY with occasional black mineral flecks. Compact, plastic and slightly moist. Homogenous.
-0.82	-1.32	4.50	5.00	0.50	dark grey silty CLAY with moderate black mineral staining. Compact, plastic and slightly moist. Homogenous

Table 2 Deposit log for MW06

Intervention		**Easting**	**Northing**	**Elevation**	**Description**
AOC25864_MW06		486073.2	414435	4.199	
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	
4.20	4.14	0.00	0.06	0.06	Tarmac
4.14	3.55	0.06	0.65	0.59	mid greyish brown clayey SAND with high frequency of tarmac chunks up to 80mm and smaller subangular stones up to 50mm. Compact and moist, highly mixed.

Table 3 Deposit log for MW07

Intervention		**Easting**	**Northing**	**Elevation**	**Description**
AOC25864_MW07		486164.5	414488.8	3.498	
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	
3.50	3.41	0.00	0.09	0.09	tarmac
3.41	2.80	0.09	0.70	0.61	mid greyish brown clayey SAND with clinker, slag and tarmac in high frequencies. Loose when disturbed, highly mixed. Firm and dry. Gradual Boundary

2.80	2.50	0.70	1.00	0.30	dark blackish grey sandy CLAY with occasional subangular stones up to 20mm. Compact, plastic and slightly moist with a gradual boundary.
2.50	2.20	1.00	1.30	0.30	mid orange brown clayey SAND, sterile. Loose when disturbed, homogenous and slightly moist.
2.20	1.90	1.30	1.60	0.30	mid mottled blue/grey and orange CLAY. Relatively firm, homogenous, moist with a diffuse boundary.
1.90	1.00	1.60	2.50	0.90	mid orange brown grey CLAY with a slight blue tinge further down towards 2.5m. Soft and plastic, homogeneous. Moist and sterile. Diffuse boundary.
1.00	0.50	2.50	3.00	0.50	dark brown grey CLAY with blue tones. Soft, quite homogenous, moist. Possible organic/ plant debris very occasionally. Soft and black silty inclusion at 3m.
0.50	0.10	3.00	3.40	0.40	missing due to technical issues
0.10	0.00	3.40	3.50	0.10	blue/ grey CLAY, sterile. Moist and homogenous. Soft with a sharp boundary.
0.00	-1.40	3.50	4.90	1.40	Peat. Dark brown peaty deposit with grey CLAY. Lenses of clay and peat. Moist, plastic to touch but fibrous in appearance, a bit spongy. Some bone fragments present. Fewer clayey lenses towards 4.90 and more bones and wood present. The wood and bone is both very soft. moderate boundary between sharp and gradual.
-1.40	-1.50	4.90	5.00	0.10	more blue grey CLAY with some peat content, soft and plastic. More homogenous than the context above.

Table 4 Deposit log for WS104

Intervention		Easting	Northing	Elevation	Description
AOC25864_WS104		486135.4	414399.91	3.722	
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	
3.72	3.62	0.00	0.10	0.10	Tarmac
3.62	3.42	0.10	0.30	0.20	brown/ grey SAND - bedding material with concrete. Dry and homogenous.
3.42	3.27	0.30	0.45	0.15	Yellow grey sand with plastic sheet remains.

Table 5 Deposit log for TP28

Intervention		Easting	Northing	Elevation	Description
AOC25864_TP28		486144.2	414279.77	3.392	
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	
3.39	3.24	0.00	0.15	0.15	Turf. Dark brownish sandy SILT with high frequent of rooting.
3.24	3.07	0.15	0.32	0.17	light greyish yellow silty SAND. Moderate subangular pieces of concrete and stone.
3.07	2.94	0.32	0.45	0.13	concrete slab.

Area 2 (Figures 4 and 6)

10.8 Interventions MW0, MW1, TP21, TP22, TP25 and TP26 were located within Area 2. Deep deposits of peat within TP26 (Plate 4) and MW0 (Plates 5-6) indicate survival of organic deposits east of the modern river channel to depths greater than 5m. Organic silty clays were recorded within MW1 and also indicate potential for deep organic deposits in this area. The organic deposits within MW0 and MW1 were not bottomed during the investigation. The sequence recorded in TP22 recorded organic deposits sandwiched between an upper clay rich deposit and a lower sand deposit (Plate 7). The upper clays likely represent the Upper Alluvium while the lower sandy deposits are likely part of the Lower Alluvium or wind blown sands.

Plate 4: TP26 peat at base of core at 5m below ground level

10.9

Plate 5: MW0 Fibrous peat at base of core at 1m below ground level

Plate 6: MW0 Fibrous and woody peat at 3m below ground level

Plate 7: TP22 Probable wind blown sand at 2.5m below ground level

10.10 The log tables for the geoarchaeological interventions monitored in Area 2 are provided below (MW0, MW1, TP/WS21, TP/WS22, TP/WS25 and TP/WS26).

Table 6 Deposit log for MW0

Intervention	Easting	Northing	Elevation	Description
AOC25864_MW0	486659.05	413791.1	2.972	

Top elevation (m OD)	Base elevation (m OD)	Top depth (m bgl)	Base depth (m bgl)	Thickness (m)	
2.97	2.57	0.00	0.40	0.40	mid grey grown silty CLAY. High frequency of roots and occasional road debris - tarmac, cbm, stone. Compact but slightly crumbly under pressure and slightly moist.
2.57	2.17	0.40	0.80	0.40	mid greyish brown slightly silty CLAY. Occasional black mineral deposits. Plastic. Compact. Homogenous. Slightly moist.
2.17	-2.03	0.80	5.00	4.20	clayey fibrous peat. Full of vegetation matter, smells strongly of sulphur, crumbles when handled. Engineers called it amorphous peat but vegetation can be seen throughout and wood seen at 3m. Becomes wet and more clayey at 5m.

Table 7 Deposit log for MW1

Intervention		Easting	Northing	Elevation	Description
AOC25864_MW01		486534.98	413999.7	3.772	
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	
3.77	3.47	0.00	0.30	0.30	mid greyish brown silty CLAY. High frequency of roots and occasional subangular stones up to 50mm. Compact. Fairly dry and crumbles under pressure.
3.47	2.57	0.30	1.20	0.90	mid orange grey slightly silty CLAY with occasional rootlets and black mineral staining. Compact, moist and plastic. Homogenous with a gradual boundary.
2.57	1.77	1.20	2.00	0.80	mid brown silty CLAY. Sterile. Plastic. Compact. Moist. Homogenous with a gradual boundary.

1.77	-1.23	2.00	5.00	3.00	dark blackish brown silty CLAY. Fibrous and smells strongly of sulphur, with frequent vegetation inclusions (looks like hay?). Compact and moist but crumbles when handled.

Table 8 Deposit log for TP/WS21

Intervention		**Easting**	**Northing**	**Elevation**	**Description**
AOC25864_WS21		486618.22	413130.22	2.921	
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	
2.92	2.42	0.00	0.50	0.50	mid greyish brown silty CLAY, with frequent roots and occasional stones up to 30mm. Fairly dry, crumbles under pressure and homogenous.
2.42	2.32	0.50	0.60	0.10	mid grey brown slightly silty CLAY, sterile. Plastic, compact and slightly moist.
2.32	1.72	0.60	1.20	0.60	clayey fibrous PEAT with frequent vegetation and occasional wood. Mid blackish brown in colour. Slightly moist, crumbly under pressure and has a sharp boundary.
1.72	0.22	1.20	2.70	1.50	dark blackish grey silty SAND, medium to coarse grain, sterile. Compact but easily disturbed. Moist and has a gradual boundary.
0.22	-0.08	2.70	3.00	0.30	mid brownish orange SAND, coarse grained and sterile. Compact but easily disturbed. Moist.

Table 9 Deposit log for TP/WS22

Intervention		**Easting**	**Northing**	**Elevation**	**Description**
AOC25864_WS22		486376.99	413088.11	2.99	
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	
2.99	2.49	0.00	0.50	0.50	mid greyish brown silty CLAY with moderate roots and subangular stones up to 30mm. Compact, dry and crumbles under pressure. Homogenous with a gradual boundary.

2.49	1.79	0.50	1.20	0.70	mid orange brown silty CLAY with occasional rootlets. Slightly friable, compact but also crumbles slightly under pressure. Homogenous. Fairly sharp boundary.
1.79	1.19	1.20	1.80	0.60	dark blackish brown clayey silty SAND with moderate organic content, occasional rooting and charcoal - engineers believe it is likely dried out peat. Crumbly, slightly moist, and has a sharp boundary.
1.19	0.79	1.80	2.20	0.40	mid orange yellow slightly silty SAND, coarse grained, with rare black mineral staining present. Compact but easily disturbed. Slightly moist, and has a sharp boundary.
0.79	0.49	2.20	2.50	0.30	mid brownish orange slightly silty SAND, coarse grained, with occasional subangular pebbles up to 10mm and black staining. Slightly moist. Compact but easily disturbed. Gradual boundary.
0.49	-0.01	2.50	3.00	0.50	mid blackish greyish brown coarse SAND, sterile. Moist. Compact but easily disturbed.

Table 10 Deposit log for TP/WS25

Intervention		**Easting**	**Northing**	**Elevation**	**Description**
AOC25864_WS25		486257.05	414101.31	3.009	
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	
3.01	2.71	0.00	0.30	0.30	Tarmac
2.71	2.31	0.30	0.70	0.40	mid brownish grey sandy CLAY with occasional subangular stone up to 50mm and CBM frags. Compact, moist, plastic and homogenous, with a hydrocarbon smell.
2.31	2.11	0.70	0.90	0.20	same as above but separated by a thin mesh.
2.11	2.01	0.90	1.00	0.10	high frequency of concrete chunks and flint with a mid brownish grey sandy CLAY, loose when disturbed, with a hydrocarbon smell.

Table 11 Deposit log for TP/WS26

Intervention		Easting	Northing	Elevation	Description
AOC25864_WS26		486200.94	414156.85	2.811	
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	
2.81	2.45	0.00	0.36	0.36	tarmac. Sharp boundary.
2.45	2.11	0.36	0.70	0.34	mid grey brown clayey silty SAND with rare gravel present, gravel size up to 30mm. Rare larger subangular stones up to 40mm and CBM. Intermixed. Moist and compact, with a smell of hydrocarbons.
2.11	1.11	0.70	1.70	1.00	No difference to deposit above but separated by mesh.
1.11	0.61	1.70	2.20	0.50	mid grey brown clayey SILT, sterile. Compact and moist with a gradual boundary.
0.61	0.51	2.20	2.30	0.10	dark grey silty CLAY, sterile. Moist and compact.
0.51	0.11	2.30	2.70	0.40	mid grey brown clayey SILT, sterile. Compact and moist with a gradual boundary.
0.11	-0.69	2.70	3.50	0.80	dark grey clayey SILT with occasional black mineral deposits and possible organics, smells strongly of organics. Compact and moist.
-0.69	-0.89	3.50	3.70	0.20	case empty
-0.89	-2.07	3.70	4.88	1.18	dark grey silty CLAY, occasional black organics with a strong organic smell present. Compact and moist.
-2.07	-2.19	4.88	5.00	0.12	PEAT. Mid greyish blackish brown clayey silt. Compact, fibrous and moist.

Area 3 (Figure 5, Figure 8)

10.11 Interventions TP11, TP12, TP14, TP16, TP32 and TP35 were located within Area 3. Peat, underlying sand or interleaved between sand and silty clay units (see Plate 8), was recorded in each of these interventions. Organic peat rich deposits were not bottomed within TP12 and indicate that organic deposits are deeper in this area. Where present the peat represents a stabilisation or cessation in sediment accumulation, and could represent possible horizons of potential human activity; provide an environmental context for any human activity or landscape development; and through radiocarbon dating could provide a chronology for the sequence of sand depositions.

Plate 8: WS14 organic silts and clays at 2-3m (top) overlying sterile stiff clay and sand at 3-4m (bottom)

10.12 The log tables for the geoarchaeological interventions monitored in Area 3 are provided below (TP/WS11, TP/WS12, TP/WS14, TP/WS16, TP/WS32 and TP/WS35).

Table 12 Deposit log for TP/WS11

Intervention		Easting	Northing	Elevation	Description
AOC25864_WS11		485820.1	409586.1	2.505	
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	
2.51	2.31	0.00	0.20	0.20	dark brown silty CLAY, dry to slightly moist with a sharp boundary.
2.31	1.21	0.20	1.30	1.10	mid grey brown slightly clayey SAND with iron pan present. Water also present. Lensoidal.
1.21	1.01	1.30	1.50	0.20	dark black grey slightly clayey sandy SILT, moist with a sharp boundary.
1.01	0.81	1.50	1.70	0.20	silty clay PEAT; plastic and not very fibrous. Soft. Homogenous, moist to wet with a sharp boundary.

0.81	-0.20	1.70	2.70	1.00	mid brown grey SAND becoming greyer towards 2.7m. Sterile. Firm but crumbles with pressure. Lensoidal/ streaky in nature with a very diffuse boundary.
-0.20	-1.90	2.70	4.40	1.70	fine grey SAND, sterile and moist; becoming wet at 4.3m. Firm but breaks under pressure. Homogenous. Sand becomes paler and more organic at 4.1m but otherwise no change.

Table 13 Deposit log for TP/WS12

Intervention		**Easting**	**Northing**	**Elevation**	**Description**
AOC25864_WS12		486096.6	409609.3	2.655	
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	
2.66	2.46	0.00	0.20	0.20	mid brown slightly silty SAND. Soft and friable, crumbly under pressure. Moist and homogenous.
2.46	1.66	0.20	1.00	0.80	mottled, mixed black grey SAND and pale grey SAND. Slightly moist and homogenous. Likely purposeful deposition for the road.
1.66	1.26	1.00	1.40	0.40	similar to the above but with a deep red brown SAND included. Slightly more organic.
1.26	-0.05	1.40	2.70	1.30	brown SAND. Fine grain, moist, homogenous and firm. Gradual boundary.
-0.05	-0.65	2.70	3.30	0.60	fine grey SAND which is firm and crumbles under pressure. Moist, homogenous, with a gradual change.
-0.65	-1.25	3.30	3.90	0.60	darker grey, more saturated SAND. Sterile.

-1.25	-2.35	3.90	5.00	1.10	mixed blue/grey SAND with dark brown peat. Peat is fibrous and spongy. Sand is firm and slightly coarse.

Table 14 Deposit log for TP/WS14

Intervention		**Easting**	**Northing**	**Elevation**	**Description**
AOC25864_WS14		486151.39	409995.19	2.828	
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	
2.83	2.53	0.00	0.30	0.30	dark brown sandy CLAY with frequent rooting and occasional subangular stones up to 30mm. Compact, homogenous and dry, with a sharp boundary.
2.53	1.63	0.30	1.20	0.90	mid yellow grey silty SAND with occasional roots and rare subangular stones up to 30mm. Compact, slightly moist, homogenous with a diffuse boundary.
1.63	0.93	1.20	1.90	0.70	dark blue/ grey with patches of orange grey clayey silty SAND. Rare rooting but otherwise sterile. Compact, slightly moist. Homogenous, with a sharp boundary.
0.93	0.23	1.90	2.60	0.70	dark blackish brown clayey SILT with high frequency of organic matter. Peaty in nature. Fibrous, moist, slightly crumbly and soft. Sharp boundary.
0.23	0.03	2.60	2.80	0.20	mid greyish brown silty CLAY, sterile. Slightly moist and organic smelling. Compact, homogenous, with a sharp boundary.
0.03	-1.37	2.80	4.20	1.40	mid white grey silty SAND, coarse grain and sterile. Compact but easily disturbed. Moist with a gradual boundary.
-1.37	-1.62	4.20	4.45	0.25	mid orange brown silty SAND, fine grained and sterile. Compact but easily disturbed. Homogenous.

Table 15 Deposit log for TP/WS16

Intervention		Easting	Northing	Elevation	Description
AOC25864_WS16		486171.4	410300.8	2.938	
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	
2.94	2.64	0.00	0.30	0.30	mid greyish brown clayey SAND with moderate roots and occasional subangular stones up to 30mm. Dry and compact, homogeneous, with a gradual boundary.
2.64	2.54	0.30	0.40	0.10	light white grey silty SAND, sterile. Easily disturbed, dry with a diffuse boundary.
2.54	2.14	0.40	0.80	0.40	mid orangey grey slightly silty SAND, sterile but engineer said ash was present. Easily disturbed, homogenous, moist with a diffuse boundary.
2.14	-0.06	0.80	3.00	2.20	light greyish orange slightly clayey SAND, sterile and coarse grained in nature. Slightly moist, easily disturbed and homogenous.
-0.06	-1.06	3.00	4.00	1.00	no recovery

Table 16 Deposit log for TP/WS32

Intervention		Easting	Northing	Elevation	Description
AOC25864_WS32		485812.67	409068.7	4.234	
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	
4.23	3.53	0.00	0.70	0.70	mid greyish brown clayey SAND with moderate rooting and occasional subangular stones up to 200mm. Dry, compact, homogenous with a diffuse boundary. Field drainpipe removed at 0.7m.

3.53	1.73	0.70	2.50	1.80	light brownish yellow SAND, very rare rooting likely intrusive, otherwise sterile. Compact but easily disturbed. Slightly moist and homogenous with a gradual boundary.
1.73	0.73	2.50	3.50	1.00	pale yellow grey SAND with occasional black mineral staining. Medium coarse. Compact but easily disturbed, moist and homogenous.

Table 17 Deposit log for TP/WS35

Intervention		**Easting**	**Northing**	**Elevation**	**Description**
AOC25864_WS35		485853.67	408765.69	3.911	
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	
3.91	3.61	0.00	0.30	0.30	dark greyish black clayey SAND with frequent rooting and rare subangular stones up to 20mm. Compact, slightly moist, homogenous with a gradual boundary.
3.61	2.71	0.30	1.20	0.90	mid orange brownish grey sandy SILT with occasional rooting and vegetation present. Compact, slightly moist, homogenous with a gradual boundary.
2.71	1.71	1.20	2.20	1.00	mid grey brown slightly silty SAND, coarse grain and containing rare vegetation (hay stalks) but likely intrusive, dropped in from above. No other inclusions. Compact but easily disturbed. Moist, with a gradual boundary.
1.71	0.91	2.20	3.00	0.80	mid grey SAND, fine grained and sterile. Compact until disturbed. Moist and homogenous.

Area 4

10.13 MW8 was the only intervention within Area 4. Sands were recorded below topsoil within this core to a depth of 5m bgl. The sand was broadly homogenous and became finer with depth. It is possible that the finer sands towards the base of the sequence identified may be aeolian (wind blown) sands

or part of the Sutton Sand Formation. MW8 is situated on the sandy slopes to the east of the Flixborough Industrial Estate in an area of high archaeological potential and in a similar topographical position to the Anglo-Saxon monastery discovered at Flixborough to the south.

10.14 The log tables for the geoarchaeological interventions monitored in Area 4 are provided below.

Table 18 Deposit log for MW08

Intervention		**Easting**	**Northing**	**Elevation**	**Description**
AOC25864_MW08		486698.36	414480.8	4.064	
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	
4.06	3.66	0.00	0.40	0.40	mid greyish brown silty SAND with a high frequency of roots and moderate subangular stones up to 40mm. Slightly moist, compact, homogenous, with a gradual boundary.
3.66	3.26	0.40	0.80	0.40	mid orange brown silty SAND with very occasional subangular stones up to 30mm and rooting. Homogenous. Firm until disturbed then crumbly. Dry, with a slightly diffuse boundary.
3.26	3.06	0.80	1.00	0.20	mid yellow brown silty clayey SAND. Moderate subangular stones and flint up to 70mm. Crumbly when disturbed. Dry and homogenous.
3.06	2.86	1.00	1.20	0.20	mid yellow brown slightly silty SAND. Sterile. Crumbly when disturbed. Dry and homogenous.
2.86	2.46	1.20	1.60	0.40	mid yellow brown clayey SAND with moderate subangular stones and flint up to 50mm. Dry, crumbly when disturbed. Homogenous with a diffuse boundary.
2.46	1.66	1.60	2.40	0.80	mid yellow brown clayey SAND with occasional black mineral staining. Compact, homogenous and slightly moist, with a sharp boundary.
1.66	0.06	2.40	4.00	1.60	light brown orange slightly clayey SAND. Fine grain and sterile. Slightly moist, homogenous, compact until disturbed. Very diffuse boundary, not perceived.

0.06	-0.94	4.00	5.00	1.00	light brownish orange SAND. Sterile, moist, compact but easily disturbed. Homogenous. Core not photographed from here as was stuck in the tube.

11 DEPOSIT MODEL

Humber Wetland Transects

11.1 Given the limited depth of excavation of the monitoring locations understanding of the geoarchaeological and palaeoenvironmental character of deposits within and around the Site was restricted and thus review of sediment stratigraphy recorded during the Humber Wetland survey has also been undertaken. A total of 24 boreholes were excavated over a distance of just over 5km from borehole SE827140 north-west of Amcotts Grange to Flixborough at SE875142 (Lillie 1998, 45). Where sufficient data on depth and character of deposits in the Humber Wetland project is available these have been added to the deposit model.

11.2 The 5.01km transect excavated across the Trent valley between Amcotts and Flixborough has shown that two channels have taken flow in the vicinity of Amcotts during the Holocene. These channels, and the floodplain margins have produced depositional sequences that overlie material of later Devensian origin. In the westernmost paleochannel sequence at SE846137 pollen and diatom analysis of deposits from -8.83m AOD have revealed middle Mesolithic age for the deposit. These deposits indicate an environment of alder dominated mixed carr woodland with both freshwater and brackish water. A maximum depth of deposits to 11.1m bgl (-8.95m AOD) was proven in borehole SE852139 but this did not extend to the full depth of the channel incision and thus it is anticipated that earlier Holocene sequences are preserved on this western side of the Trent. Further up in the sequence evidence for plant communities characteristic of raised mires was recorded and indicates a raised mire was colonised by plants after c 1000 AD (Lillie 1998, 51).

11.3 On the eastern side of the modern River Trent within the Site boundary the depositional sequence was found to extend over 10.75m bgl to -7.73m AOD, but as with the west side of the river, the sequence was not bottomed and thus it is likely that earlier deposits are preserved below these depths. Pollen analysis of deposits from -7.69m AOD revealed an environment of mixed alder carr woodland indicative of a middle Mesolithic age at c 5300BC. Higher in this sequence at -1.36m AOD the deposits suggest an open landscape associated with mid-Iron Age or later anthropogenic modification of the floodplain environment for agriculture after c400 cal BC (Lillie 1998, 52).

11.4 Excavation of a further seven boreholes on the eastern side of the Trent floodplain in the vicinity of the Site was undertaken as part of the Humber Wetlands Project to investigate warping sediment. Warp over alluvium floodplain peats was encountered in all seven of these boreholes. Borehole SE869131 was excavated to the north of Neap house within the Site and in an area that has not been defined as warp by the BGS. The sequence revealed in this borehole comprises a warp derived humus silt loam plough soil to 0.25m over a laminated warp to 0.77m which overlay a thin buried topsoil which in turn overlies a humified floodplain peat to 0.95m in depth below which wind-blown sands were recorded. Pollen analysis of the upper part of the peat within the borehole produced an assemblage of post Alnus rise age which suggest a post-Neolithic age for the deposit.

In all boreholes where warp deposits were identified they were shown to exhibit a light well drained silt loam topsoil.

Key Stratigraphy

11.5 Although the results and interpretation detailed in this report have been produced as accurately as possible, it should be noted that the conclusions offered are a subjective assessment of collected data sets.

11.6 Five stratigraphic units have been identified across the Site. These units are summarised in Table 19 below and listed in stratigraphic order from the oldest to the most recent. The vertical deposit succession is illustrated on the transects drawn across the site (Figure 4 to Figure 9). The major stratigraphic units are also represented by surface and/or thickness plots (Figure 10 to Figure 17).

Table 19 Summary of identified stratigraphic units (subdivision of the Holocene based Walker et al 2012)

Stratigraphic unit (facies)	Lithology/Description	Chronology	Environment of deposition
Mercia Mudstone	Stiff, reddish brown to light grey clayey gravel	Early Triassic Period (52 to 247 million years ago)	Marine seabed
Lower alluvium/Warp/Sutton Sand	Stiff to firm, red/ brown/ yellow/ grey, silty sand	Devensian (115 thousand years ago) to Early Holocene / Greenlandian (c 11,650–8,276 BP/ 9,700–6326 BC)	Most likely aeolian or wind-blown redeposition of underlying deposits or bedrock during periglacial to temperate conditions.
Organic deposits	Black, humified peat to brown, organic sands	Early Holocene / Greenlandian (c 11,650–8,276 BP/ 9,700–6326 BC) to Late Holocene / Meghalayan (c 4200 BP/2250 BC onwards)	Temperate wetland development within a floodplain environment
Upper alluvium/Warp/Sutton Sand	Brown silty sand to clay	Early Holocene / Greenlandian (c 11,650–8,276 BP/ 9,700–6326 BC) to Late Holocene / Meghalayan (c 4200 BP/2250 BC onwards)	Most likely representative of overbank floodplain deposition whether natural or anthropogenic
Topsoil and made ground	Dark brown silt to sand, and redeposited material of local origin with additional modern inclusions (concrete etc)	Victorian to modern (19th Century AD onwards)	Modern agriculture

Mercia Mudstone

11.7 A predominantly stiff to firm, red to light grey, clayey gravel, this deposit was laid down in the early Triassic Period as a marine seabed. The modelled topographic plot of the unit's surface elevation (Figure 10) can give an indication of the landscape at the start of the Holocene (c. 10,000 BC) as

it will inform the character of any overlying pre-Holocene deposition. Such a model can be especially useful when the boundary between the pre-Holocene and Holocene deposits is difficult to identify. Figure 10 shows the surface of the Mudstone lies at c. -16.5m AOD in Area 1 in the north of the Site and rises to c. -12.5m AOD in Area 2, and c. -6.5m AOD towards the south of the Site in Area 3.

11.8 A note of caution with regards to this representation is required, however. On the transects (Figure 4 to Figure 9), it is evident that none of the deposit logs monitored as part of this programme of works reached the Mudstone and result in a simplistic model of the Mudstone surface. Of particular relevance is the absence of records from the south of Area 4 and the central parts of the Site within Area 3 which have reached the mudstone surface. However, despite its simplicity Figure 10 does draw attention to the fall in bedrock from east to west away from the mudstone ridge beyond the east of the majority of the site, and towards the modern river.

Lower alluvium/Warp/Sutton Sand

11.9 This unit is a stiff to firm, red to grey, silty sand. Its lithology indicates it could be Sutton Sand, natural alluvium or human induced alluvium (Warp), and does not unequivocally point to one or another. Those deposits that have a firmer/stiff character are likely to be Sutton Sand. The Sutton Sand Formation is recorded by the BGS (2021) as a fine silty sand, which formed during the Devensian to Holocene (115 thousand years ago onwards) and represents an aeolian or wind-blown redeposition of underlying deposits.

11.10 In character this unit is almost identical to the Upper alluvium/Warp/Sutton Sand and the Organic unit, sandwiched between the Lower and Upper alluvium/Warp/Sutton Sand units, is all that really distinguishes them. It is likely that the majority of the lower portion of this unit is of a pre-Holocene date and unlikely to have any archaeological interest. The upper portion of this deposit may be of Holocene date as either an Early Holocene wind-blown deposit or as early to mid-Holocene overbank floodplain deposits (alluvium).

11.11 Figure 11 models the thickness of this unit across the Site. In the north of the Site within Area 1 the unit is recorded to from 4.5-8.5m thick and within Area 2 the unit is recorded to be generally below 5.5m thick, the depth increases southwards to maximum depths of around 13m in the centre of Area 3 (also illustrated in Figure 9) before reducing in thickness towards the south of the Site. As would be expected the thicker deposits generally in fill the recorded low-lying areas of bedrock, as identified in Figure 10.

11.12 Figure 8, a west to east transect across the southern limit of Area 2, records a thickness up c. 12m but as is also evident from this transect very few interventions in the vicinity reach beyond 2-4m bgl and represent incomplete records.

11.13 Figure 12 is an elevation model of the surface of the Lower alluvium/Warp/Sutton Sand. Despite the questions concerning an identifiable pre-Holocene/Holocene boundary within or on the surface of the Lower alluvium/Warp/Sutton Sand unit, Figure 12 is considered the most probable approximation of the topography of the Site as it existed at the beginning of the early Mesolithic period (c. 10,000 years ago). The development of the Holocene floodplain is likely to have been influenced by the topography inherited from the Pleistocene/Late Glacial period. This surface would have dictated the course of later channels, with gravel high points forming areas of dry land within the wetlands, and lower lying areas forming the main threads of later channels.

11.14 The modelled surface of the Lower alluvium/Warp/Sutton Sand is shown on Figure 12. This indicates that the surface across the southern half of Area 3 lies at approximately 0 to 1.5m AOD. There is a dip in the surface of the Lower alluvium towards the north of Area 3 (c. -2m AOD), the level rises again to the south of Area 2 (c. 0.5m AOD), before dropping again in Area 1 and the northern part of Area 2 (c. -11.5m AOD) which reflects the lower elevation of the bedrock at this location (See Figure 10). The surface model also shows a general dip in the surface to the west of the Site towards the modern river channel, potentially signifying a relic low-lying floodplain.

11.15 The high elevation (c. 0.5m AOD) of the surface of the alluvium/Warp/Sutton Sand indicated for the southern part of Area 2 is also illustrated in transect form (Figure 8), although it should be noted that no useful deposit records exist to the west of TP22 and its is not known how far such elevations continue.

11.16 No deep interventions exist in Area 4 to record the presence of lower alluvium/warp/Sutton sand, as evident from Figure 7.

Organic Deposit

11.17 The Organic deposits unit is predominantly black to brown, humified peat to organic clays, silts and sands. It is indicative of a temperate climate and vegetation growth within a wetland or waterlogged environment, possibly on the margins of a river. These deposits are almost certainly of Holocene date (9,700 BC/11,650 BP onwards) but there is some minor potential that any low-lying and/or sandier organic deposits relate to Late Glacial interstadials (14,700-11,650 BP).

11.18 Figure 13 models the thickness of this unit across the Site and the wider study area. In the north of the Site within Area 1 the unit is up to c. 5m thick. The unit is thickest within Area 2 where it is mapped to be up to 7m thick. The thickness of the unit generally decreases southwards across Area 3. An area of thicker deposits is mapped to the west of the Site and east of the River Trent. This runs broadly north to south and may represent an infilled meander/palaeochannel of the River Trent.

11.19 Figure 14 is an elevation model of the surface of the Organic unit but in contrast to the previous elevation model (Figure 12), it is unlikely to represent contemporary deposits or a period specific surface. Figure 14 is more usefully employed to show incidence and survival in respect to Organic deposits thickness plot (Figure 13), the proposed early Mesolithic topographic model in Figure 12, as well as to any proposed development impacts.

11.20 The transects provide further detail concerning the incidence and form of the Organic deposits. The north to south transect through Areas 1 and Area 2 (Figure 4) shows areas of deep peat within the northern portion of Area 2. This is further supported by the west to east transect which terminates within Area 2 and also shows a deep sequence of organic deposits here. The north to south transect through Area 3 shows shallower organic deposits but nevertheless indicates relatively long periods of stabilisation and wetland vegetation development. A west to east transect across the north of Area 3 (Figure 9) records thick organic deposits (c.6-8m) beyond the west of the site within a relic low-lying floodplain. These deposit thin eastwards towards the site to c. 1m. The organic sands found across Area 3 of the Site could indicate short-lived periods of wetland development within a more active fluvial environment or later fluvial erosion of well-formed peats, like those found in the north of the Site. Peat, underlying sand or between sand units, may also signify old land surfaces and soil formation between periods of windblown sand deposition but are more likely to represent

periods of waterlogging and wetland formation. Alternatively, they could be related to the warp also known in the area.

11.21 Figure 8, a west to east transect across the southern limit of Area 2, records a near-surface organic deposit up c. 1.5m thick to the west, and these may represent more recent waterlogged environments or even be warp. The shallow nature of the interventions across this area do allow for the possibility of further organic deposits that remain unrecorded at greater depth (as seen in Figures 4 and 5).

11.22 No deep interventions exist in Area 4 to record the presence of organic deposits, as evident from Figure 7.

Upper alluvium warp sands

11.23 The Upper alluvium/Warp/Sutton Sand are recorded as a brown, silty sand to clay. As with the Lower alluvium/Warp/Sutton Sand unit it could viably be either Sutton Sand, natural alluvium or human induced alluvium (Warp). However, as the Upper unit overlies the Organic deposits it is much more likely that this unit represents either natural overbank/floodplain deposits as a result of relative sea level rise and the Late Holocene ponding back of inland rivers (alluvium), and/or human induced alluvial accretion (Warp).

11.24 The history of warping in the vicinity of the Site as well as changes in the river channel of the River Trent up until relatively recent times has been discussed in Section 3.1 above. Overbank flooding, floodwarping and cart warping are all recorded within the Site in the post-medieval period and it remains very difficult to distinguish between alluvium and Warp. As such the Upper alluvium/Warp/Sutton will generally be treated as a natural floodplain deposit, dated potentially from the Early Holocene (9,700 BC) onwards, but more than likely from Mid Holocene (6326 BC) onwards.

11.25 Figure 15 models the thickness of the Upper alluvium/Warp/Sutton Sand across the Site. In the far north of the Site within Area 1 the unit is up to c. 5m thick. The unit is up to 8m thick in the far north-west of Area 2 but is thinner within the majority of Area 2 (less than c. 3m). The unit increases in thickness again to c. 4.5m thick in the centre of Area 3. The thickness of the deposit here correlates closely with the location of a large east to west aligned drain and may indicate floodwarping practices. In the south of the Site within Area 3 the deposits are generally thinner approximately 1m thick. It is also notable that relatively thin areas of alluvium appear to be present over the areas of deeper peat within Area 2.

11.26 Figure 16 is an elevation model of the surface of the Upper alluvium/Warp/Sutton Sand, again it is unlikely to represent contemporary deposits or a period specific surface and is more usefully employed to show incidence and survival. Over the majority of the Site the surface of this unit lies at c. 1.5-3.5m AOD. The areas of lower surface have some level of correlation with the deeper areas of Made Ground mapped on Figure 17 and indicate that to some extent the surface of the upper alluvium also maps the extent of truncation from modern/more recent activity. The high elevation recorded in Area in the northeast (also present on Figure 7) may reflect rising ground on the edge of the north south aligned mudstone ridge and possible Glaciolacustrine deposits.

Topsoil and made ground

11.27 The sequence is sealed by topsoil across the majority of the Site. The topsoil is a dark brown silt

to sand up to c. 0.5m thick across the majority of the Site (Figure 17). Widespread agricultural improvements took place from the medieval period onwards. Medieval and post-medieval archaeology could survive within the upper deposits.

11.28 Modern activities within the industrial estate and around the M181 have resulted in disturbance of deposits and deeper areas of Made Ground are mapped in Area 1 and area around the industrial estate and within Area 3 near the M181.

12 ARCHAEOLOGICAL AND PALAEOENVIRONMENTAL POTENTIAL

Realisation of the Research Aims

12.1 The results of the borehole monitoring alongside reviews of other nearby geotechnical works have been used to create a series of projected profiles, surface and thickness plots across the Site showing the main deposits encountered. These can be used to further discuss and understand the geoarchaeological and palaeoenvironmental potential of the Site.

12.2 Areas of alluvial deposits, as well as areas of peat and waterlogged material are present in a number of possible former channel areas and the relic low-lying floodplain within Areas 1 and 2. Deposits of peat up to 7m thick are known within Area 1 in the north of the Site and it is advised that further sampling is undertaken here to retrieve continuous core samples for possible future palaeoenvironmental assessment is recommended. The thickest, deep peat deposits were located in BH6 (4.7-11.7m bgl) during investigations by IFA in 2018 and peat deposits in MW7 were not bottomed during the recent monitoring programme. Development proposals include the excavation of a bunker hall to a depth of 10m below ground level within Area 1, and thus there will be potential for disturbance of these deposits which have high palaeoenvironmental potential. Locating a further geoarchaeological borehole within this area between these two points in order to retrieve samples from the full Holocene sequence would therefore be appropriate.

12.3 Areas 1 and 2 are located within 'Archaeological Potential Zone 1' (Figure 18), the portion of the Trent floodplain that lies immediately east of the current river channel. Until the drainage and warping schemes of the 17th century onwards, this zone would have been too wet for cultivation and intermittently flooded for much of the year. It is considered unlikely that significant archaeological evidence relating to settlement will be encountered in this zone, with the possible exception of Flixborough Stathe (the site of the ERF plant) where medieval riverside activity is known to have occurred. There is potential for earlier prehistoric activity and material (eg flint scatters, wooden revetments, boats, votive deposits of metalwork) to occur, although this is likely to be buried beneath overlying warp deposits.

12.4 The organic deposits found across the site could indicate short-lived periods of stabilisation and wetland development within a more active fluvial environment, later fluvial erosion of well-formed peats, periods of soil development and waterlogging atop previously dry land surfaces. The latter being the least likely considering the generally low-lying floodplain nature of the landscape in question. Alternatively, they could be related to the warp also known in the area. Investigations to the north of the site (Lillie 2008, Lillie and Bunting 2016) recorded organic deposits on the eastern margins of the floodplain, similar to that recorded in Areas 2 and 3, they were interpreted as either channel abandonment and infilling, or floodplain margin deposits (mire) but paleoenvironmental investigation (diatom and pollen) could not determine the precise nature of their formation.

12.5 Either way the peat represents a stabilisation or cessation sediment accumulation, and could record

possible horizons of human activity; provide an environmental context for any human activity or landscape development; and through radiocarbon dating could provide a chronology for the sequence of alluvial or sand deposition.

12.6 In order to improve the distribution of data points across Areas 1 and 2 it may be beneficial to undertake a number of purposive geoarchaeological boreholes running west to east across these areas and drilling to the base of the Holocene sequence. This would have the added benefit of extending the Humber Wetlands transect (Lillie 1998), thus providing a more robust understanding of the paleoenvironmental context and archaeological potential of the site and any archaeological remains found by ongoing investigations. In Area 2 a west to east hand auger transect could be beneficial, broadly following the route of Transect 5 (Figure 8) with interventions at 25 to 50m intervals over c. 1200m. The exact location of further purposive geoarchaeological boreholes would need to be agreed in advance with Alison Williams as North Lincolnshire Council's archaeological advisor and detailed in a Written Scheme of Investigation.

12.7 It may be useful to combine any additional borehole transects, or to supplement existing borehole transects, with Electrical resistivity tomography (ERT) transects in the vicinity of Transect 4 (Figure 7) and Transect 5 (Figure 8) with another ERT transect between the two. These may be able to identify sub-surface structures and lithological changes, which in combination with any new or existing borehole data could then fill in the gaps between the borehole locations and provide a more robust and complete cross section of the deposits.

12.8 The southern utilities corridor and associated construction/laydown areas (Area 3) record thinner but relatively well-preserved organic alluvial deposits interleaved between the Upper and Lower alluvium/warp/sand. Area 3 is located within 'Archaeological Potential Zone 2' which lies on the edge of the Trent valley and extends from 'Archaeological Potential Zone 1' in the east to the base of the west-facing slopes of 'Archaeological Potential Zone 3' in the west. Much of this zone was historically occupied by uncultivated and unenclosed common land, including areas of sandhills on Brumby Common, at the southern end of the Site. There is the potential for significant archaeological remains to occur in this zone, from settlement of the Neolithic or Bronze Age periods, to potentially seasonal occupation in the Iron Age, Roman and medieval periods. There are a number of cropmark sites in the area to the west of the Foxhills Industrial Estate which may be late prehistoric or Roma in date.

12.9 Purposive geoarchaeological boreholes retrieving continuous cored samples between the locations of TP12 and TP14 shown on Figure 5 would allow for targeting of a possible infilled channel sequence of palaeoenvironmental potential and also possibly for OSL dating of the underlying sands which would aid in further understanding the dates of formation of the deposits within this zone. The exact location of further purposive geoarchaeological boreholes would need to be agreed in advance with Alison Williams as North Lincolnshire Council's archaeological advisor and detailed in a Written Scheme of Investigation

12.10 The AGI plant within Area 4 recorded a single intervention MW08 which indicated depths of windblown sand extending below 5m bgl. Area 4 is located within 'Archaeological Potential Zone 3' on the sandy slopes to the east of the valley. These slopes are rich in archaeological remains, including significant multi-period remains of Neolithic, Bronze Age, Iron Age and Roman date from the sand and gravel quarry at Willow Halt and the mid-late Anglo-Saxon settlement at Flixborough. Purposive geoarchaeological boreholes retrieving continuous cored samples would allow for OSL

dating of the sand sequence and also allow for palaeoenvironmental assessment of deep and potentially better-preserved deposits within Area 4. Any core taken for OSL will be taken in opaque liners or immediately wrapped in black plastic once drilled. A further round of geoarchaeological works (hand augering or machine drilled boreholes) in this area would provide a more comprehensive distribution of deposit sequences for the deposit model in this area and extend the mapping in Area 4.

13 CONCLUSIONS

13.1 Review of evidence from the surrounding area has thus revealed the Site to be located within a wider area rich in evidence for Pleistocene and Holocene landscape evolution. Review of borehole evidence from within the Site indicates that deposits of palaeoenvironmental potential are present across the Site. These deposits provide evidence for dynamic landscape formation processes at the end of the Pleistocene which have shaped how the land was exploited by people throughout the Holocene.

13.2 In the Lower Trent valley, paleoenvironmental evidence for post-glacial landscape is found largely at the sites of former channels and wetlands. The likely existence of infilled palaeochannels within Areas 1 and 2 and wetland areas within Area 3 has been indicated by the monitoring programme undertaken here. The monitoring programme also indicates that, where present, peat and organic clay deposits are well preserved and will thus likely preserve paleoenvironmental remains such as pollen, ostracods and diatoms. Any further paleoenvironmental work would need to be underpinned by radiocarbon or OSL dating, sufficient to provide a secure understanding of the landscape development of the Site.

13.3 However the depths of these deposits and their potential to provide valuable dating evidence is still not yet fully understood and it is advised that additional geoarchaeological hand auger or machine drilled boreholes may be required in order to fill in data gaps within the preliminary deposit model and also to provide northwest to southeast, or simply west to east, transects that would link the low-lying and deep alluvial sequences, of high palaeoenvironmental potential, with the higher ground of greater potential for past settlement and occupation. A deposit model, and particularly a transect, linking the areas of differing potential across the site, in combination with future palaeoenvironmental investigation of sampled deposit sequences, would provide a chronological framework and understanding of the palaeoenvironmental and landscape changes in which the local human activity and settlement developed and would aid in further understanding of the existing sequence. In particular a greater understanding of the mid-late Holocene would contribute to knowledge on the development of the landscape following the LGM and prior to warping and drainage for modern agriculture.

13.4 The waterlogged preservation of material culture in the Lower Trent valley occurs where archaeological sites are buried by peat growth and alluvial sedimentation and where the exploitation of wetlands resulted in human activity. While direct evidence for human activity associated with the palaeoenvironmental deposits at the Site have not been proven, the Site lies on the wetland/dryland margin just below the Lincolnshire Edge which would have formed an important relatively free draining area in an otherwise wetland landscape. This is reflected in evidence for later prehistoric activity in the wider area and it is likely that these drier sand rich areas in the Site would have proven an attractive base for occupation and for exploiting surrounding wetland areas from the start of the Holocene and thus the archaeological potential of this Site

remains high.

13.5 Development impacts may affect buried Holocene horizons or deposits of archaeological or palaeoenvironmental significance. Although it is difficult to ascertain with certainty the potential of the deposits to contain archaeological remains, the nature of the deposits observed suggests any archaeological remains present may take the form of prehistoric localised dryland activity (i.e. short-lived flint and/or faunal 'camp site' assemblages) to floodplain exploitation (i.e., brushwood trackways and platforms, fish traps, etc.

14 ARCHIVE

14.1 The archive will contain all the data collected during the archaeological monitoring, including all digital and paper records. It will be quantified, ordered, indexed and internally consistent.

14.2 The archive will be assembled in line with the recommendations provided in Historic England's MoRPHE Project Planning Note 3: Archaeological Excavation (PPN3) (2015). It will also be prepared in accordance with the Guidelines for the preparation of Excavation Archives for long–term storage (United Kingdom Institute for Conservation, 1990) and Standards in the museum care of archaeological collections (Museums and Galleries Commission, 1994). Provision will be made for the stable storage of paper records and their long–term storage

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APPENDICES

16 APPENDIX A – GEOARCHAEOLOGICAL RECORDING FORM

AOC Archaeology Geoarchaeological Log Sheet

Site / AOC Code		Sample / BH No.		Elevation		Coordinates	

Drawn log	Top (m bgl)	Base (m bgl)	Sub Sample (eg P/D/O)	Description							
				Lithology	Colour	Soil strength	Soil structure	Moisture	Boundary	Inclusions	Peat
				(secondary PRIMARY / peat, organic, clay, silt, sand, gravel)	(munsel or very light, light, mid, dark, very dark, primary / secondary)	(very soft, soft, firm, stiff, very stiff, hard / friable, elastic)	(homogenous, bedded, fissured, polished, slickensided, blocky, lensoidal)	(dry, moist, wet, saturated)	(diffuse, very gradual, gradual, sharp, very sharp / undulating)	(rootlets, rooting, angular to rounded flint)	(firm, spongy, plastic, fibrous, amorphous, decompostion)
	0										
	1										
	2										
	3										
	4										
	5										
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	7										
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	50										

AOC Archaeology Geoarchaeological Log Sheet

Logged by		Date	

AOC Archaeology Geoarchaeological Log Sheet

17 APPENDIX B – DEPOSIT MODEL DATA REFERENCES

Deposit log	Easting	Northing	Elevation	Source
AECOM1216_LincLakes_BH01	485456.3	408458.59	2.5	AECOM
AECOM1216_LincLakes_BH02	485481.144	408387.358	2.22	AECOM
AECOM1216_LincLakes_BH03	485613.501	408527.708	2.03	AECOM
AECOM1216_LincLakes_BH04	485732.811	408401.406	9.92	AECOM
AECOM1216_LincLakes_BH05	485784.415	408575.439	1.76	AECOM
AECOM1216_LincLakes_BH06	485948.788	408473.817	2.09	AECOM
AECOM1216_LincLakes_BH07	486097.469	408390.511	2.25	AECOM
AECOM1216_LincLakes_SA01	485598.317	408487.421	2.17	AECOM
AECOM1216_LincLakes_SA02	485679.124	408498.639	1.94	AECOM
AECOM1216_LincLakes_SA03	485906.507	408481.164	1.95	AECOM
AECOM1216_LincLakes_SA04	485974.451	408460.888	2.24	AECOM
AECOM1216_LincLakes_TP01	485260.036	408482.916	1.32	AECOM
AECOM1216_LincLakes_TP02	485406.943	408451.705	2.43	AECOM
AECOM1216_LincLakes_TP03	485421.808	408525.915	1.79	AECOM
AECOM1216_LincLakes_TP04	485461.635	408441.288	2.51	AECOM
AECOM1216_LincLakes_TP05	485469.26	408348.783	2.3	AECOM
AECOM1216_LincLakes_TP06	485529.397	408442.062	2.18	AECOM
AECOM1216_LincLakes_TP07	485533.758	408517.593	1.83	AECOM
AECOM1216_LincLakes_TP08	485735.278	408531.243	1.86	AECOM
AECOM1216_LincLakes_TP09	485765.55	408499.976	1.92	AECOM
AECOM1216_LincLakes_TP10	485883.2	408493.562	1.76	AECOM
AECOM1216_LincLakes_TP11	486047.943	408368.738	1.91	AECOM
AECOM1216_LincLakes_TP12	486055.247	408420.181	2.17	AECOM
AECOM1216_LincLakes_TP13	486108.263	408415.783	2.08	AECOM
AECOM1216_LincLakes_TP14	486110.951	408378.636	2.13	AECOM
AECOM1216_LincLakes_TP15	486183.666	408383.312	2.15	AECOM
AECOM1216_LincLakes_WS01	485579.014	408424.695	4.74	AECOM
AECOM1216_LincLakes_WS02	485691.516	408532.15	1.96	AECOM
AECOM1216_LincLakes_WS03	485870.129	408615.774	3.92	AECOM
AECOM1216_LincLakes_WS04	485863.197	408363.347	7.68	AECOM
AECOM1216_LincLakes_WS05	485974.935	408356.786	3.12	AECOM
AECOM1216_LincLakes_WS06	486010.186	408450.917	2.09	AECOM
AECOM1216_LincLakes_WS07	486115.911	408329.861	2.05	AECOM
AECOM1216_LincLakes_WS08	486291.923	408362.202	2.45	AECOM
AOC52033_BH1	485273	408478	1.475053	AOC
AOC52033_BH2	485474	408349	2.310903	AOC
AOC52033_BH3	485546	408478	2.479138	AOC
AOC52033_BH4	485734	408475	1.937275	AOC
AOC52033_BH5	485870	408433	2.39711	AOC
AOC52033_BH6	486043	408379	2.084866	AOC
AOC52033_BH7	486137	408479	2.199354	AOC
FWS1115_LincLakes_BH1	486457.8	408724.9	2.5	FWS
FWS1115_LincLakes_BH2	486179.9	408370.5	2.1	FWS
FWS1115_LincLakes_BH3	486061.7	408661.8	1.74	FWS

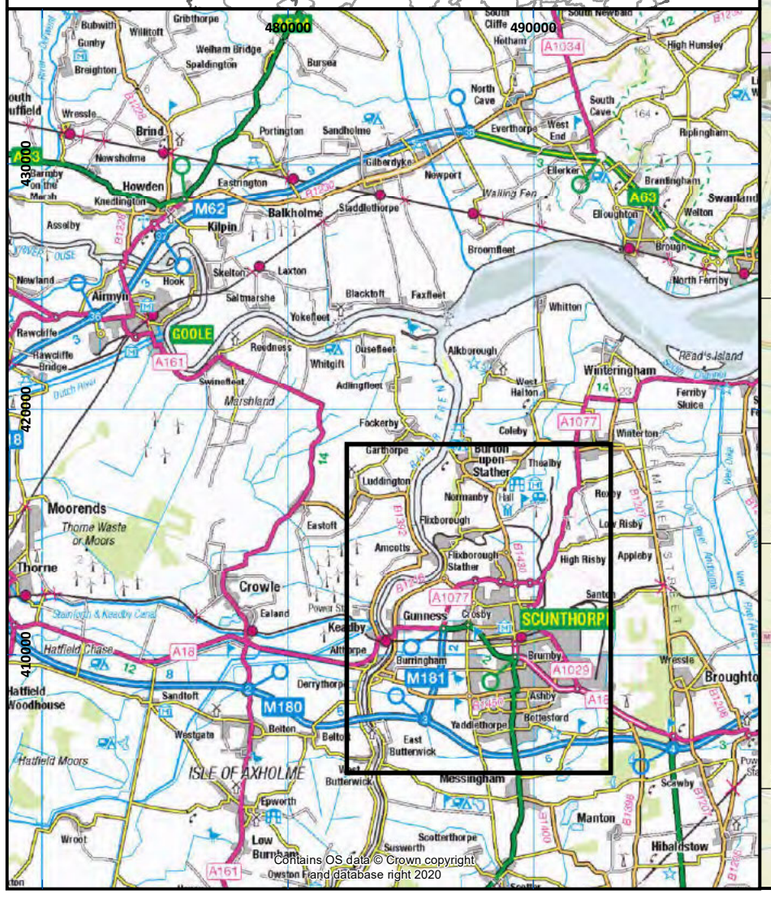
Deposit log	Easting	Northing	Elevation	Source
FWS1115_LincLakes_TP01	486445.4	408366.7	2.64	FWS
FWS1115_LincLakes_TP02	485895.2	408398	1.85	FWS
FWS1115_LincLakes_TP03	486281.9	408565.6	2.25	FWS
AOC_25864_MW0	486659.046	413791.055	2.972	AOC
AOC_25864_MW1	486534.982	413999.65	3.772	AOC
AOC_25864_MW5	486199.435	414370.746	3.68	AOC
AOC_25864_MW6	486073.204	414435.045	4.199	AOC
AOC_25864_MW7	486164.504	414488.839	3.498	AOC
AOC_25864_MW8	486698.362	414480.798	4.064	AOC
AOC_25864_WS104	486135.360	414399.907	3.722	AOC
AOC_25864_TP21	486618.215	413130.224	2.921	AOC
AOC_25864_TP22	486376.986	413088.107	2.99	AOC
AOC_25864_TP25	486257.046	414101.307	3.009	AOC
AOC_25864_TP26	486200.944	414156.851	2.811	AOC
AOC_25864_TP28	486144.150	414279.769	3.392	AOC
AOC_25864_TP11	485820.102	409586.119	2.505	AOC
AOC_25864_TP12	486096.598	409609.336	2.655	AOC
AOC_25864_TP14	486151.387	409995.185	2.828	AOC
AOC_25864_TP16	486171.402	410300.787	2.938	AOC
AOC_25864_TP32	485812.665	409068.696	4.234	AOC
AOC_25864_TP35	485853.674	408765.687	3.911	AOC
AOC_25864_HW1	482700.000	414000.000	0.160	Humber Wetlands
AOC_25864_HW2	482900.000	413900.000	0.550	Humber Wetlands
AOC_25864_HW3	483100.000	413900.000	0.650	Humber Wetlands
AOC_25864_HW4	484600.000	413700.000	1.700	Humber Wetlands
AOC_25864_HW5	485200.000	413900.000	2.150	Humber Wetlands
AOC_25864_HW6	486400.000	413900.000	3.015	Humber Wetlands
AOC_25864_HW7	486900.000	413100.000	2.000	Humber Wetlands
AOC_25864_HW8	486600.000	412400.000	2.000	Humber Wetlands
SOLAR21_IFA_BH1	486048.000	414425.000	5.000	IFA
SOLAR21_IFA_BH2	486102.000	414500.000	5.000	IFA
SOLAR21_IFA_BH3	486121.000	414445.000	5.000	IFA
SOLAR21_IFA_BH4	486142.000	414393.000	5.000	IFA
SOLAR21_IFA_BH5	486128.000	414337.000	5.000	IFA
SOLAR21_IFA_BH6	486223.000	414345.000	5.000	IFA
SE81SE224	485900.000	414700.000	4.450	BGS
SE81SE21	486245.000	414061.000	3.000	BGS
SE81SE42	486720.000	414400.000	2.850	BGS
SE81SE43	486800.000	414330.000	2.550	BGS
SE81SE44	486890.000	414280.000	2.650	BGS

Deposit log	Easting	Northing	Elevation	Source
SE81SE23	486359.000	412982.000	2.100	BGS
SE81SE78	486630.000	412930.000	2.000	BGS
SE81SE26	486445.000	412481.000	1.550	BGS
SE81SE27	484819.000	411473.000	1.500	BGS
SE81SE28	485292.000	410450.000	1.800	BGS
SE81SW53	484620.000	410190.000	2.490	BGS
SE81SWE29	486580.000	410610.000	3.400	BGS
SE80NW10	484630.000	409610.000	1.500	BGS
SE80NE72	485331.000	408857.000	1.800	BGS
SE80NE76	485881.000	407948.000	0.900	BGS
SE81SE79	485790.000	412460.000	1.000	BGS
SE81SE34	485820.000	412400.000	1.000	BGS
SE81SE70	485600.000	412350.000	1.000	BGS
SE81SE80	485240.000	412360.000	1.000	BGS
SE81SW70	484920.000	412300.000	1.000	BGS
SE81SW26	484450.000	412400.000	2.700	BGS
SE81SW72	483980.000	412350.000	3.000	BGS
SE81SW31	484380.000	411450.000	2.100	BGS
SE81SW6	484970.000	411450.000	2.440	BGS
SE81SE204	485950.000	411130.000	3.000	BGS
SE81SW91	484200.000	410965.000	7.000	BGS
SE81SW34	484320.000	410490.000	2.400	BGS
SE81SE15	485153.000	410083.000	2.600	BGS
SE80NE69	485772.000	409583.000	3.000	BGS
SE80NW53	484770.00	408440.00	2.000	BGS
SE80NW14	484160.00	408800.00	1.200	BGS
SE80NE75	485128.00	408031.00	1.500	BGS
TLP_25864_BH1	486208.750	414264.070	2.81	TLP Ground Investigations
TLP_25864_BH2	486166.000	414218.040	2.81	TLP Ground Investigations
TLP_25864_BH3	486200.080	414218.900	2.81	TLP Ground Investigations
TLP_25864_BH4	486223.990	414216.240	2.81	TLP Ground Investigations
TLP_25864_BH5	486172.270	414196.810	2.81	TLP Ground Investigations
ARC_25864_WT1	486,111.29	415,498.16	4.50	ARC Archaeo-environmental Research & Consultancy Services Ltd
SE81SE48	486980	413750	1.16	BGS
SE81SE53	487340	413290	1.35	BGS
SE81SE49	487100	413720	1.39	BGS
SE81SE52	487280	413370	1.46	BGS
SE81SE26	486445	412481	1.5	BGS

Deposit log	Easting	Northing	Elevation	Source
SE81SE47	486980	413860	1.51	BGS
SE81SE46	487010	414100	1.6	BGS
SE81SE50	487210	413640	1.93	BGS
SE81SE51	487250	413550	2	BGS
SE81SE45	486960	414200	2.03	BGS
SE81SE24	487067	412892	2.4	BGS
SE81SE43	486800	414330	2.55	BGS
SE81SE44	486890	414280	2.65	BGS
DS20-1405.01_CP101	486242.340	414356.710	4.10	DeltaSimons
DS20-1405.01_CP102	486223.560	414383.190	4.06	DeltaSimons
DS20-1405.01_CP103	486222.960	414422.910	3.53	DeltaSimons
DS20-1405.01_DS101	486140.880	414343.300	5.00	DeltaSimons
DS20-1405.01_DS102	486242.680	414361.130	4.00	DeltaSimons
DS20-1405.01_DS103	486243.350	414337.940	4.18	DeltaSimons
DS20-1405.01_DS104	486237.820	414373.360	4.09	DeltaSimons
DS20-1405.01_DS105	486223.560	414360.320	3.74	DeltaSimons
DS20-1405.01_DS106	486201.800	414385.870	4.08	DeltaSimons
DS20-1405.01_DS106A	486203.870	414391.710	3.78	DeltaSimons
DS20-1405.01_DS106B	486203.880	414392.710	3.78	DeltaSimons
DS20-1405.01_DS107	486219.170	414389.000	4.04	DeltaSimons
DS20-1405.01_DS108	486244.680	414395.990	4.07	DeltaSimons
DS20-1405.01_DS109	486194.680	414397.920	3.61	DeltaSimons
DS20-1405.01_DS110	486219.060	414406.110	3.53	DeltaSimons
SE81SE40	486710.000	414740.000	19.66	BGS
SE81SE41	486590.000	414700.000	8.59	BGS
SE81SE1	487428.000	412275.000	2.44	BGS

18 APPENDIX C – SURVEY METADATA

Field	Description
Surveying Company	AOC Archaeology
Data collection staff	Kim Hosking,
Client	Undertaken and prepared for ERM
Site name	Solar 21
County	North Lincolnshire
NGR	TA 1676 6108 (centre)
Land use/ field condition	Arable and beach
Duration	13/04/21 - 30/04/21
Weather	Overcast, Sunny
Survey type	Test-pit monitoring
Processing software	RockWorks
Visualisation software	ArcGISPro
Geology	Bedrock: Mercia Mudstone. Superficial: Sutton Sand Formation, Glacial Sand and Gravel – Sand and Gravel; Alluvium - Clay, Silt And Sand; Sand And Gravel Of Uncertain Age And Origin - Sand And Gravel, Peat, Warp (BGS, 2021).
Soils	Freely draining slightly acid loamy soils and areas of clayey soils of coastal flats with naturally high groundwater; (Soilscapes, 2019).
Scheduled Ancient Monument	No
Known archaeology on site	No
Historical documentation/ mapping on site	Yes
Report title	SOLAR 21: GEOARCHAEOLOGICAL WATCHING BRIEF REPORT (25864)
Project number	25864
Report Author	Lynne Roy
Report approved by	Virgil Yendell



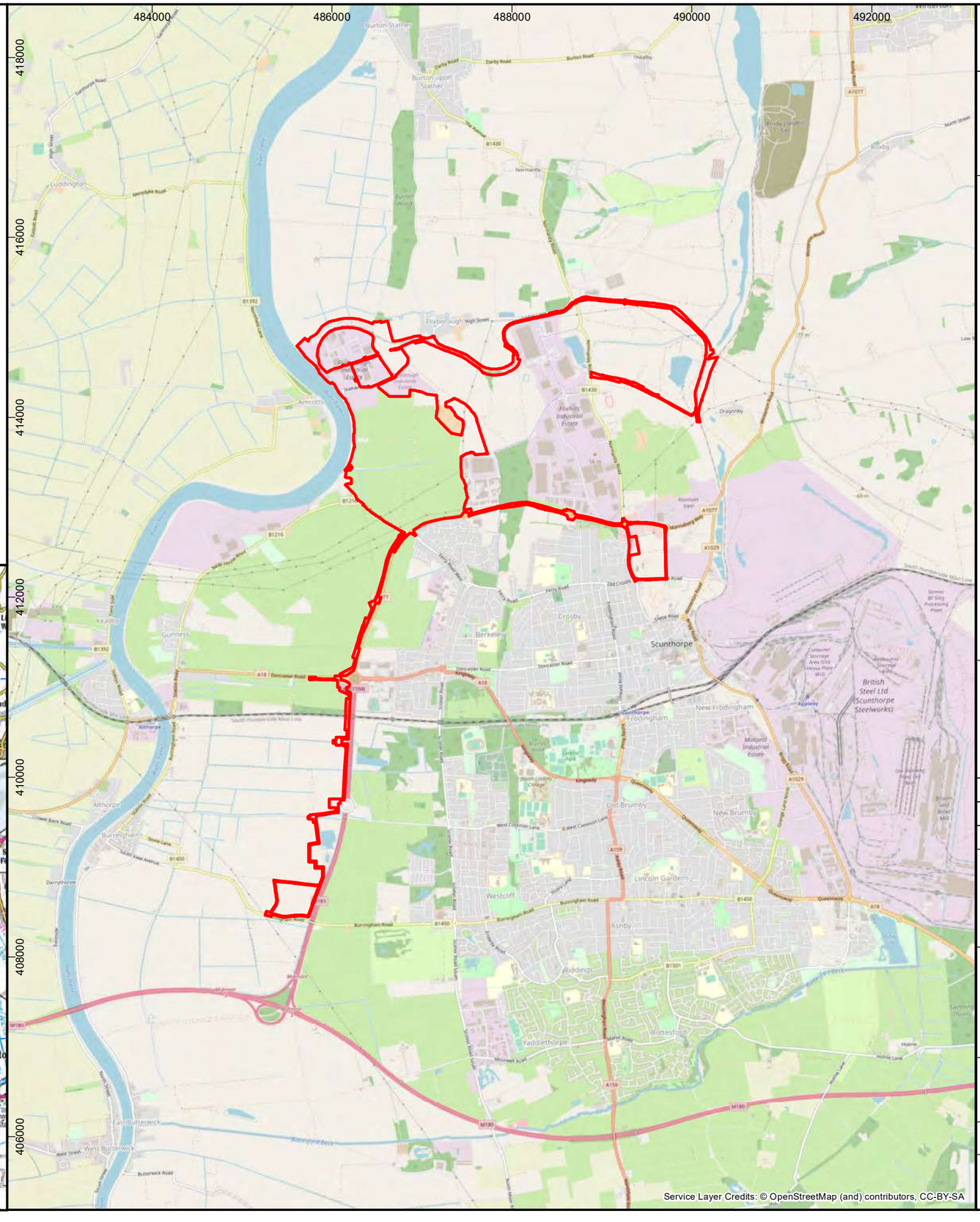


Figure 1

Site Location Plan

Legend

Site Boundary

FOR

ERM
2nd Floor Exchequer Court,
33 St Mary Axe,
London
EC3A 8AA

Drawn/checked:	LR/VY
DWG no:	01/25864/DSR/01/01
AOC Project No.:	25864

AOC Archaeology Group

SYSTEM

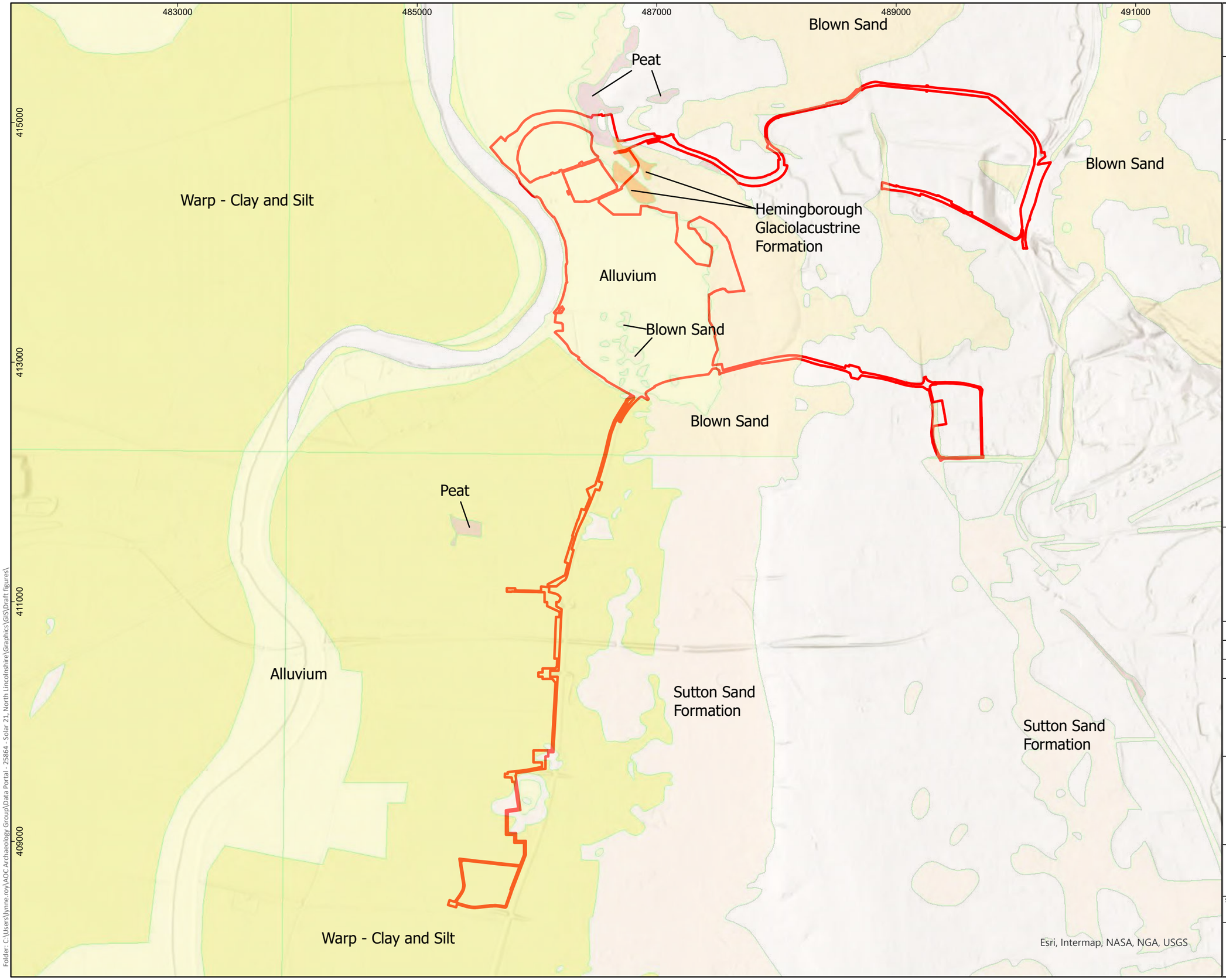
Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:50,000 @ A3

SCALE

0 1,700 m



Folder: C:\Users\lynne.roy\AOC Archaeology Group\Data Portal - 25864 - Solar 21, North Lincolnshire\Graphics\GIS\Draft figures\

Figure	2

Superficial Geological Deposits mapped by the British Geological Survey in vicinity of the Site

Legend

Site Boundary

FOR

ERM
2nd Floor Exchequer Court,
33 St Mary Axe,
London
EC3A 8AA

Drawn/checked:	LR/VY
DWG no:	01/25864/DSR/02/01
AOC Project No:	25191

AOC Archaeology Group

N

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:30,000 @ A3

SCALE

0 — 1,450 m

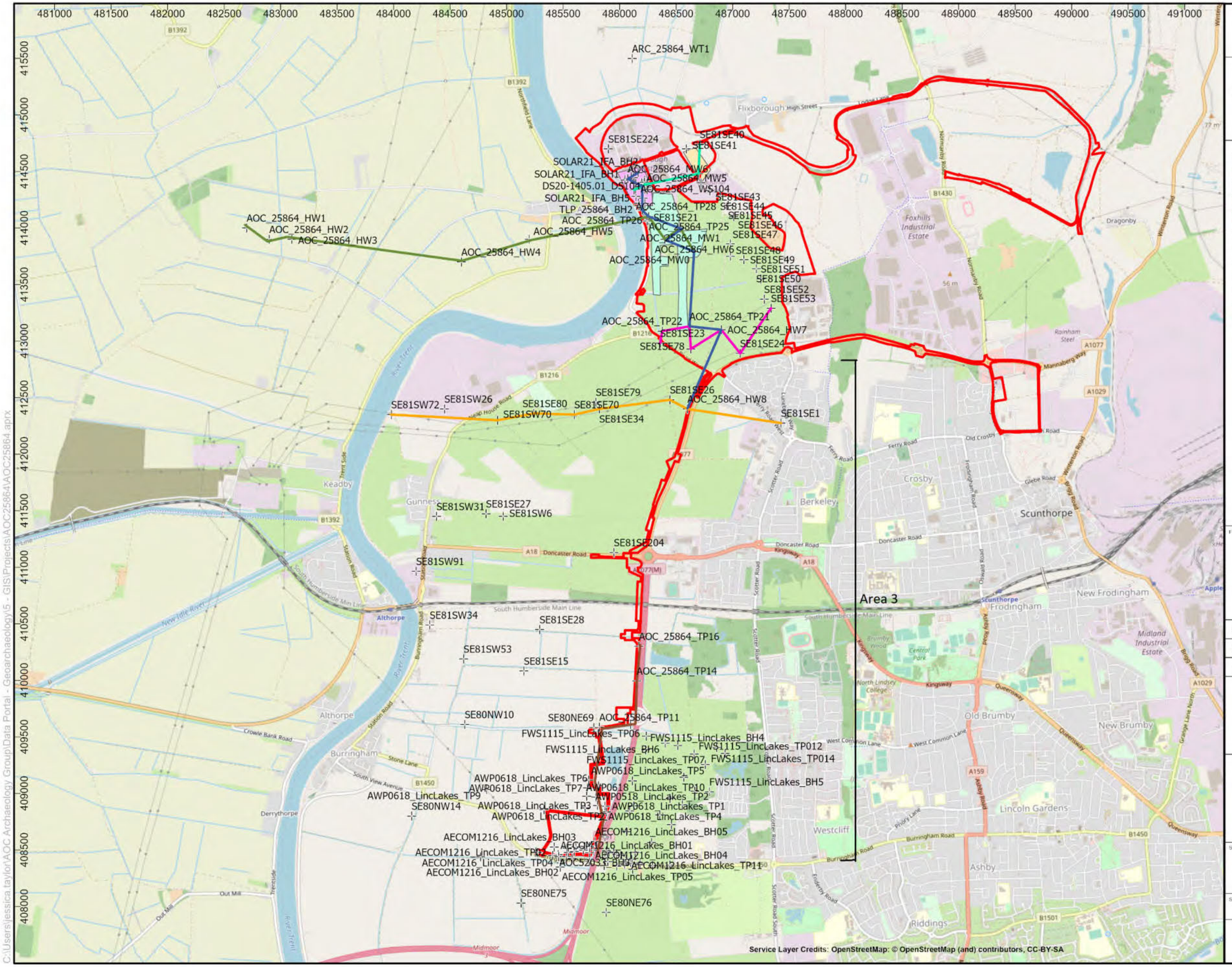


Figure 3

Data Points and Transect Locations

Legend

- Area4
- Area2
- Area1
- Site boundary
- Data Points
- Transect 1
- Transect 2
- Transect 3
- Transect 4
- Transect 5
- Transect 6

FOR

ERM
2nd Floor Exchequer Court
33 St Mary Axe,
London
EC3A 8AA

Drawn/checked:	VY/JT
DWG no:	N/A
AOC Project No.:	25864

AOC Archaeology Group

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:31,665 @ A3

0 100m

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Area 1

Area 2

N

S

Possible palaeochannel

AOC25864_MW7
AOC25864_MW6
AOC25864_WS04
AOC25864_MW5
AOC25864_TP26
AOC25864_TP25
AOC25864_MW1
AOC25864_HW6
AOC25864_MW0
AOC25864_TP21
AOC25864_HW7
AOC25864_HW8

Elevation (m AOD)

5
0
-5

0
500
1000
1500
2000
2500
3000

Relative Distance (m)

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Figure 4

Transect 1: N-S projected transect through deposits in north of the Site (Area 1 and 2)

Legend

- Clay
- Clay, organic
- Clay, sandy
- Clay, silty
- Clay, stiff
- Made Ground
- Peat
- Peat, clayey
- Peat, humified
- Sand
- Sand, clayey
- Sand, gravelly
- Sand, silty
- Silt
- Silt, clayey
- Holocene Lower Alluvium
- Holocene organic deposits
- Upper Alluvium
- Made Ground

FOR

ERM
2nd Floor Exchequer Court,
33 St Mary Axe,
London
EC3A 8AA

Drawn/checked:	LR/VY
DWG no:	01/25864/DSR/4/01
AOC Project No:	25864

AOC Archaeology Group

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

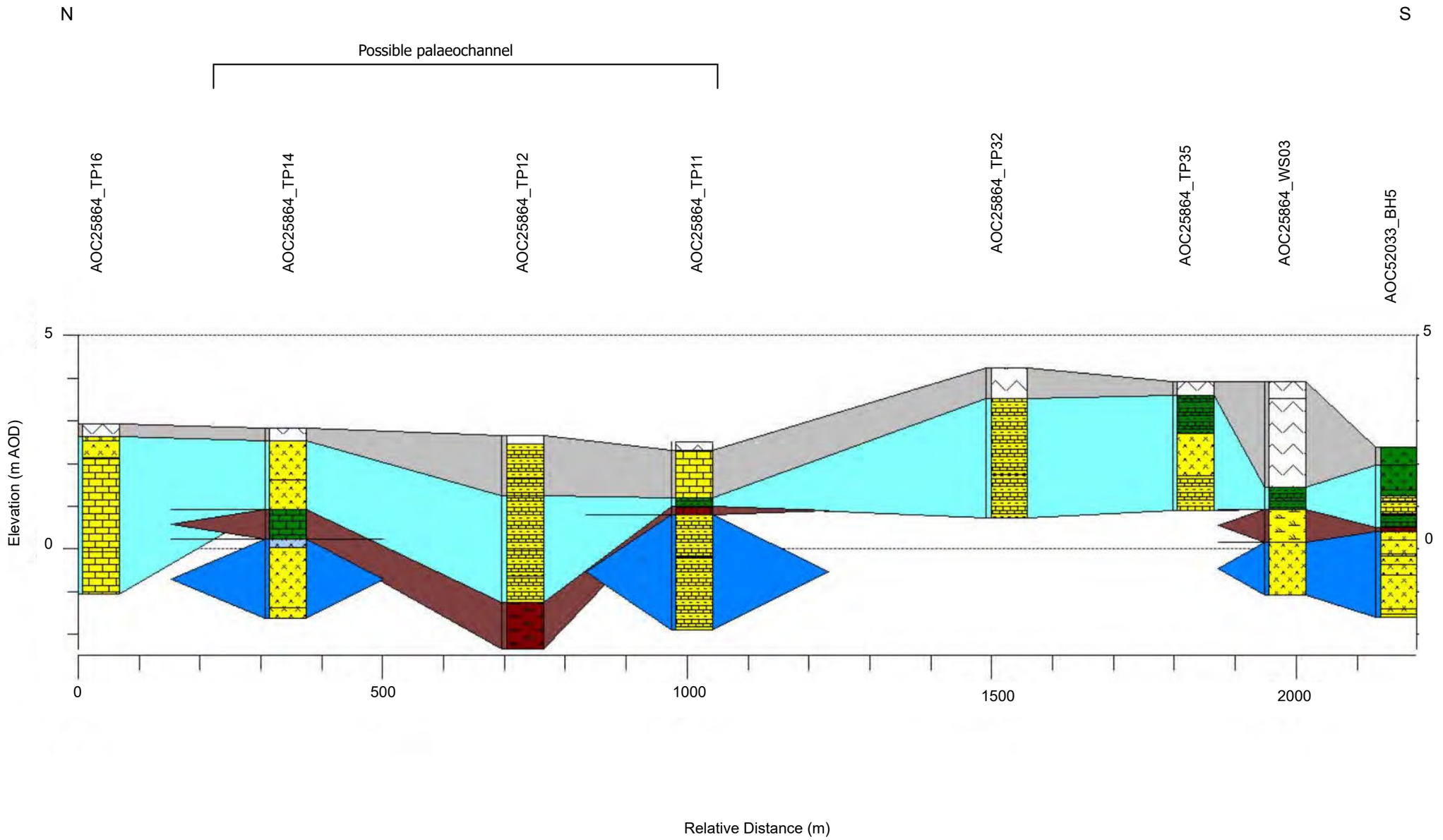
Not to Scale

SCALE

Not to Scale

Figure 5

Transect 2: N-S projected transect through deposits in south of the Site (Area 3)



Legend

- Clay
- Clay, organic
- Clay, sandy
- Clay, silty
- Clay, stiff
- Made Ground
- Peat
- Peat, clayey
- Peat, humified
- Sand
- Sand, clayey
- Sand, gravelly
- Sand, silty
- Silt
- Silt, clayey
- Holocene Lower Alluvium
- Holocene organic deposits
- Upper Alluvium
- Made Ground

FOR

ERM
2nd Floor Exchequer Court,
33 St Mary Axe,
London
EC3A 8AA

Drawn/checked:	LR/VY
DWG no:	01/25864/DSR/5/01
AOC Project No:	25864

AOC Archaeology Group

N

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

Not to Scale

SCALE

Not to Scale

Folder: C:\Users\lynne.roy\AOC Archaeology Group\Data Portal - 25864 - Solar 21, North Lincolnshire\Graphics\GIS\Draft figures\

W

E

AOC25864_HW1
AOC25864_HW2
AOC25864_HW3
AOC25864_HW4
AOC25864_HW5
AOC25864_TP25
AOC25864_HW6
AOC25864_MW1
AOC52033_MW0

Elevation (m AOD)

0

0

0
500
1500
2000
2500
3000
3500
4000
4000

Relative Distance (m)

Folder: C:\Users\lynne.roy\AOC Archaeology Group\Data Portal - 25864 - Solar 21, North Lincolnshire\Graphics\GIS\Draft figures\

Figure 6

Transect 3: W-E projected transect through deposits in north of the Site (Area 2)

Legend

- Clay
- Clay, organic
- Clay, sandy
- Clay, silty
- Clay, stiff
- Made Ground
- Peat
- Peat, clayey
- Peat, humified
- Sand
- Sand, clayey
- Sand, gravelly
- Sand, silty
- Silt
- Silt, clayey
- Holocene Lower Alluvium
- Holocene organic deposits
- Upper Alluvium
- Made Ground

FOR

ERM
2nd Floor Exchequer Court,
33 St Mary Axe,
London
EC3A 8AA

Drawn/checked:	LR/VY
DWG no:	01/25864/DSR/6/01
AOC Project No:	25864

AOC Archaeology Group

N

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

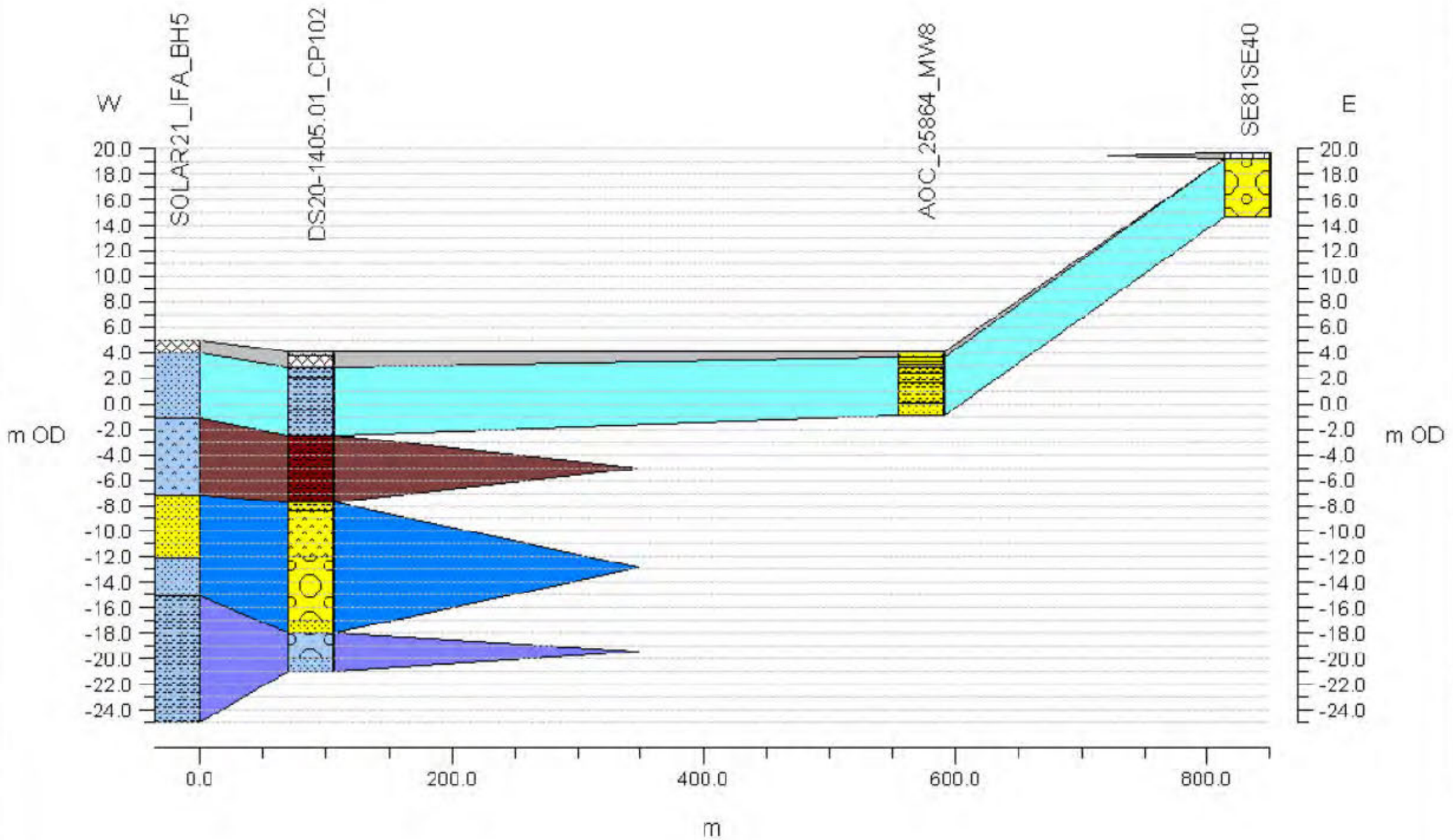
Not to Scale

SCALE

Not to Scale

Figure 7

Transect 4: E-W projected transect through deposits in the north of the Site



Legend

Lithology

CHALK
CLAY
CLAY, gravelly
CLAY, organic
CLAY, sandy
CLAY, shelly
CLAY, silty
CLAY, stiff
CLAY, stiff + gravel
CLAY, stiff/fissured
CONCRETE
GRAVEL
GRAVEL, clayey
GRAVEL, sandy
GRAVEL, silty
MADE GROUND
MADE GROUND, redeposited alluvium
MADE GROUND, alluvium
MADE GROUND, alluvium/foreshore
MADE GROUND, archaeology
MADE GROUND, topsoil
MADE GROUND, undefined
MADE GROUND, victorian to modern construction
PEAT
PEAT, clayey
PEAT, gravelly
PEAT, humified
PEAT, sand / gravel / grit
PEAT, sandy
PEAT, silty
PEAT, woody
quarry
SAND
SAND, clayey
SAND, gravelly
SAND, organic
SAND, shelly
SAND, silty
SILT
SILT, calcareous
SILT, clayey
SILT, gravelly
SILT, organic
SILT, sandy

Stratigraphy

Topsoil - Modern
Made Ground - Victorian to modern (AOC DD Wide)
Holocene - upper alluvium/Warp/Sutton Sand
Holocene - organic deposits
Holocene - lower alluvium/Warp/Sutton Sand
Tertiary Bedrock - Mercia Mudstone (AOC DD Wide)

FOR

ERM
2nd Floor Exchequer Court
33 St Mary Axe,
London
EC3A 8AA

Drawn/checked:	VY/JT
DWG no:	N/A
AOC Project No.:	25864

AOC Archaeology Group

N

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

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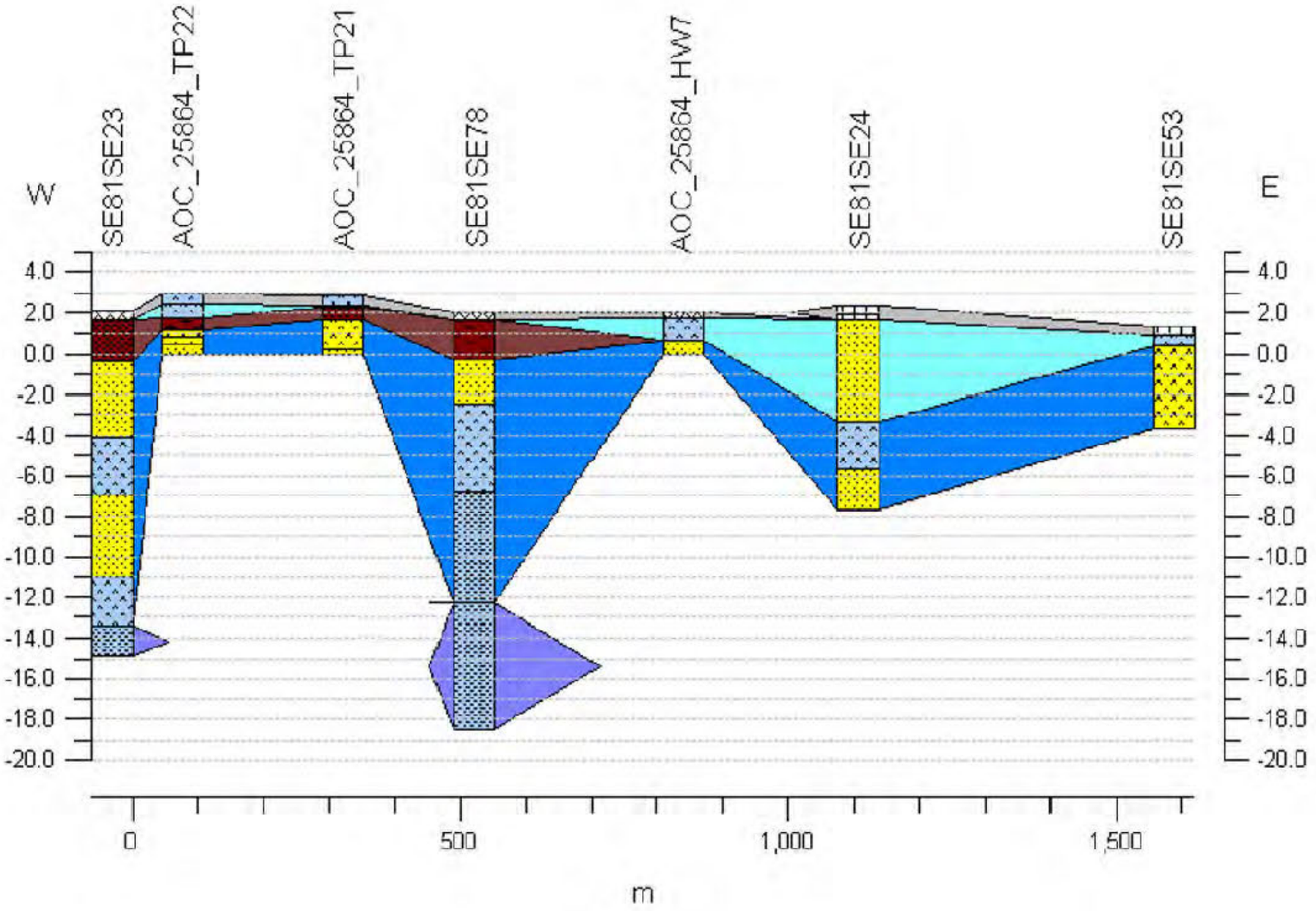

Figure 8

Transect 5: W-E projected transect through deposits in the north of the Site

Legend

Lithology

CHALK
CLAY
CLAY, gravelly
CLAY, organic
CLAY, sandy
CLAY, shelly
CLAY, silty
CLAY, stiff
CLAY, stiff + gravel
CLAY, stiff/fissured
CONCRETE
GRAVEL
GRAVEL, clayey
GRAVEL, sandy
GRAVEL, silty
MADE GROUND
MADE GROUND, redeposited alluvium
MADE GROUND, alluvium
MADE GROUND, alluvium/foreshore
MADE GROUND, archaeology
MADE GROUND, topsoil
MADE GROUND, undefined
MADE GROUND, victorian to modern construction
PEAT
PEAT, clayey
PEAT, gravelly
PEAT, humified
PEAT, sand / gravel / grit
PEAT, sandy
PEAT, silty
PEAT, woody
QUARY
SAND
SAND, clayey
SAND, gravelly
SAND, organic
SAND, shelly
SAND, silty
SILT
SILT, calcareous
SILT, clayey
SILT, gravelly
SILT, organic
SILT, sandy

Stratigraphy

Topsoil - Modern
Made Ground - Victorian to modern (AOC DD Wide)
Holocene - upper alluvium/Warp/Sutton Sand
Holocene - organic deposits
Holocene - lower alluvium/Warp/Sutton Sand
Tertiary Bedrock - Nercia Mudstone (AOC DD Wide)

FOR

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London
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AOC Project No.:	25864

AOC Archaeology Group

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SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:31,209 @ A3

0 100 m

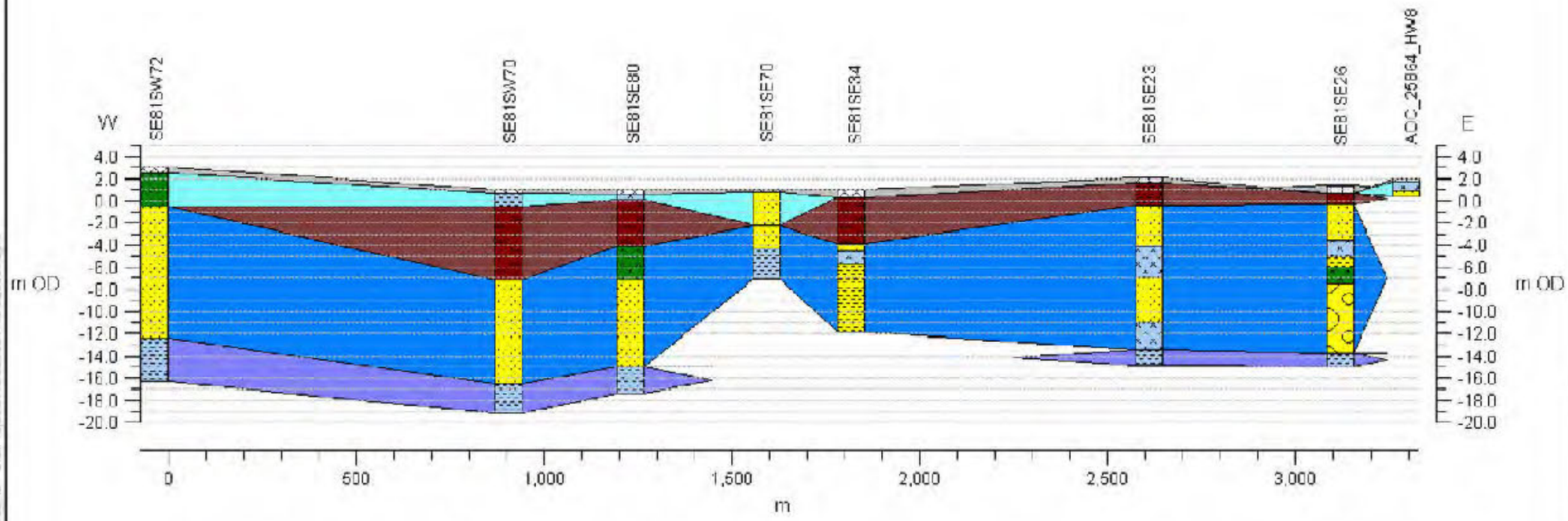

Figure	9

Transect 6: E-W projected transect through deposits in the north of the Site

Legend

Lithology

CHALK
CLAY
CLAY, gravelly
CLAY, organic
CLAY, sandy
CLAY, shelly
CLAY, silty
CLAY, stiff
CLAY, stiff + gravel
CLAY, stiff/fissured
CONCRETE
GRAVEL
GRAVEL, clayey
GRAVEL, sandy
GRAVEL, silty
MADE GROUND
MADE GROUND, redeposited alluvium
MADE GROUND, alluvium
MADE GROUND, alluvium/foreshore
MADE GROUND, archaeology
MADE GROUND, topsoil
MADE GROUND, undefined
MADE GROUND, victorian to modern construction
PEAT
PEAT, clayey
PEAT, gravelly
PEAT, humified
PEAT, sand / gravel / grit
PEAT, sandy
PEAT, silty
PEAT, woody
quary
SAND
SAND, clayey
SAND, gravelly
SAND, organic
SAND, shelly
SAND, silty
SILT
SILT, calcareous
SILT, clayey
SILT, gravelly
SILT, organic
SILT, sandy

Stratigraphy

Topsoil - Modern
Made Ground - Victorian to modern (AOC DD Wide)
Holocene - upper alluvium/Warp/Sutton Sand
Holocene - organic deposits
Holocene - lower alluvium/Warp/Sutton Sand
Tertiary Bedrock - Mercia Mudstone (AOC DD Wide)

FOR

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DWG no:	N/A
AOC Project No.:	25864

AOC Archaeology Group

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SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

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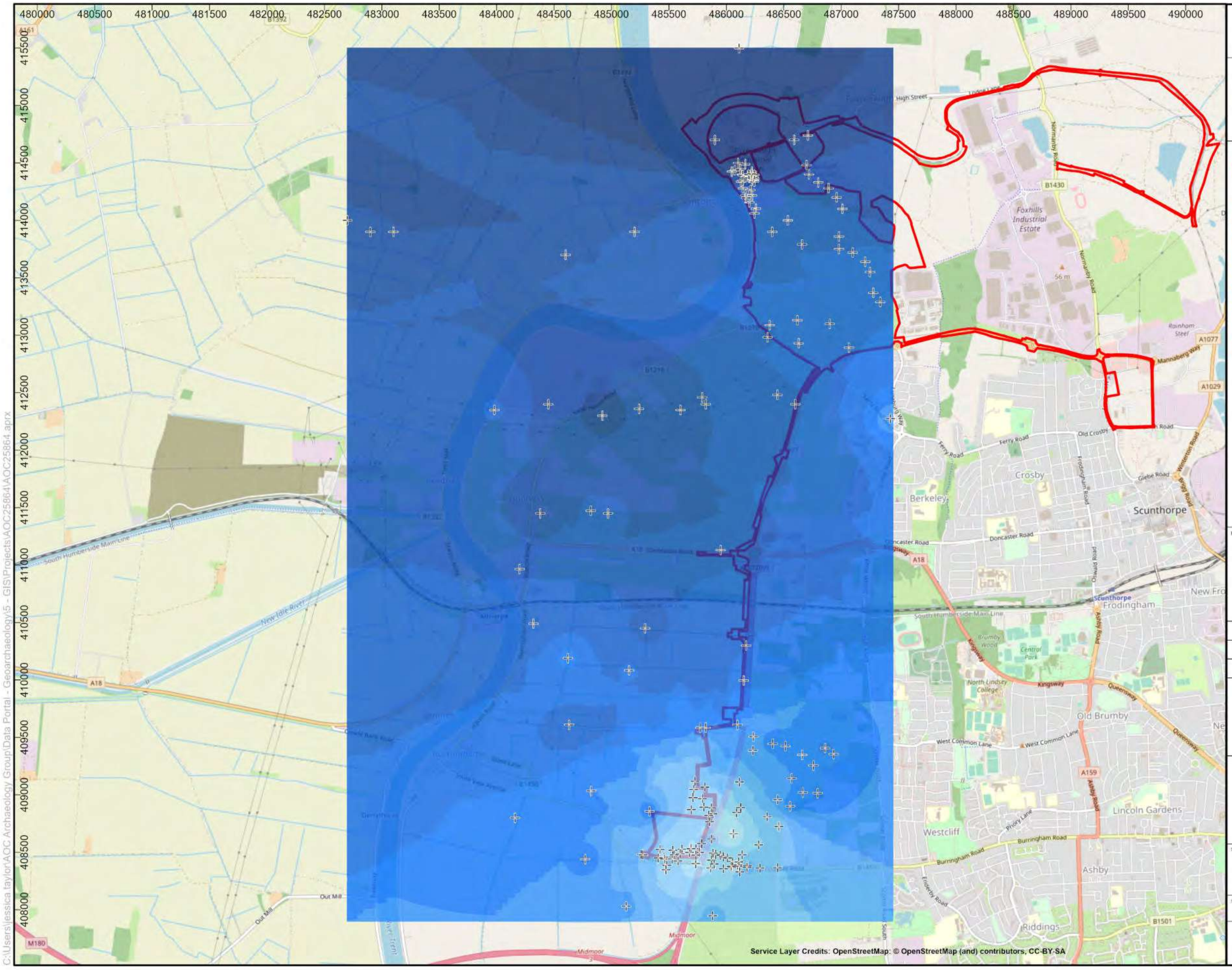

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Figure	10

Topographic plot of the surface of the Mercia Mudstone projected from deposit records

Legend

- Site boundary
- Data Points

m OD

- -4.999999 - -4.000000
- -5.999999 - -5.000000
- -6.999999 - -6.000000
- -7.999999 - -7.000000
- -8.999999 - -8.000000
- -9.999999 - -9.000000
- -10.999999 - -10.000000
- -11.999999 - -11.000000
- -12.999999 - -12.000000
- -13.999999 - -13.000000
- -14.999999 - -14.000000
- -15.999999 - -15.000000
- -16.500000 - -16.000000

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SYSTEM:

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE:

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0 100m

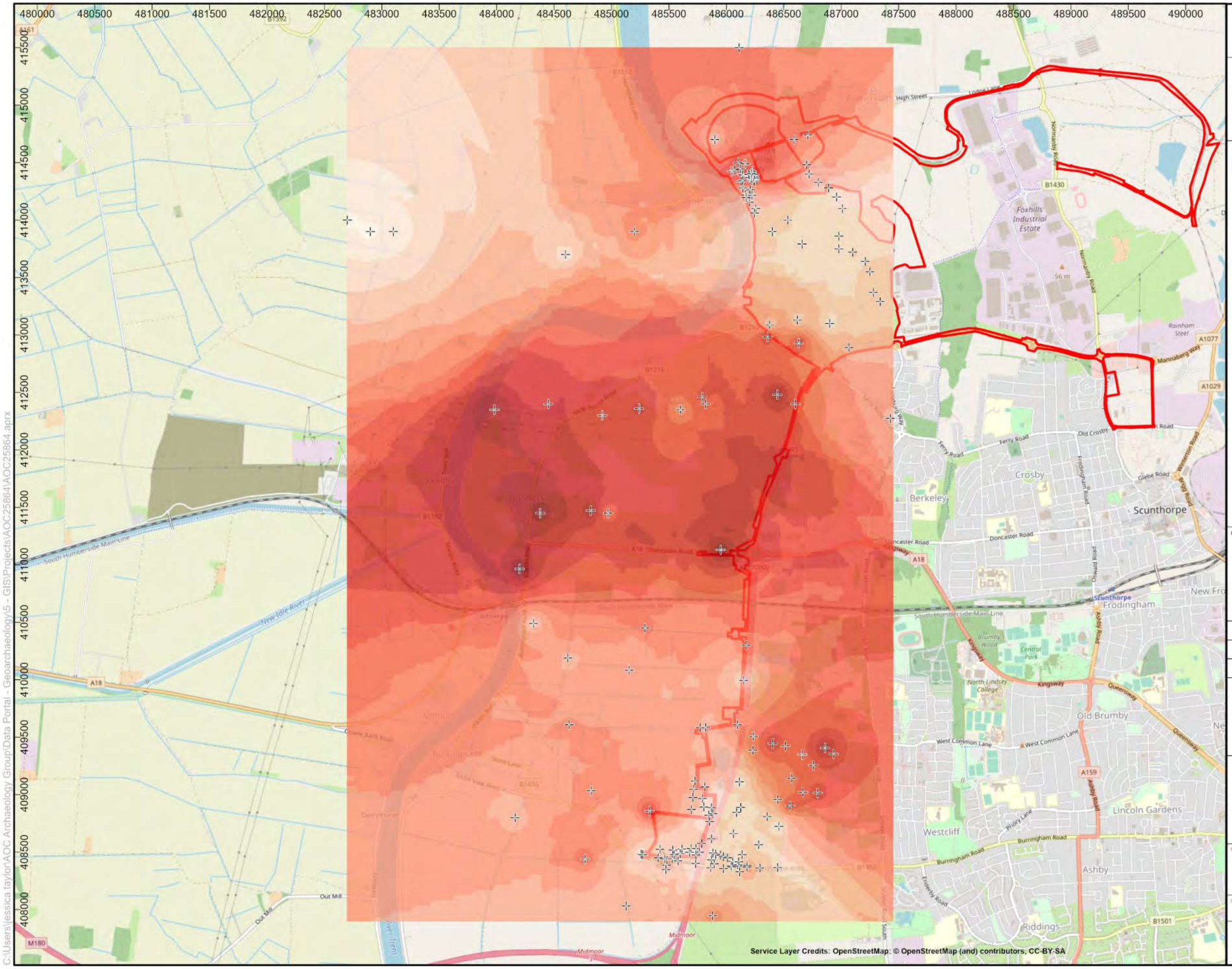

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Figure 11

Projected thickness plot of the Lower Alluvium/Warp/Sutton Sands

Legend

- Site boundary
- Data Points

m

- 0.500000 - 1.000000
- 1.000001 - 2.000000
- 2.000001 - 3.000000
- 3.000001 - 4.000000
- 4.000001 - 5.000000
- 5.000001 - 6.000000
- 6.000001 - 7.000000
- 7.000001 - 8.000000
- 8.000001 - 9.000000
- 9.000001 - 10.000000
- 10.000001 - 11.000000
- 11.000001 - 12.000000
- 12.000001 - 13.000000
- 13.000001 - 14.000000

FOR:

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AOC Project No.:	25864

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N

SYSTEM:

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE:

1:31,209 @ A3

0 100m

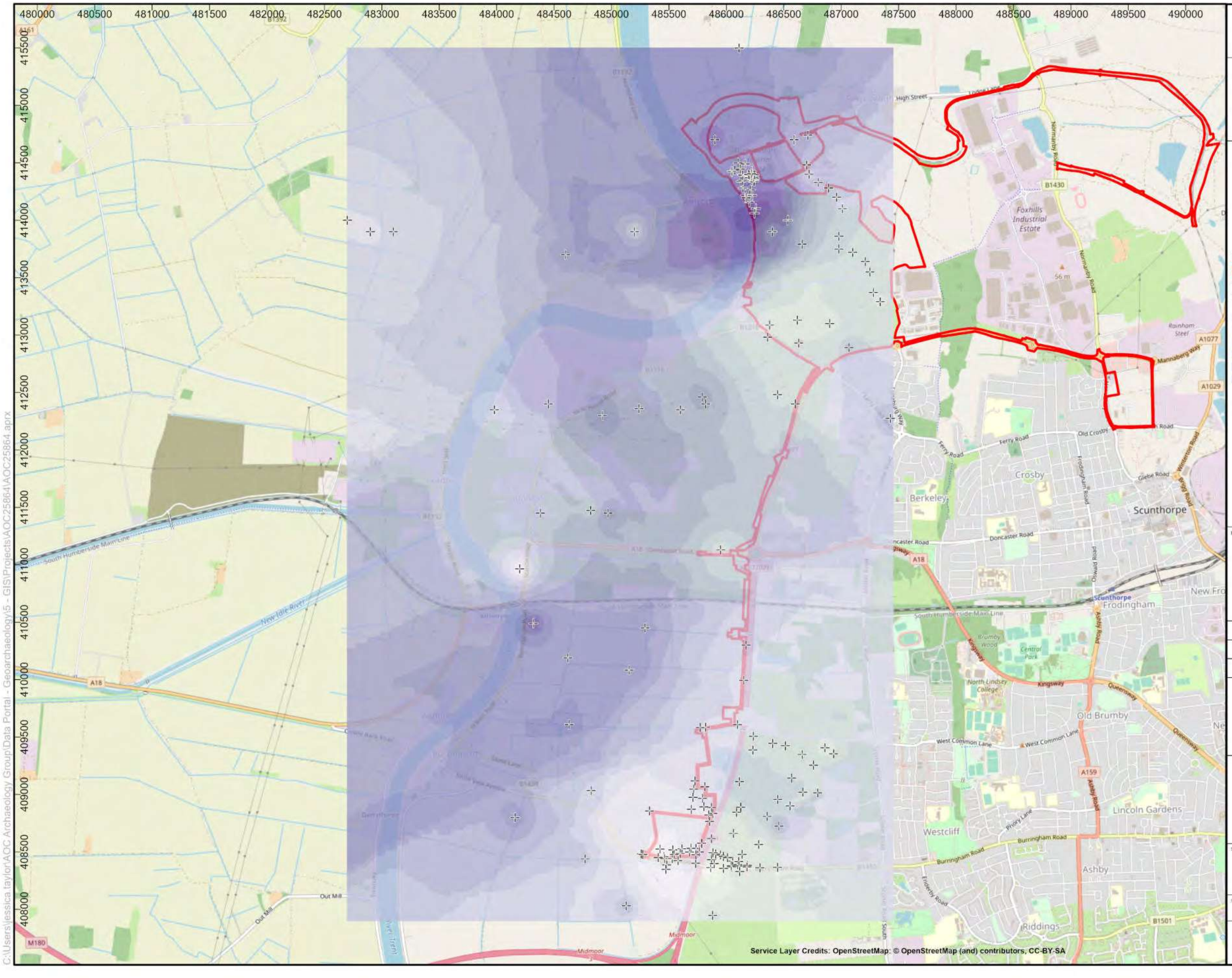

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Figure	12

Topographic plot of the surface of the Lower Alluvium/Warp/ Sutton Sands from deposit records

Legend

- Site boundary
- Data Points

m OD

- 3.000001 - 4.000000
- 2.000001 - 3.000000
- 1.000001 - 2.000000
- 0.000001 - 1.000000
- -0.999999 - 0.000000
- -1.999999 - -1.000000
- -2.999999 - -2.000000
- -3.999999 - -3.000000
- -4.999999 - -4.000000
- -5.999999 - -5.000000
- -6.999999 - -6.000000
- -7.999999 - -7.000000
- -8.999999 - -8.000000
- -9.999999 - -9.000000
- -10.999999 - -10.000000
- -11.999999 - -11.000000
- -12.000000

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SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:31,209 @ A3

0 100m

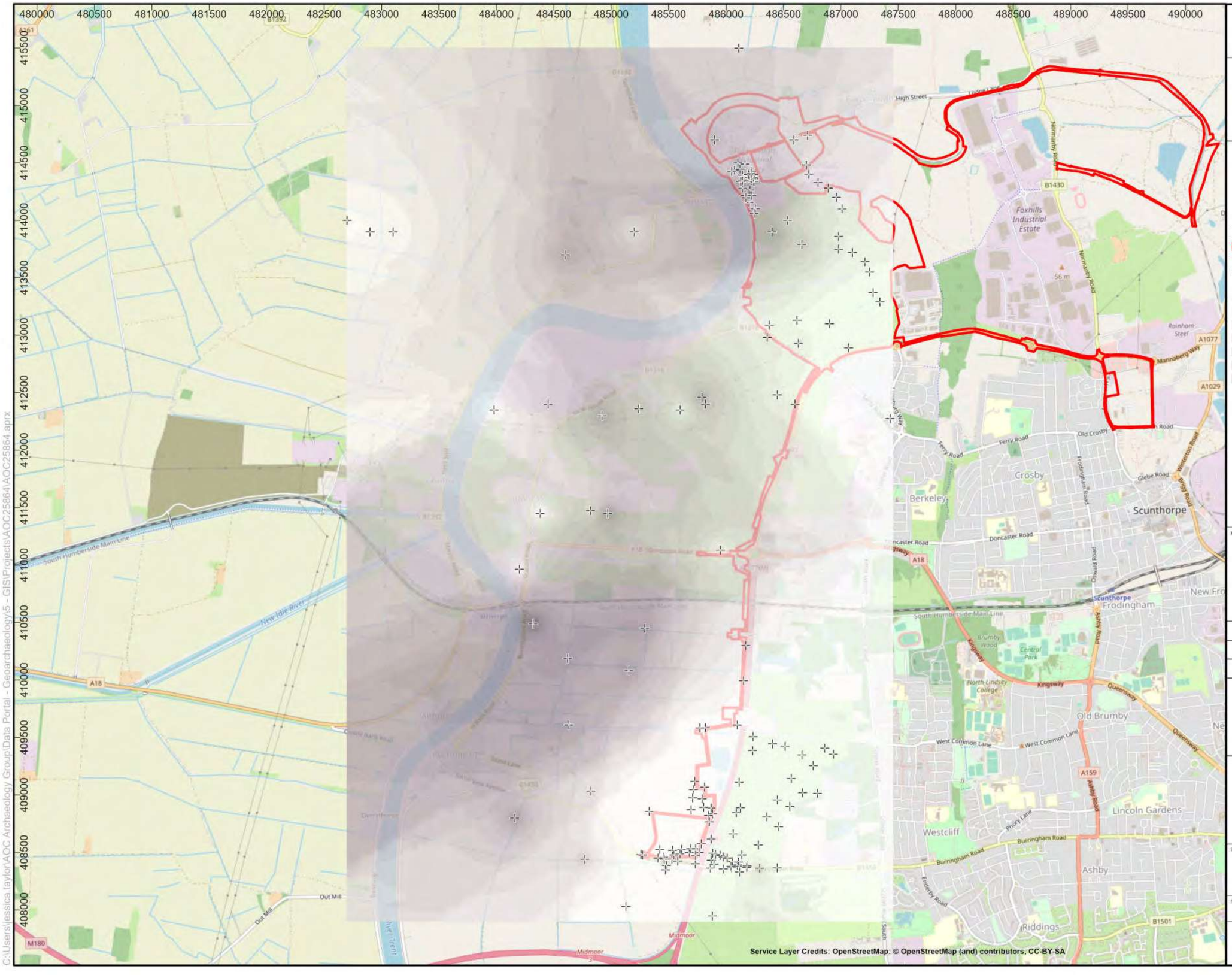

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Figure 13

Projected thickness plot of the Holocene organic deposits

Legend

- Site boundary
- Data Points

m

0.500000 - 1.000000	4.500001 - 5.000000
1.000001 - 1.500000	5.000001 - 5.500000
1.500001 - 2.000000	5.500001 - 6.000000
2.000001 - 2.500000	6.000001 - 6.500000
2.500001 - 3.000000	6.500001 - 7.000000
3.000001 - 3.500000	7.500001 - 8.000000
3.500001 - 4.000000	8.000001 - 8.500000
4.000001 - 4.500000	8.500001 - 9.000000
	9.000001 - 9.500000
	9.500001 - 10.000000

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Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:31,209 @ A3

0 100m

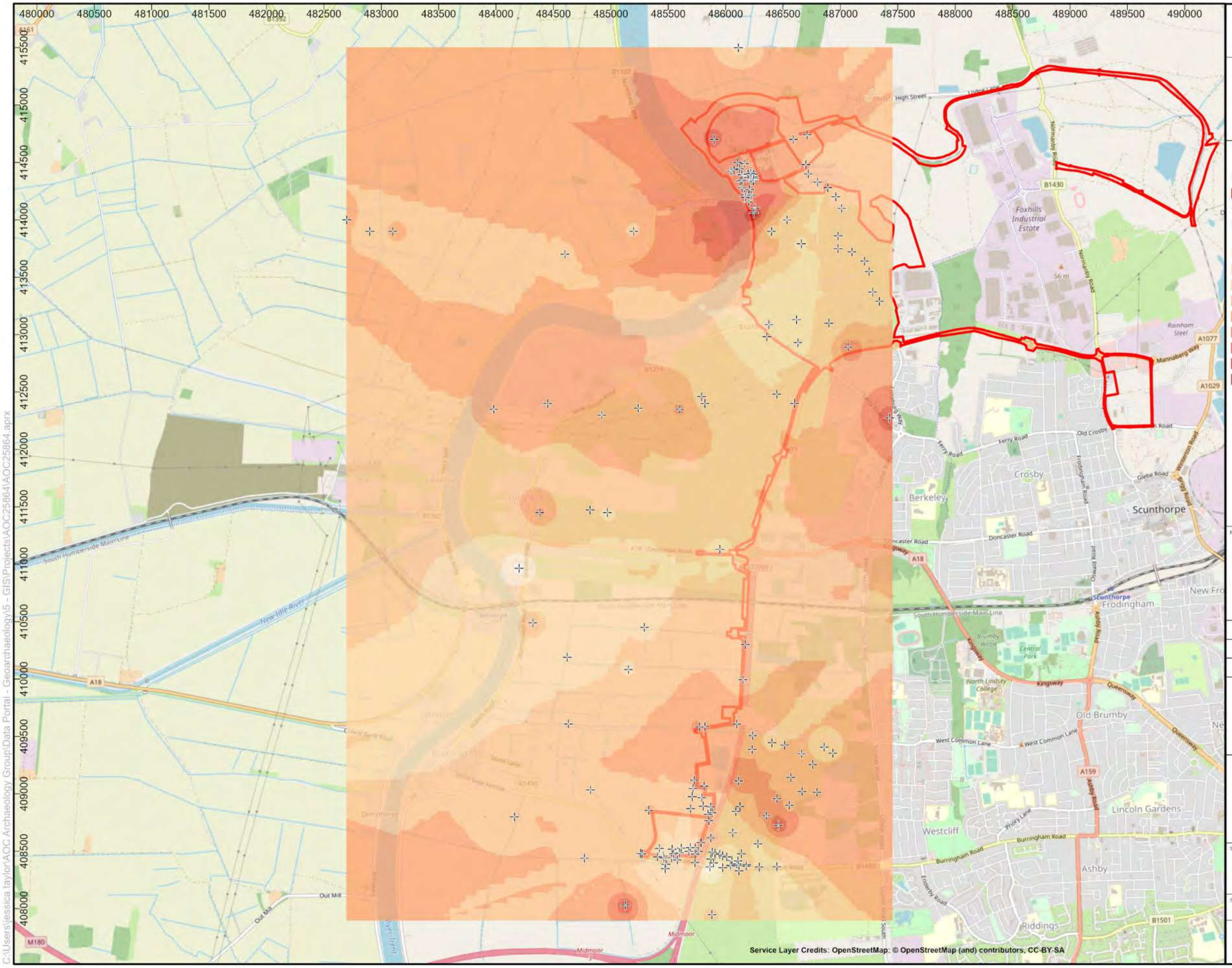

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Figure	14

Topographic plot of the surface of the Holocene organic deposits project from deposit records

Legend

- Site boundary
- Data Points

m OD

- 3.000001 - 4.000000
- 2.000001 - 3.000000
- 1.000001 - 2.000000
- 0.000001 - 1.000000
- -0.999999 - 0.000000
- -1.999999 - -1.000000
- -2.999999 - -2.000000
- -3.999999 - -3.000000
- -4.999999 - -4.000000
- -5.500000 - -5.000000

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SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:31,209 @ A3

0 100m

Figure	15

Projected thickness of the Upper Alluvium/Sutton Sand/ Warp

Legend

- Site boundary
- Data Points

m

- 0.500000 - 1.000000
- 1.000001 - 1.500000
- 1.500001 - 2.000000
- 2.000001 - 2.500000
- 2.500001 - 3.000000
- 3.000001 - 3.500000
- 3.500001 - 4.000000
- 4.000001 - 4.500000
- 4.500001 - 5.000000
- 5.000001 - 5.500000
- 5.500001 - 6.000000
- 6.000001 - 6.500000
- 6.500001 - 7.000000
- 7.000001 - 7.500000
- 7.500001 - 8.000000
- 8.000001 - 8.500000

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Datum: OSGB 1936

SCALE

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0 100m

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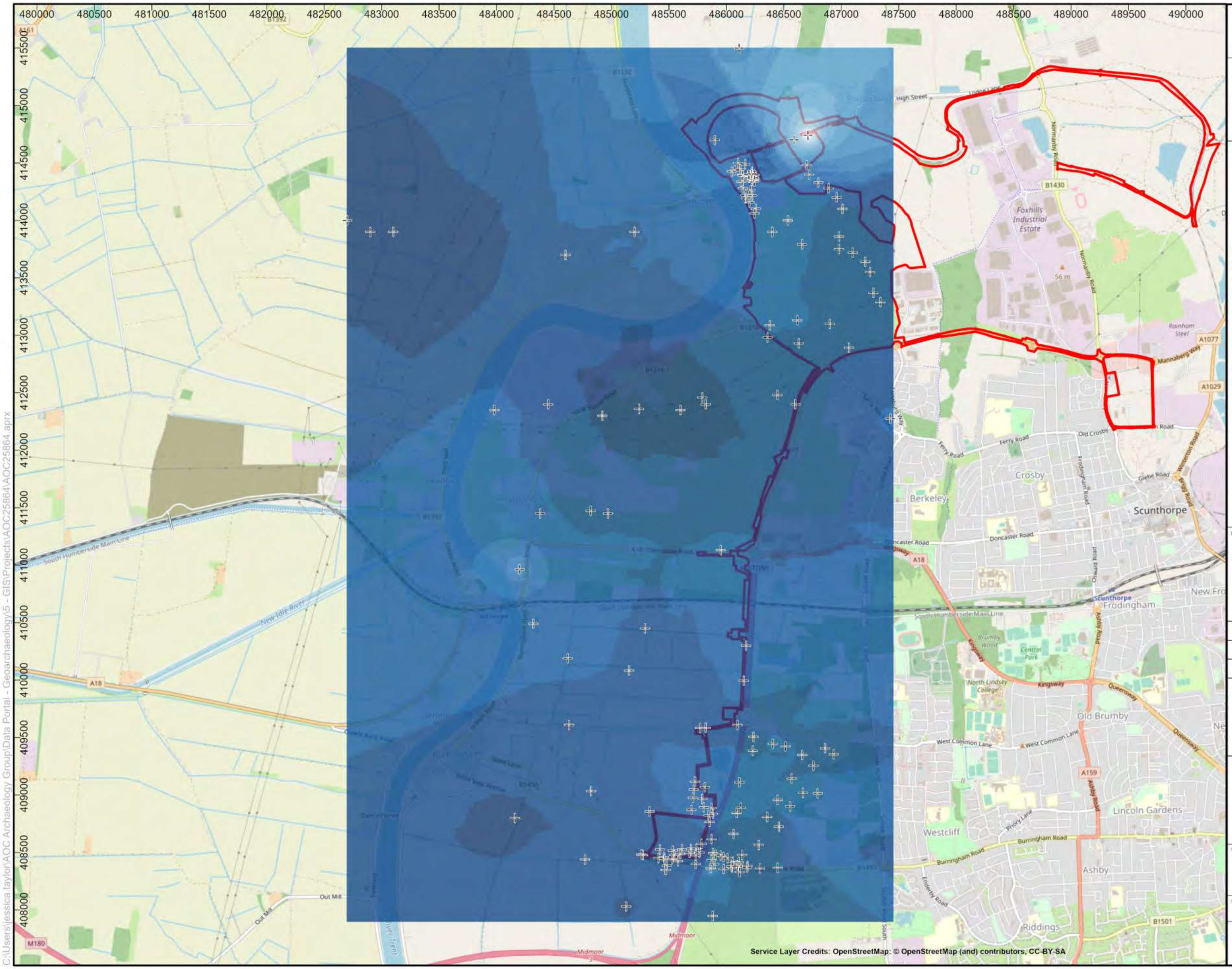

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Figure	16

Topographic plot of the Upper Alluvium/Sutton Sand/ Warp projected from deposit records

Legend

- Site boundary
- Data Points

m OD

- 15.000001 - 16.000000
- 14.000001 - 15.000000
- 13.000001 - 14.000000
- 12.000001 - 13.000000
- 11.000001 - 12.000000
- 10.000001 - 11.000000
- 9.000001 - 10.000000
- 8.000001 - 9.000000
- 7.000001 - 8.000000
- 6.000001 - 7.000000
- 5.000001 - 6.000000
- 4.000001 - 5.000000
- 3.000001 - 4.000000
- 2.000001 - 3.000000
- 1.000001 - 2.000000
- 0.000000 - 1.000000

FOR

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SYSTEM

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Datum: OSGB 1936

SCALE

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0 100m

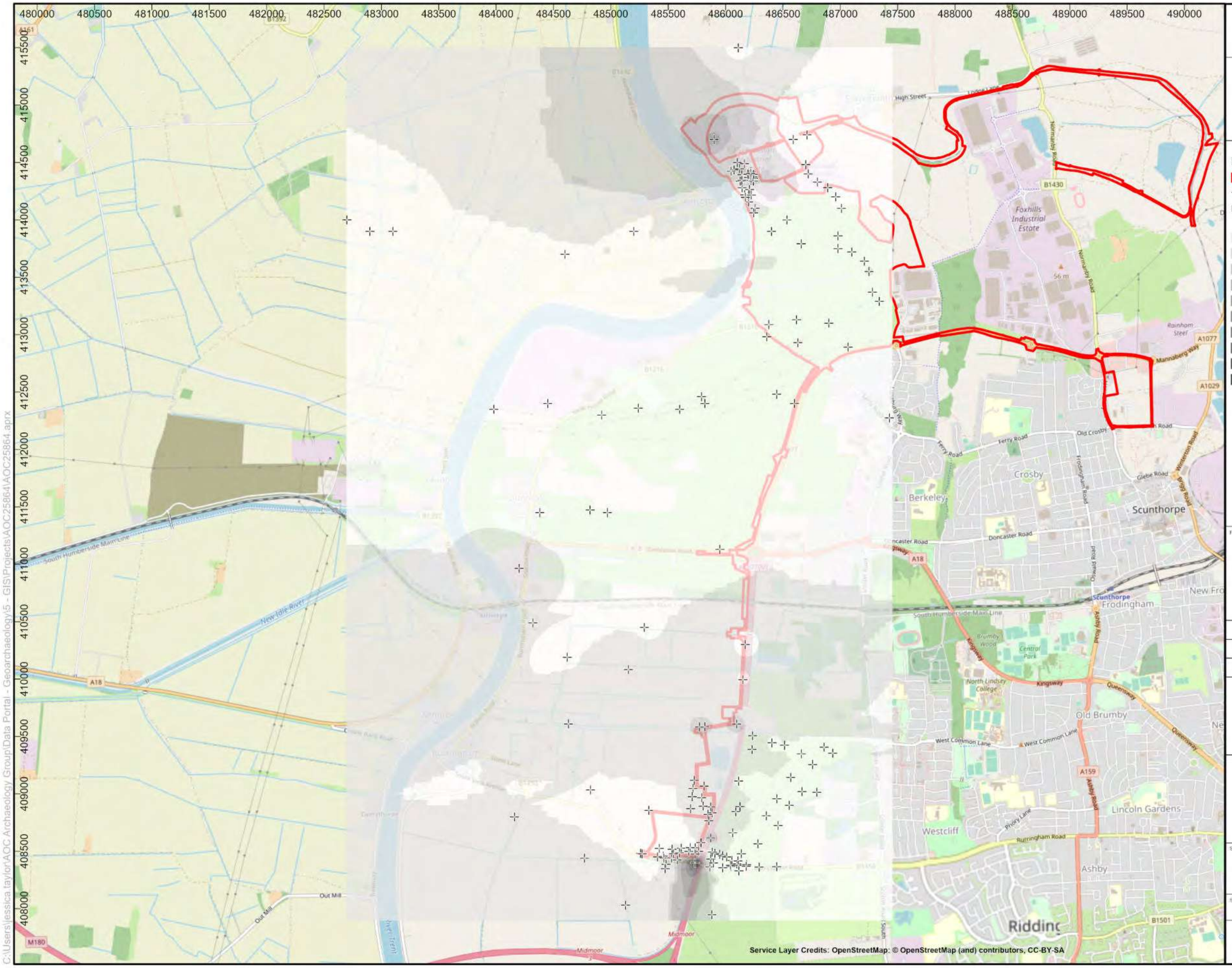

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Figure	17

Projected thickness plot of the Made Ground

Legend

- Site boundary
- Data Points

m

- 0.500000
- 0.500001 - 1.000000
- 1.000001 - 1.500000
- 1.500001 - 2.000000
- 2.000001 - 2.500000
- 2.500001 - 3.000000
- 3.000001 - 3.500000
- 3.500001 - 4.000000
- 4.000001 - 4.500000
- 4.500001 - 5.000000
- 5.000001 - 5.500000

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Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

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0 100m

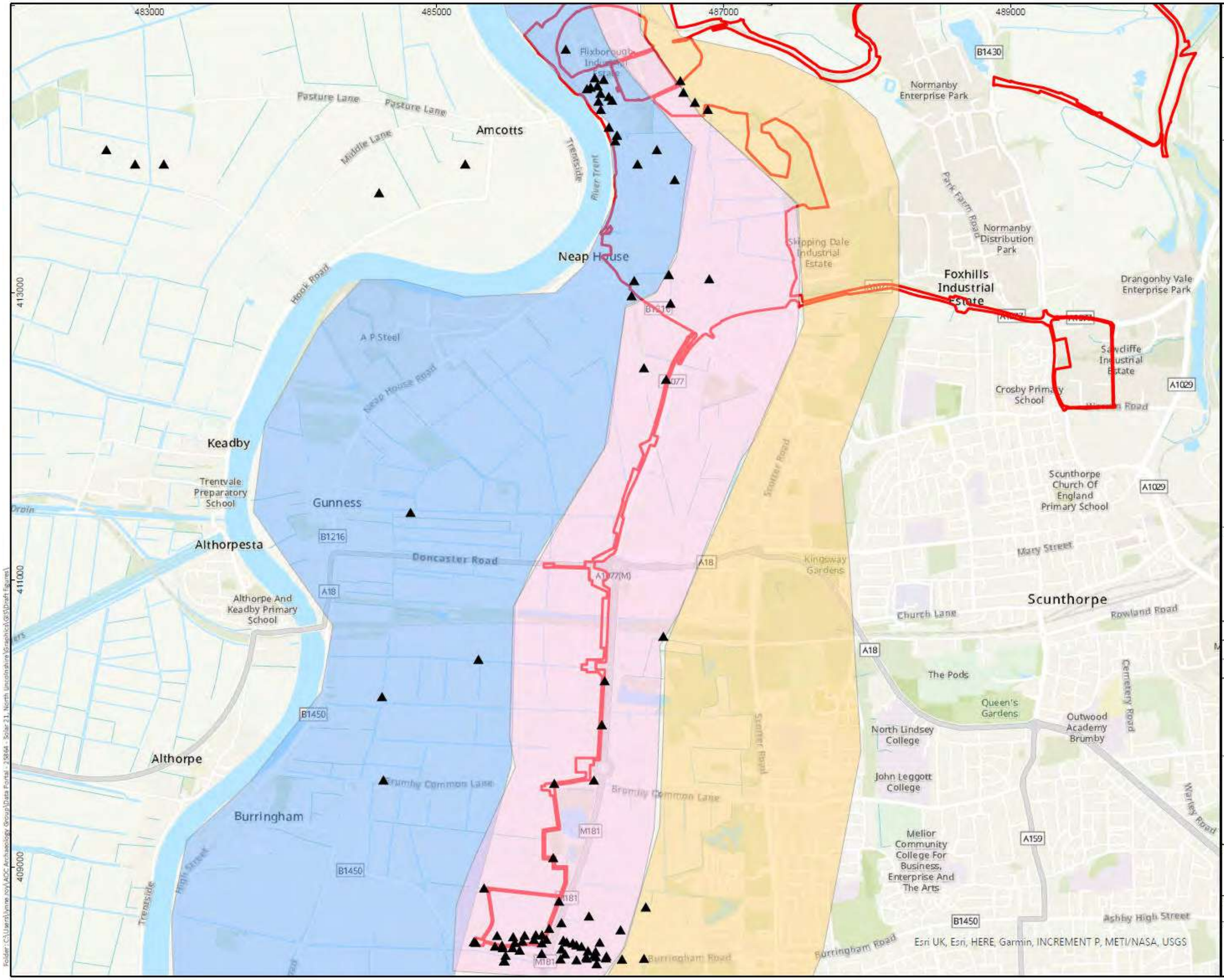

Figure 18

Zones of Archaeological Potential

Legend

- Site Boundary
- Zone 1
- Zone 2
- Zone 3

FOR

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33 St Mary Axe,
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AOC Project No:	25864

AOC Archaeology Group

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:25,000 @ A3

SCALE

0 1,250 m

AOC Archaeology Group

AOC Archaeology Group, **Unit 7, St Margarets Business Centre, Moor Mead Road, Twickenham TW1 1JS**
tel: **020 8843 7380** | fax: **020 8829 0549** | e-mail: **london@aocarchaeology.com**

[redacted]

APPENDIX D GEOPHYSICAL SURVEY REPORT

North Lincolnshire Green Energy Park, Scunthorpe, North Lincolnshire

Detailed Gradiometer, Caesium Vapour and Ground-Penetrating Radar Survey Report

Report Ref.:
254050.03 May 2022

wessexarchaeology

Portway House
Old Sarum Park
Salisbury
Wiltshire
SP4 6EB

Wessex Archaeology Ltd is a company limited by guarantee registered in England, company number 1712772. It is also a Charity registered in England and Wales number 287786, and in Scotland, Scottish Charity number SC042630. Our registered office is at Portway House, Old Sarum Park, Salisbury, Wiltshire, SP4 6EB

Document Information

Document title	North Lincolnshire Green Energy Park, Scunthorpe, North Lincolnshire
Document subtitle	Detailed Gradiometer, Caesium Vapour and Ground-Penetrating Radar Survey Report
Document reference	254050.03
Client name	ERM
Address	2nd Floor Exchequer Court 33 St Mary Axe London EC3A 8AA
Site location	Scunthorpe
County	North Lincolnshire
National grid reference	Area 3 485700 408450 (SE 85700 08450) to 486770 412720 (SE 86770 12720) Area 4 486650 414600 (SE 86650 14600) Area 5 486820 412745 (SE 86820 12745) to 489050 412845 (SE 89050 12845)
Statutory designations	None
WA project name	North Lincolnshire Green Energy Park
WA project code	254050
Dates of fieldwork	27/10/2021 – 28/10/2021 02/11/2021 – 04/10/2021 22/12/2021 14/01/2022 3/2/2022 – 4/2/2022
Fieldwork directed by	Amy Dunn and Cameron Ray
Project management by	Chris Breeden
Document compiled by	Alexander Schmidt
Contributions from	Tom Richardson, Brett Howard, Rok Plesnicar
Graphics by	Rok Plesnicar & Brett Howard

Quality Assurance

Issue	Date	Author	Approved by
1	23/11/2021	AJS	TR
2	31/01/2022	AJS / BH / RP	CB
3	11/03/2022	AJS / BH / RP	TR
4	13/05/2022	AJS / BH / RP	CB

Contents

List of Figures

Summary

A geophysical survey was conducted over land outlined for the development of the North Lincolnshire Green Energy Park, Scunthorpe, North Lincolnshire (Area 3 between NGR 485700 408450 and 486770 412720; Area 4 centred on 486650 414600; Area 5 between 486820 412745 and 489050 412845; Inland Port centred on 486090 414316). The project was commissioned by ERM with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features in support of a planning application.

The magnetic survey comprises 18 arable fields and consists of a detailed gradiometer survey over 20.7 ha of land (Areas 3, 4 and 5) and caesium vapour magnetometry survey across 16.3 ha (Area 3).

These surveys were undertaken between the 27 and 28 October, 2 and 4 November 2021, 14 January and 3 – 4 February and has demonstrated the presence of a number of anomalies of potential archaeological interest. These are predominantly located in Area 4.

A substantial portion of evidence associated with ridge and furrow cultivation has been revealed by the surveys. Two large enclosures have been identified in the south-eastern portion of Area 4. Also in Area 4, numerous linear and curvilinear anomalies have been identified spanning almost the entire survey area. These could evidence settlement activity, although a natural origin cannot be ruled out.

Numerous weakly positive discrete anomalies are tentatively considered evidence of possible extraction or refuse pits. However, this interpretation is not confident as these anomalies could equally be natural in origin.

A number of further anomalies thought to indicate natural variation in the underlying geological deposits have been identified throughout Area 3 and 4. In Area 3 anomalies thought to indicate localised variation in the magnetic susceptibility of the probable superficial deposits have been identified. In Area 4, evidence of underlying natural fissures has been widely identified in the form of weakly positive interconnected sinuous anomalies.

The remaining anomalies can possibly be interpreted as modern in origin and predominantly associated with recent agricultural activity though it is possible that they are natural and the result of warping causing the redeposition of material. Further, highly ferrous anomalies associated with an underlying service as well as extant pylons have also been identified in Area 4 and 5 respectively.

The ground penetrating radar survey was undertaken at the Inland Port area on 22 December 2021 covering approximately 0.16 hectares of area.

This survey revealed a series of high amplitude linear and rectilinear features that are potentially the remains of former buildings on the site and the line of a former road.

Acknowledgements

Wessex Archaeology would like to thank ERM for commissioning the geophysical survey. The assistance of Charles Le Quesne is gratefully acknowledged in this regard.

The fieldwork was undertaken by Amy Dunn, Cameron Ray, Andres Perez Arana, and Jo Instone-Brewer. Alexander Schmidt and Rok Plesnicar processed and interpreted the geophysical data. Alexander Schmidt, Brett Howard and Rok Plesnicar wrote the report. The geophysical work was quality controlled by Tom Richardson. Illustrations were prepared by Rok Plesnicar and Brett Howard. The project was managed on behalf of Wessex Archaeology by Chris Breeden.

North Lincolnshire Green Energy Park, Scunthorpe, North Lincolnshire

Detailed Gradiometer, Caesium Vapour and Ground-Penetrating Radar Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned by ERM to conduct a geophysical survey to support the North Lincolnshire Green Energy Park Scheme. This is separated into three areas. Area 3 is located between NGR 485700 408450 and 486770 412720 to the west of Scunthorpe, Area 4 is centred on NGR 486650 414600 to the east of the Flixborough Industrial Estate, and Area 5 is located between NGR 486820 412745 and 489050 412845 to the north of Scunthorpe (**Figure 1**).

1.1.2 The proposed development comprises a new Green Energy Park located at Flixborough Industrial Estate.

1.2 Scope of document

1.2.1 This report presents a brief description of the methodology followed by the detailed survey results and the archaeological interpretation of the geophysical data.

1.3 The site

Area 3

1.3.1 Area 3 is located west of the town of Scunthorpe, North Lincolnshire and covers the land between NGR 485710 408440 and 486770 412720. This comprises 26.6 ha of agricultural land. On the eastern side, the area is bounded by the M181 and A1077 and extends between Burringham Road to the south and Ferry Road to the north.

1.3.2 This area is located on relatively flat land, located between 2 m – 3 m above Ordnance Datum (aOD).

1.3.3 The solid geology comprises sedimentary bedrock of Mercia Mudstone Group with overlying superficial geological deposits of Warp (clay and silt), and Alluvial (clay, silt, sand, and gravel) deposits to the north of Ferry Road (BGS 2021).

1.3.4 The soils underlying the site are likely to consist of gleyic brown calcareous earths of the 532b (Romney) association (SSEW SE Sheet 1 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

Area 4

1.3.5 Area 4 is located at the eastern edge of the Flixborough Industrial Estate, centred on NGR 486650 414600. This comprises 3.5 ha of agricultural land. The area is bounded by Flixborough Industrial Estate to the west, Stather Road to the south and First Avenue to the north. To the east, the area extends as further agricultural land.

1.3.6 The area is on a slight incline sloping from 11 m aOD at the northern edge to 7 m aOD at the southern edge.

1.3.7 The solid geology comprises Mudstone of the Penarth Group at the western part of the area and Mudstone and Limestone of the Scunthorpe Mudstone Formation in the eastern part of

the area. Overlying superficial geological deposits comprise clay and silt of Hemingbrough Glaciolacustrine Formation (BGS 2021).

1.3.8 The soils underlying the site are likely to consist of typical brown sands of the 551d (Newport 1) association (SSEW SE Sheet 1 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey

Area 5

1.3.9 Area 5 is located north of the town of Scunthorpe, North Lincolnshire between NGR 486820 412745 and NGR 489050 412845.

1.3.10 The area comprises 5.6 ha of agricultural land currently utilised as ploughed fields in the west and wooded and pastures to the east, spread across seven parcels. They are located along the A1077 Phoenix Parkway.

1.3.11 The western part of the area is situated in flat land at 4 m aOD with a steeper slope towards the east, rising from 4 m aOD to 55 m aOD.

1.3.12 The solid geology comprises Mudstone, Siltstone, and Sandstone of Triassic Rocks in the western part and Mudstone, Siltstone, Limestone, and Sandstone of the Lias Group in the eastern part of the area. Overlying superficial geological deposits comprise Alluvial clay, silt, and sand in the western part and Blown Sand deposits to the east (BGS 2021).

1.3.13 The soils underlying the site are likely to consist of gleyic brown calcareous earths of the 532b (Romney) association in the western part and typical sandy gley soils of the 821b (Blackwood) and typical brown sands of the 551d (Newport 1) association in the eastern part (SSEW SE Sheet 1 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

Inland Port

1.3.14 The inland port area consists of 0.39 hectares of industrial works centred on NGR 486090 414316.

1.3.15 The site forms part of RMS Ports Flixborough Wharf and is located at its southern entrance. Ground conditions consisted of a tarmac entrance and roadway along with loose material storage areas and buildings.

2 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

2.1 Introduction

2.1.1 The archaeological and historical background was assessed in a prior DBA (ERM 2021), which considered the recorded historical environment resource within a 1 km study area of the proposed development. The DBA used information from the North Lincolnshire Historic Environmental Record (NLHER) and the National Heritage List for England (NHLE). Additional sources of information are referenced, as appropriate. The DBA relates to the entire scheme and presents a detailed account of the archaeological and historical environment. This summary of the historic assets will be comprised of elements considered relevant to the geophysical survey.

2.2 Archaeological and historical context

2.2.1 There is one scheduled monument within the 1 km study area. Flixborough Saxon nunnery and the site of All Saints medieval church and burial ground (NHLE 1009382) are located 1 km to the east of Area 4.

2.2.2 There are six Grade II listed buildings within the study area. The Smithy (NHLE 1161486), Dovecote (NHLE 1103757), the Church of All Saints (NHLE 1103756), and Liliac Cottage (NHLE 1161472) are located in the village of Flixborough. The Berkley Hotel (NHLE 1426932) and Angel of War memorial (NHLE 1391399) are located in Scunthorpe.

2.2.3 Several microliths, cores, flakes, scrapers, and two 'leaf-shaped' arrowheads and Bronze Age pottery were found 300 m to the north of Area 5, at the site of Skippingdale Retail Park.

2.2.4 Prehistoric flint flakes were found within Area 4. Furthermore, a scraper and seven flakes were found 200 m north of Area 4.

2.2.5 Several features were excavated 250 m to the north-east of Area 4. Finds included a Neolithic pit containing pottery sherds, a Middle Bronze Age cinerary urn, a poorly preserved Iron Age crouched inhumation with grave goods, an Iron age storage jar, and a Roman pit containing burnt bone, pottery, and nails.

2.2.6 A Bronze Age ring ditch was identified 400 m to the east of Area 3, during a geophysical survey on Brumby Common West, in 2014-15. It was interpreted as the remains of a potential Bronze Age round barrow.

2.2.7 A 'heart-shaped' enclosure, visible as a crop mark on an aerial photograph taken in 1989, is located immediately west of Holyrood Drive, 100 m to the north of Area 5. The described and depicted form of the feature suggests an Iron Age feature.

2.2.8 A fragmentary sub-rectangular enclosure is visible as a crop mark on aerial photographs taken in 1989. The enclosure is located on a discrete area of sand immediately south of Ferry Road West located within Area 3. It measures 44 m x 50 m and appears to have a conjoined section of ditch on its western side. At least one internal pit is visible in the southern half of the enclosure. Recent Environment Agency Lidar survey information indicates that this enclosure is located on a raised area 1 m above the surrounding land.

2.2.9 A field walking survey was undertaken in advance of a proposed residential development, about 200 m east of Area 3, which recovered 16 pieces of flint, as well as post-medieval and modern material. The finds comprised two early Neolithic blades, a Neolithic or early Bronze Age end scraper, two primary flakes, a tertiary flake, two retouched flakes, and eight pieces of unworked flint.

2.2.10 Two ditches, one containing Iron Age pottery, were recorded during an archaeological evaluation in 2015 located 500 m to the east of Area 5.

2.2.11 At least four Roman coins were recovered in Bridge Field during metal detecting in 2000, 200 m to the north-east of Area 4.

2.2.12 Parallel linear cropmarks with a possible enclosure at the northern end are visible on aerial photographs, taken in 1995. They suggest an Iron Age or Roman stock or settlement enclosure within its immediate farming landscape. This is situated 120 m to the north of the western part of Area 5.

2.2.13 A findspot of a bronze coin of Victorinus was found on the allotments 400 m to the south of the eastern extent of Area 5. However, this was the site of former ironstone mining, and the topsoil has been replaced. Another roman coin from the third century was found 350 m to the east of Area 5.

2.2.14 A post-medieval linear crop mark, visible on an aerial photograph is located 370 m to the north of Area 4.

2.2.15 Post-medieval cropmark remains of a series of parallel linear ditches, probably defining trackways, are located 150 m to the west of Area 3, by the train line. These ditches are on the same orientation as a major post-medieval warping drain complex to the north and may be related and contemporary.

2.2.16 Post-medieval Old Park Farm was located on Park Farm Road. The site is beneath the Foxhills Industrial Estate 500 m to the north of Area 5.

2.2.17 Several post-medieval grange farmhouses are located within the buffer area; however, they are not listed. None the less they indicate to rural nature of the area in the post-medieval period.

2.2.18 Post-medieval cropmarks of warping drains and field boundaries were identified during a geophysical survey in 2005 and a desk-based assessment in 2006. They were identified 250 m to the east of Area 3.

2.2.19 A Second World War heavy anti-aircraft battery was located to the east of Neap House Farm between Areas 3 and 5 (MLS21394).

2.2.20 The site of Area 235 Number 13 searchlight battery at Frodingham is located 250 m east of Area 3. The battery was established during the Second World War in 1940 by Number 30 Searchlight Regiment and it was staffed by 316 Searchlight Battalion. It was equipped with one 150 cm projector with a sound locator and five normal 90 cm projectors. It was demolished during the 20th century.

2.2.21 Within the Inland Port area lies the site of the Flixborough Staithe historic port. This port had medieval origins and was the site of the eastern landing of the ferry crossing across the river Trent. The ferry crossing and associated buildings can be identified on early historic mapping such as the Snape 1778 survey and the 1885 1st Edition Ordnance Survey. The 1885 map specifically identifies Ferry Boat Inn as being located within this area.

3 METHODOLOGY

3.1 Introduction

3.1.1 The magnetic surveys were undertaken by Wessex Archaeology's in-house geophysics team between 27 and 28 October, 2 and 4 November 2021, 14 January 2022 and between 3 and 4 February 2022. Field conditions were adequate throughout the period of survey. An overall coverage of 20.6 ha has been achieved during the first stage of survey works (Area 3 totalling 5.5 ha; Area 4 totalling 13.74 ha; Area 5 totalling 1.33 ha).

3.1.2 The ground-penetrating radar survey (GPR) was undertaken on the 22 December 2021. Due to the survey site being a working port with multiple obstructions, including buildings and material storage, 0.16 of the proposed 0.39 hectares was successfully surveyed.

3.1.3 The methods and standards employed throughout the geophysical survey conform to that set out in the Written Scheme of Investigation (WSI) (Wessex archaeology 2021), as well as to current best practice, and guidance outlined by the Chartered Institute for Archaeologists' (CIfA 2014) and European Archaeologiae Consilium (Schmidt *et al.* 2015).

3.2 Aims and objectives

3.2.1 The aims of the survey comprise the following:

- To determine, as far as is reasonably possible, the nature of the detectable archaeological resource within a specified area using appropriate methods and practices; and

- To inform either the scope and nature of any further archaeological work that may be required; or the formation of a mitigation strategy (to offset the impact of the development on the archaeological resource); or a management strategy.

3.2.2 In order to achieve the above aims, the objectives of the geophysical survey are:

- To conduct a geophysical survey covering as much of the specified area as possible, allowing for on-site obstructions;
- To clarify the presence/absence of anomalies of archaeological potential; and
- Where possible, to determine the general nature of any anomalies of archaeological potential.

3.3 Fieldwork methodology

3.3.1 The cart-based gradiometer system used a Leica Captivate RTK GNSS instrument, which receives corrections from a network of reference stations operated by the Ordnance Survey (OS) and Leica Geosystems. Such instruments allow positions to be determined with a precision of 0.02 m in real-time and therefore exceeds European Archaeologiae Consilium recommendations (Schmidt *et al.* 2015).

3.3.2 The detailed gradiometer survey was undertaken using four Bartington Grad-01-1000L gradiometers spaced at 1 m intervals and mounted on a non-magnetic cart. Data were collected with an effective sensitivity of 0.03 nT at a rate of 10 Hz, producing intervals of 0.15 m along transects spaced 4 m apart.

3.3.3 The detailed gradiometer survey was also undertaken using four SenSys FGM650/3 magnetic gradiometers spaced at 1 m intervals and mounted on a non-magnetic cart towed by an ATV. Data were collected with an effective sensitivity of ±8 µT over ±1000 nT range at a rate of 100 Hz, producing intervals of 0.02 m along transects spaced 4 m apart.

3.3.4 The caesium vapour magnetometer surveys were conducted using two Geometrics G-864 sensors mounted 1 m apart on a non-ferrous cart. Data was collected at intervals no greater than 0.25 m along transects spaced 1 m apart with an effective sensitivity of 0.02 nT, in accordance with EAC guidelines. A Geometrics G-857 base station was also used to correct for diurnal magnetic drift when processing the data.

3.3.5 The GPR survey was conducted using an Impulse Radar Raptor 45 array. This multi-channel GPR system uses separate shielded transmitter and receiver antennae placed in an arrangement that allows it to be manually pushed across the area. The Raptor system contains eight separate transmitter and receiver antennae with a central frequency of 450 MHz. The data were recorded every 2.5 cm with a horizontal profile spacing of 8 cm within a time window of 100 ns.

3.3.6 The GPR system provides real-time positioning enabling full site coverage without the need to set up individual grid nodes across the survey areas. However, in order to ensure survey accuracy, the boundaries of the survey extent were established using a real-time kinematic (RTK) Global Navigation Satellite System (GNSS) instrument. This allows positions to be determined with sub-decimetre accuracy and therefore exceeds EAC recommendations.

3.4 Data processing

3.4.1 Data from the survey were subjected to minimal correction processes. These comprise a background removal median function with an effective window of 60 m, applied to correct for any variation between the sensors, a discard overlaps function where transects have been collected too close together and an interpolation used to grid the data.

3.4.2 GPR data from the survey were subjected to common radar signal correction processes. These include amplitude and wobble correction of the radar profile to correct for variance in temperature and soil moisture content, and background and bandpass filtering to remove

noise in the data from the surrounding area. Further details of the geophysical and survey equipment, methods and processing are described in Appendix 1.

3.4.3 The approximate depth conversion for the 450 MHz antenna is shown in Table 1. These have been calculated on the assumption that the GPR pulse through the ground is 0.066 m/ns for the 450 MHz antenna. It is possible to determine more precisely the average velocity of the GPR pulse through the ground is excavated features at a known depth can be identified in the data. Radargrams were analysed for suitable hyperbolic reflections, which can be used to determine the velocity of the GPR pulse through the subsurface deposits.

Table 1 Relative velocity to depth conversion based on a dielectric constant of 20.51 for the 450 MHz antenna

Time Slice	Time (ns)	Depth (m)	Time Slice	Time (ns)	Depth (m)
1	0-4.49	0–0.15	**11**	45.02-49.52	1.49-1.64
2	4.5-8.99	0.15-0.3	**12**	49.53-54.02	1.64-1.79
3	9.0-13.50	0.3-0.45	**13**	54.03-58.52	1.79-1.94
4	13.51-18.00	0.45-0.6	**14**	58.53-63.02	1.94-2.09
5	18.01-22.50	0.6-0.75	**15**	63.03-67.53	2.09-2.24
6	22.51-27.00	0.75-0.89	**16**	67.54-72.03	2.24-2.39
7	27.01-31.51	0.89-1.04	**17**	72.04-76.53	2.39-2.53
8	31.52-36.01	1.04-1.19	**18**	76.54-81.03	2.54-2.68
9	36.02-40.51	1.19-1.34	**19**	81.04-85.54	2.68-2.83
10	40.52-45.01	1.34-1.49			

3.4.4 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix 1**.

4 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION

4.1 Introduction

4.1.1 The geophysical survey has identified magnetic anomalies across the scheme. Results are presented as a series of greyscale plots and archaeological interpretations at a scale of 1:1,500 (**Figures 2** to **25**). The data are displayed at -2 nT (white) to +3 nT (black) for the greyscale images.

4.1.2 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous responses, burnt or fired objects, and magnetic trends (**Figures 3**, **5**, **7**, **9**, **11**, **13**, **15**, **17**,**19**, **21**, **23**, **25**). Full definitions of the interpretation terms used in this report are provided in **Appendix 2**.

4.1.3 Numerous ferrous anomalies are visible throughout the dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

4.1.4 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be present than have been identified through geophysical survey.

4.1.5 Gradiometer and Caesium Vapour survey may not detect all services present on site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.

4.1.6 The 450 MHz GPR antenna used in this survey has the potential of detecting features to a depth of 2 – 4 m in optimal conditions, however the total depth reached varies depending on the specific conditions of each area.

4.1.7 For ease of interpretation, the most representative timeslices have been selected for presentation with the interpretation image detailing the salient results from each relevant depth of the two areas. For this report, it was decided that **Timeslice 2**, **3**, **4**, and **5** would be chosen as these best represent the data. For reference, the depth from surface for the timeslices are detailed in Table 1.

4.1.8 The GPR survey has identified several planar returns and linear responses, as well as anomalous areas of low amplitude response across the survey area. Results are presented as a series of greyscale timeslices, and archaeological interpretations at a scale of 1:800 (**Figure 27** and **Figure 28**).

4.1.9 All features are described in terms of their geophysical character. It is important to stipulate that all the depths referred to in this report are approximate levels below the current ground surface. The interpretation of the GPR data highlights the presence of possible archaeological features and high/low amplitude responses representing planar and linear reflections.

4.1.10 It should be noted that small features and waterlogged features may produce responses that are below the detection threshold of the GPR antenna. Excessive disturbance can also impede the ability of geophysical techniques to detect archaeology. It may therefore be the case that more archaeological features are present than have been identified through the geophysical survey.

4.2 Detailed gradiometer survey results and interpretation

Area 3

4.2.1 An area of increased magnetic response **3000** has been identified in the southern portion of Area 3 (**Figure 3**). It extends for 70 m east – west and covers the width of the survey area. This anomaly indicates made ground and is considered to be modern.

4.2.2 An area of variable positive and negative responses has been identified at the southern end of Area 3, at **3001** (**Figure 5**). It covers the entire surveyed area for 250 m but has little discernible pattern or coherence to it. This is indicative of the natural alluvial sediments recorded in the area.

4.2.3 To the north of the area of alluvial deposits is an area of increased magnetic response at **3002** (**Figure 7**). It covers the entire width of the survey area and is 60 m long south-west to north-east. This is indicative of made ground and could relate to the construction of the adjacent M181.

4.2.4 A weakly negative broad anomaly is located in the central portion of Area 3 at **3003** (**Figure 9**). It is 20 m wide, 90 m long, and extends beyond the survey area, continuing to the north of Doncaster Road at **3004** (**Figure 11**). This subtle feature is visible in aerial photography and likely relates to a former course of the river Trent.

4.2.5 An area of increased magnetic response is noted in the central portion of the surveyed area at **3005** (**Figure 11**). This anomaly extends 30 m north – south and covers the breadth of

the survey area. This is thought to be modern in origin and likely associated with the construction of the adjacent highway.

4.2.6 Several weakly positive, discrete anomalies have been identified in the central portion of Area 3. Examples of these anomalies are noted at **3006**. These anomalies indicate pit-like features and could evidence wider settlement activity, such as localised extraction or refuse pits. However, it is equally possible these anomalies are natural, pertaining to localised variation in the magnetic susceptibility of the topsoil or geological deposits.

4.2.7 The majority of the area presents with broad areas of weakly positive response, such as at **3007** (**Figure 13**). This is likely to be evidence of localised variation in the magnetic susceptibility of the geological deposits and is therefore interpreted as natural in origin.

4.2.8 Several weakly positive discrete anomalies have been identified in the northern portion of Area 3 at **3008** (**Figure 15**). They are up to 2 m in diameter and indicate pit-like features. These pits could indicate archaeological activity; however, it is more likely that they are a consequence of natural pitting and undulations in the superficial deposits.

4.2.9 About 20 m to the south of **3008** are two areas of increased magnetic response at **3009** and **3010** that relate to made ground at the entrance to the field.

Area 4

4.2.10 Two large enclosures are noted to south-west of Area 4 (**Figure 17**). The first is at **4000** and covers 62 m x 37 m. The second is at **4001** and covers 62 m x 39 m. The relative similarity in the size of these enclosures as well as their shared alignment to the ridge and furrow anomalies suggests their potential as evidence of earlier enclosure features. Such features are likely to be medieval in origin.

4.2.11 A fragmented positive linear anomaly has been identified in the far south-east of the area at **4002**. The anomaly is 40 m long on a north-east to south-west alignment and could evidence a further ditch feature. This shares an alignment with the enclosures at **4000** and **4001** but due to its fragmented nature, cannot be more confidently interpreted.

4.2.12 In the south-east of the area, a weakly positive rectilinear anomaly is noted at **4003**. This anomaly extends from the southern boundary of the survey area for 22 m before turning to the west-south-west for a further 18 m. The anomaly is 1 m wide and parallel to anomalies interpreted as ridge and furrow in the area. It is possible the anomaly indicates a contemporary boundary feature that is not recorded on the available historical mapping. However, an earlier origin cannot be ruled out.

4.2.13 The majority of the field surrounding the anomalies interpreted as archaeological in the south-east of Area 4 (**4000** – **4003**) presents with a highly variable magnetic background. The majority of this is interpreted as evidence of natural variation in the underlying superficial deposits. However, ditch- and pit-like anomalies have been identified throughout that an anthropogenic origin cannot be ruled out for. However, due to the variable magnetic background and density of these anomalies, a confident interpretation cannot be ascribed. Several curvilinear anomalies are noted which could indicate earlier boundary features or even evidence settlement activity (**4004**). However, further investigation would be required to confirm this. The anomalies are largely fragmented, likely as a result of the ridge and furrow recorded in this area. This suggests a potential prehistoric origin. However, the anomalies could equally be natural.

4.2.14 In the north of the area, a weakly positive recti-linear anomaly has been identified at **4005** (**Figure 11**). The anomaly measures 13 m north – south and 15 m east – west. To the east, two parallel linear anomalies are noted at **4006** and **4007**. These anomalies are on the same alignment and spaced 13 m apart. These anomalies indicate ditch features and may relate

to a series of small enclosures or earlier boundary features. However, the anomalies are weak and could evidence modern agricultural activity.

4.2.15 Two broader parallel linear anomalies are noted on a north – south alignment in the north of the area at **4008** and **4009**. The anomalies are up to 2 m wide, spaced 93 m apart and span the breadth of the surveyed area for 40 m. These anomalies indicate ditch features and could evidence former boundary features. However, due to their weak magnitude, a more confident interpretation is not possible.

4.2.16 Further to the east at **4010**, a weakly positive linear anomaly has been identified (**Figure 21**). This anomaly is 1 m wide and spans the breadth of the surveyed area on a north-west to south-east alignment for 90 m. The anomaly could evidence an earlier boundary ditch. However, the anomaly is broadly on a similar alignment to anomalies interpreted as land drains to the east (**4020**) and as such, could be associated with drainage.

4.2.17 In the east of the area at **4011**, a positive, curvilinear anomaly has been identified (**Figure 19**). This is 1 m wide and 23 m long. This evidences a ditch and could be anthropogenic. However, the anomaly is isolated, and a more confident interpretation is not clear from the results of the geophysical survey alone.

4.2.18 Towards the south-east of the area, a weakly positive linear anomaly has been identified at **4012**. This is 148 m long and up to 1.5 m wide. This type of anomaly indicates a ditch and is most likely associated with a boundary feature of unknown date.

4.2.19 Numerous weakly positive, discrete anomalies have been identified across Area 4. Examples of these anomalies are noted at **4013**. These anomalies indicate pits and could evidence wider settlement activity, such as localised extraction or refuse pits. However, it is equally possible these anomalies are natural, pertaining to localised variation in the magnetic susceptibility of the topsoil, or underlying geological deposits.

4.2.20 Broadly spaced (5 – 6.5 m), weakly positive and negative linear anomalies are noted in the eastern portion of the area at **4014**. The anomalies are on a west north-west to east-south-east alignment. These anomalies indicate historical cultivation and are interpreted as evidence of ridge and furrow based on the spacing between the anomalies. This type of feature date to the medieval or post-medieval period.

4.2.21 In the east of the area, weakly positive, sprawling sinuous anomalies have been identified at **4015** (**Figure 19**). The lack of any regular shape or pattern suggests this area of anomalies is natural in origin. It is indicative of cracking or fissures in the bedrock, backfilled with natural material.

4.2.22 A broader area of positive magnetic variation is noted traversing the eastern portion of the area on a north – south alignment at **4016**. Similar variations are noted continuing throughout the area to the south-east at **4017** and **4018**. These anomalies are evidence of natural variation in the magnetic susceptibility of the underlying geological deposits.

4.2.23 Broadly spaced, weakly dipolar linear anomalies have been identified in the western portion of the area at **4019** (**Figure 21**). The anomalies are noted in both a parallel linear and 'herringbone' array. These anomalies indicate material that has been burnt or fired, such as ceramic. Similarly spaced, positive linear anomalies are noted in the south-east of the area at **4020**. These are interpreted as drains.

4.2.24 Closely spaced, parallel linear anomalies have been identified throughout the eastern portion of Area 4 at **4021** (**Figure 17**). These anomalies are interpreted as evidence of the modern ploughing regime.

4.2.25 Across the southern boundary of the north-western portion of Area 4, an alignment of increased magnetic response is noted at **4022** (**Figure 21**). This is adjacent to a trackway and considered to be modern in origin.

4.2.26 A highly magnetic dipolar linear anomaly is noted traversing the western boundary of the east of Area 4 at **4023** (**Figure 19**), continuing to the south at **4024** (**Figure 17**). This indicates a modern service, such as a pipe or cable.

Area 5

4.2.27 Broadly spaced (4 m), weakly positive and negative linear anomalies are noted in the eastern portion of Area 5 at **5000** (**Figure 23**). The anomalies are on a north-west to south-east alignment. These anomalies indicate ridge and furrow based on the spacing between the anomalies. This type of feature date to the medieval to post-medieval period.

4.2.28 A broad, weakly positive linear anomaly is noted at **5001** in Area 5 that is perpendicular to the anomalies interpreted as ridge and furrow. The anomaly extends to the north for 30 m and is 2.5 m wide. This could indicate an unrecorded boundary. However, the anomaly could also be earlier in origin indicating a disassociated ditch-feature.

4.2.29 Numerous positive, discrete anomalies have been identified across Area 5. Examples of these anomalies are noted at **5002**. These anomalies indicate pits and could evidence wider settlement activity such as localised extraction or refuse pits. However, it is equally possible these anomalies are natural, pertaining to localised variation in the magnetic susceptibility of the topsoil, or underlying geological deposits.

4.2.30 Two areas of increased magnetic response have been identified to the west of Area 5 at **5003** and **5004**. The anomaly at **5003** measures 31 m east – west and has not been fully realised at its northern extent due to the limit of the survey area. The anomaly at **5004** appears to curve broadly parallel to the south-western corner of the field. The anomalies are most likely modern and associated with recent agricultural activity.

4.2.31 A highly magnetic response has been identified in the central portion of the surveyed area at **5005**. This corresponds to two extant pylons along the bisecting field boundary.

4.3 Caesium vapour magnetometer survey results and interpretation

Area 3

4.3.1 The caesium vapour survey has identified a number of anomalies that are interpreted as possible archaeology (**3100**) (**Figure 25**). These pertain to pit-like anomalies similar to those identified throughout the detailed gradiometer survey results. These anomalies are positive, 1 – 2 m in breadth and could evidence wider settlement activity such as refuse or extraction pits. However, the anomalies could equally be natural in origin, pertaining to localised variation in the magnetic susceptibility of the topsoil or underlying geological deposits.

4.3.2 Large areas of weakly increased magnetic response are noted throughout the dataset (**3101**). These anomalies correspond to features visible throughout the landscape in aerial imagery as cropmarks and indicate localised natural variation in the alluvial deposits.

4.3.3 A large area of increased magnetic response has been identified, dominating the eastern and central portion of the surveyed area at **3102**. This type of response indicates a greater variation in the magnetic susceptibility of the underlying deposits. As such these anomalies can be natural in origin, consisting of different deposits to the surrounding variation. It is also possible this anomaly is associated with the heavy anti-aircraft battery that is known to have existed east of Neap House Farm.

4.4 Ground-Penetrating Radar Results and interpretation

Inland Port

4.4.1 The geophysical survey has identified a number of features that are likely to be associated with archaeological remains. These features are predominantly located in the centre of the

GPR survey area and are associated with amorphous planar reflectors and linear features potentially relating to former structures.

4.4.2 Multiple high amplitude planar reflectors, present at depths starting from 0.15 m from surface through to 0.75 m from surface, are visible across the GPR survey area (**6000** – **6006; Figure 27**). Responses marked **6000**, **6003**, **6004**, **6005**, and **6006**, present as collections of broadly rectilinear forms and cover an area of approximately 26 m by 26 m. These responses are most likely foundation remains of former structures, as seen on historic mapping.

4.4.3 Further high amplitude responses (**6001** and **6002; Figure 27**) are present at 4 m and 22 m, respectively, north-east of the main collection of responses. These are amorphous, high amplitude responses at a depth range of between 0.15 m – 0.45 m (**Timeslice 2** and **3**) from surface; **6001** covers an area of 8 m by 3 m, whereas **6002** covers an area of 8 m by 5 m. The characteristics of the responses, both in amplitude and dimension, suggest the presence of further structure foundation material relating to former buildings in the area.

4.4.4 A high amplitude linear response (**6007**; **Figure 27**) is present 5 m south of **6003**, and measures approximately 28 m in length and 1 m wide, on an east-west orientation. This response is indicative of the edge of the former road route, opposite the former buildings.

4.4.5 There are a series of areas of low amplitude response across the survey area (**6008**, **6009**, **6010**). At 7 m by 4 m, **6008** presents as a well-defined rectangular area indicative of groundworks to replace, or remodel, the floor. Further, an amorphous low amplitude area at **6009**, 23 m east of **6008**, is suggestive of further groundworks, or road repair. Both **6008** and **6009** are present from the surface timeslices, inferring modern activity. However, **6010**, immediately east of **6004** and **6006**, is most visible in Timeslice 4 (**Figure 27**) at a depth of 0.45 m to 0.6 m from surface. At 20 m by 8 m, **6010** is broadly rectangular and is suggestive of former surfacing works, most likely related to the former structures on the site.

4.4.6 Existing surface features have been indicated on the figures, as has evidence of services.

5 DISCUSSION

5.1.1 A substantial portion of evidence associated with ridge and furrow cultivation has been revealed by the surveys. These are prevalent in Area 4 and 5. Two large enclosures have been identified in the south-eastern portion of Area 4. These anomalies evidence an earlier iteration of land division comprising ditch field boundaries. They are parallel to anomalies associated with ridge and furrow and therefore may be contemporary. However, they could equally be associated with earlier activity.

5.1.2 Also in Area 4, numerous linear and curvilinear anomalies have been identified spanning almost the entire survey area. These could evidence settlement activity, although a natural origin cannot be entirely ruled out. The ridge and furrow cultivation may have impacted the preservation and detection of these features, and as such, a confident interpretation is not possible.

5.1.3 In addition, numerous weakly positive discrete anomalies are tentatively considered evidence of possible extraction or refuse pits. However, this interpretation is not confident as these anomalies could equally be natural in origin.

5.1.4 A number of further anomalies thought to indicate natural variation in the underlying geological deposits have been identified throughout Area 3 and 4. In Area 3 anomalies thought to indicate localised variation in the magnetic susceptibility of the probable superficial deposits have been identified. In Area 4, evidence of underlying natural fissures has been widely identified in the form of weakly positive interconnected sinuous anomalies.

5.1.5 The remaining anomalies are interpreted as modern in origin and predominantly associated with recent or modern agricultural activity such as ploughing or surface spreads as well as underlying land drains. Further, highly ferrous anomalies associated with an underlying service as well as extant pylons have also been identified in Area 4 and 5 respectively.

5.1.6 The GPR survey results have provided evidence for the presence of archaeological features in the Inland Port area.

5.1.7 The collections of high amplitude rectilinear features in the centre of the survey area, and the amorphous features to the east, suggest the remains of foundations of former structures as indicated on historic mapping, such as the known Ferryman Inn.

5.1.8 It is likely that the linear feature to the south is also associated with the former buildings and was the edge of the former road which led, from the extant road, west to the ferry terminal, known to have operated in this vicinity.

5.1.9 The low amplitude features in the data are indicative of groundworks, most likely resurfacing, both modern and historical.

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Wessex Archaeology 2021 *North Lincolnshire Green Energy Park, Scunthorpe, Lincolnshire Written Scheme of Investigation for Archaeological Geophysical Survey*. Ref: 254050.02

Cartographic and documentary sources

Ordnance Survey 1983 *Soil Survey of England and Wales Sheet 1, Soils of Northern England.* Southampton.

Online resources

British Geological Survey Geology of Britain Viewer (accessed November 2021) [redacted]

Old Maps (accessed November 2021) [redacted]

APPENDICES

Appendix 1: Survey Equipment and Data Processing

Gradiometer Survey

Survey methods and equipment

Bartington Array

The magnetic data for this project were acquired using a Bartington 601-2 dual magnetic gradiometer system. This instrument has four sensor assemblies fixed horizontally 1 m apart allowing four traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 1 m separation and measures the difference between the vertical components of the total magnetic field within each sensor array. This arrangement of magnetometers suppresses any diurnal or low frequency effects.

The gradiometers have an effective resolution of 0.03 nT over a ±100 nT range. All of the data are then relayed to a CS35 tablet, running the MLgrad601 software, which is used to record the survey data from the array of Grad601 probes at a rate of 10 Hz. The program also receives measurements from a GPS system, which is fixed to the cart at a measured distance from the sensors, providing real time locational data for each data point.

Sensys Array

The magnetic data for this project were acquired using a non-magnetic cart fitted with four SenSys FGM650/3 magnetic gradiometers. The instrument has four sensor assemblies fixed horizontally 1 m apart allowing four traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 0.6 m separation and measures the difference between the vertical components of the total magnetic field within each sensor array. This arrangement of magnetometers suppresses any diurnal or low frequency effects.

The gradiometers have an effective resolution of ±8 µT over ±1000 nT range. All of the data are then relayed to a CS35 tablet, running the MONMX program, which is used to record the survey data from the array of FMG650/3 probes at a rate of 20 Hz. The program also receives measurements from a GPS system, which is fixed to the cart at a measured distance from the sensors, providing real time locational data for each data point.

The cart-based system relies upon accurate GPS location data which is collected using a Leica Captivate system with rover and base station. This receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems, allowing positions to be determined with a precision of 0.02m in real-time and therefore exceed the level of accuracy recommended by European Archaeologiae Consilium recommendations (Schmidt *et al.* 2015) for geophysical surveys.

Data may be collected with a higher sample density where complex archaeological anomalies are encountered, to aid the detection and characterisation of small and ephemeral features. Data may be collected at up to 0.01 m intervals along traverses spaced up to 0.25m apart.

Post-processing

The magnetic data collected during the survey is downloaded from the system for processing and analysis using both commercial and in-house software. This software allows for both the data and

the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.

Typical data and image processing steps may include:

- GPS Destripe – Determines the median of each transect and then subtracts that value from each datapoint in the transect. May be used to remove the striping effect seen within a survey caused by directional effects, drift, etc.

- GPS Base Interpolation – Sets the X & Y interval of the interpolated data and the track radius (area around each datapoint that is included in the interpolated result).

- Discard Overlaps - Intended to eliminate a track(s) that have been collected too close to one another. Without this, the results of the interpolation process can be distorted as it tries to accommodate very close points with potentially differing values.

Typical displays of the data used during processing and analysis:

- Greyscale – Presents the data in plan using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data

- XY Plot – Presents the data as a trace or graph line for each traverse. Each traverse is displaced down the image to produce a stacked profile effect. This type of image is useful as it shows the full range of individual anomalies.

Ground penetrating radar (GPR)

The ground penetrating radar (GPR) data will be collected using a cart-mounted shielded antenna with central frequency suitable for the types of targets being investigated. Lower frequency antennae are able to acquire data from deeper below the surface, whereas higher frequencies allow high resolution imaging of near-surface targets at the expense of deep penetration. The exact make and model of equipment varies.

The depth of penetration of GPR systems is determined by the central frequency of the antenna and the relative dielectric permittivity (RDP) of the material through which the GPR signal passes. In general, soils in floodplain settings may have a wide range of RDPs, although around 8 may be considered average, resulting in a maximum depth of penetration of approximately 2.5 m with the GPR signal having a velocity of approximately 0.1 m/ns.

The GPR beam is conical in shape, however, and whilst most of the energy is concentrated in the centre of the cone, the GPR signal illuminates a horizontal footprint, which becomes wider with increasing depth. At the maximum depth of the antenna, it becomes impossible to resolve any feature smaller than the horizontal footprint for the corresponding depth. The size of the footprint is dependent upon central frequency, and its size increases as the central frequency decreases.

The vertical resolution is similarly dependent upon the central frequency; for example, a 300 MHz antenna, features of the order of 0.05 m may be resolved vertically. Antennae with lower frequencies can therefore penetrate more deeply but are less resolute in both horizontal and vertical directions.

Choice of antenna frequency is guided largely by the anticipated depth to the target and the required resolution.

GPR data for detailed surveys are collected along traverses of varying length separated by 0.5 m with cross lines collected running perpendicular to these traverses at wider separations. The data sampling resolution is governed by the data logger and a minimum separation of 0.05 m between traces is collected for all surveys, in accordance with European Archaeologiae Consilium recommendations (Schmidt *et al.* 2015).

Post-Processing

The radar data collected during the detail survey are downloaded from the GPR system for processing and analysis using commercial software (GPR Slice). This software allows for both the data and the images to be processed to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.

Typical data and image processing steps may include:

- Gain – Amplifies GPR data based upon its position in the profile, which boosts the contrast between anomalies and background. A wobble correction is also applied during this step;
- Background Filter - is used to remove banding noises that are seen across the radargrams
- Bandpass – Removes GPR data lying outside a specified range, which removes high- and low-frequency noise.

Typical displays of the data used during processing and analysis:

- Timeslice – Presents the data as a series of successive plan views of the variation of reflector energy from the surface to the deepest recorded response. The variation in amplitude is represented using a greyscale with black indicating high amplitude and white indicating low amplitude responses.
- Radargram – Presents each radar profile in a vertical view with distance along the profile expressed along the x axis and depth along the y axis. The amplitude variation is expressed using a greyscale.

Appendix 2: Geophysical Interpretation

The interpretation methodology used by Wessex Archaeology separates the anomalies into four main categories: archaeological, modern, agricultural, and uncertain origin/geological.

The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided into three groups, implying a decreasing level of confidence:

- Archaeology – used when there is a clear geophysical response and anthropogenic pattern.
- Possible archaeology – used for features which give a response, but which form no discernible pattern or trend.

The modern category is used for anomalies that are presumed to be relatively modern in date:

- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin.
- Modern service – used for responses considered relating to cables and pipes; most are composed of ferrous/ceramic material although services made from non-magnetic material can sometimes be observed.

The agricultural category is used for the following:

- Former field boundaries – used for ditch sections that correspond to the position of boundaries marked on earlier mapping.
- Ridge and furrow – used for broad and diffuse linear anomalies that are considered to indicate areas of former ridge and furrow.
- Ploughing – used for well-defined narrow linear responses, usually aligned parallel to existing field boundaries.
- Drainage – used to define the course of ceramic field drains that are visible in the data as a series of repeating bipolar (black and white) responses.

The uncertain origin/geological category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:

- Increased magnetic response – used for areas dominated by indistinct anomalies which may have some archaeological potential.
- Trend – used for low amplitude or indistinct linear anomalies.
- Superficial geology – used for diffuse edged spreads considered to relate to shallow geological deposits. They can be distinguished as areas of positive, negative, or broad bipolar (positive and negative) anomalies.

Appendix 3: OASIS form

Project Details:

Project name		North Lincolnshire Green Energy Park, Scunthorpe, North Lincolnshire			
Type of project		Field evaluation			
Project description		The geophysical survey has demonstrated the presence of a number of anomalies of potential archaeological interest. These are predominantly located in Area 4. A substantial portion of evidence associated with ridge and furrow cultivation has been revealed by the surveys. Two large enclosures have been supposed in the south-eastern portion of Area 4. Also in Area 4, numerous linear and curvilinear anomalies have been identified spanning almost the entire survey area. These could evidence settlement activity, although a natural origin cannot be ruled out. Numerous weakly positive discrete anomalies are tentatively considered evidence of possible extraction or refuse pits. However, this interpretation is not confident as these anomalies could equally be natural in origin. A number of further anomalies thought to indicate natural variation in the underlying geological deposits have been identified throughout Area 3 and 4. In Area 3 anomalies thought to indicate localised variation in the magnetic susceptibility of the probable superficial deposits have been identified. In Area 4, evidence of underlying natural fissures has been widely identified in the form of weakly positive interconnected sinuous anomalies. The remaining anomalies are interpreted as modern in origin and predominantly associated with recent agricultural activity. Further, highly ferrous anomalies associated with an underlying service as well as extant pylons have also been identified in Area 4 and 5 respectively.			
Project dates		**Start:** 27-10-2021		**End:** 04-02-2022	
Previous work		Yes			
Future work		Not known			
Project Code:	254050	**HER event no.**	N/A	**OASIS form ID:**	wessexar1-506729
		NMR no.	N/A		
		SM no.	N/A		
Planning Application Ref.					
Site Status		None			
Land use		Cultivated land 3 – operations to a depth greater than 0.25 m			

Project Location:

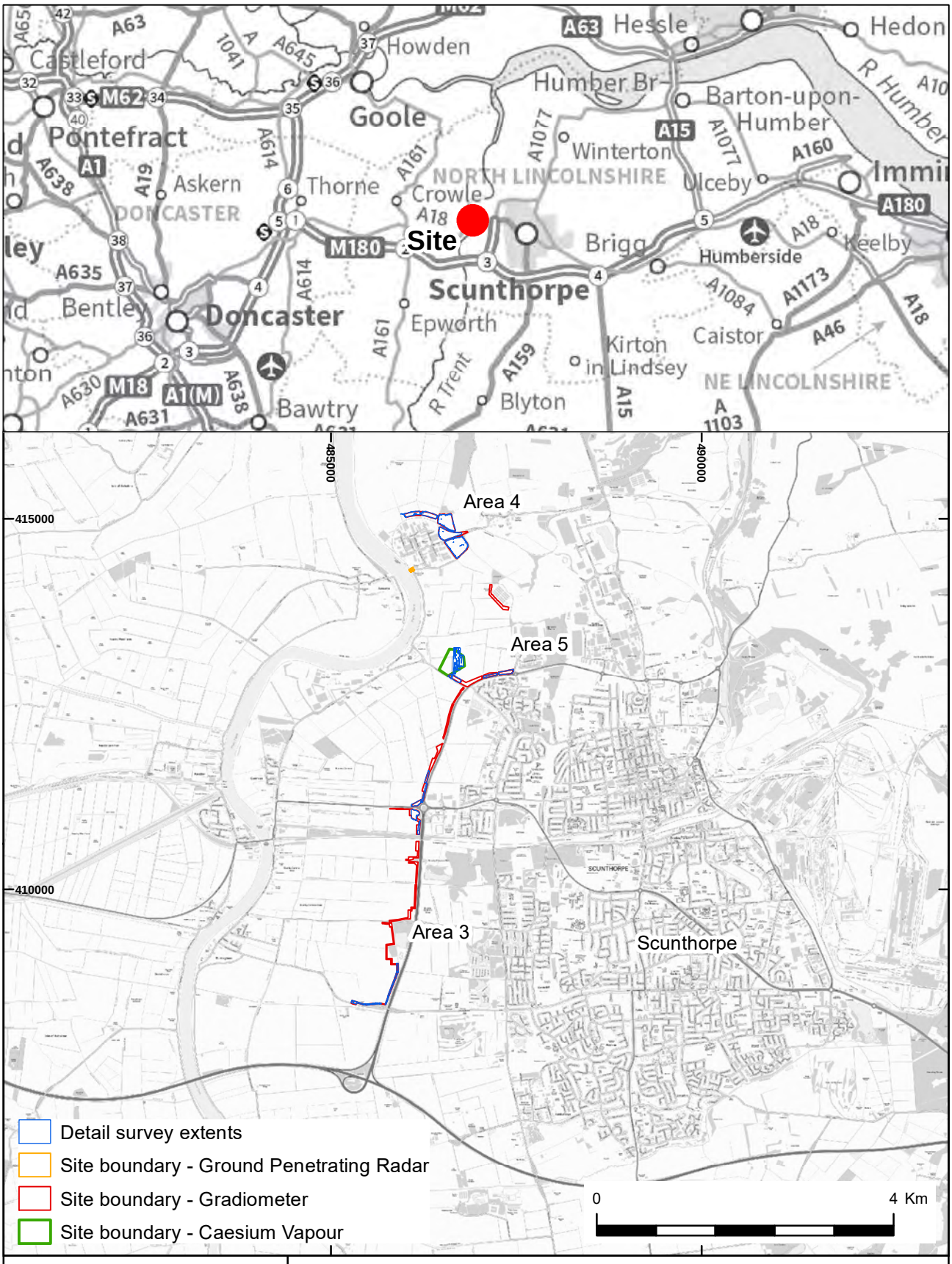
Site Address	Land west and north-west of Scunthorpe / M181 / A1077			**Postcode**	DN15 8SG
County	Lincolnshire	**District**		**Parish**	
Study Area		**Height OD**	2 – 11 m	**NGR**	485710 408440 486650 414600 486820 412745

Project Creators:

Name of Organisation	Wessex Archaeology		
Project brief originator	ERM	**Project design originator**	Wessex Archaeology
Project Manager	Chris Breeden	**Project Supervisor**	Amy Dunn
Sponsor or funding body	ERM	**Type of Sponsor**	Client

Project Archive and Bibliography:

Physical archive	N/A	**Digital Archive**	Geophysical survey and report	**Paper Archive**	N/A
Report title	North Lincolnshire Green Energy Park, Scunthorpe, North Lincolnshire Detailed Gradiometer, Caesium Vapour Survey and Ground Penetrating Radar Report			**Date**	2022
Author	Wessex Archaeology	**Description**	Unpublished report	**Report ref.**	254050.03



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Site location and survey extents

Figure 1

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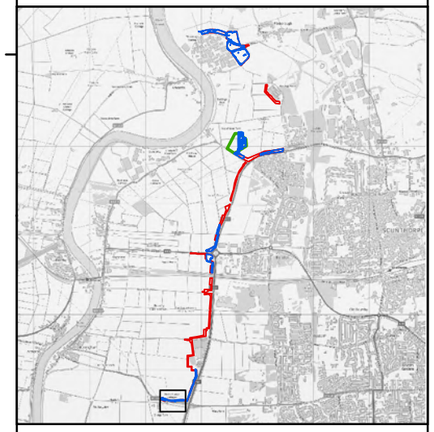
485400
485500
485600
485700
408600
408500
408400
408300



Detail survey extents
Site boundary - Gradiometer
Site boundary - Caesium Vapour

-2 nT
3 nT

0
50 m

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Revision Number:	0
Scale:	1:1,500 at A3
Illustrator:	RP
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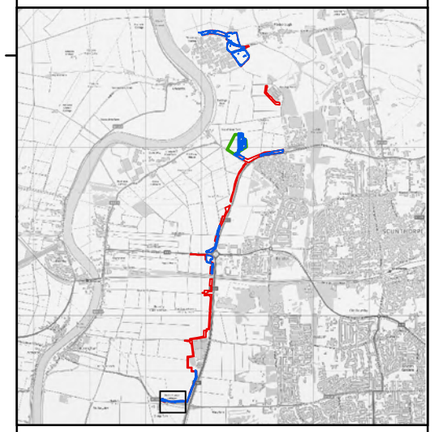
Detailed gradiometer survey results: greyscale plot (Area 3 South)

Figure 2

485300
485400
485500
485600
485700
408600
408500
408400
408300
3000



Possible archaeology
Increased magnetic response
Superficial geology
Modern service
Ferrous
Ridge and furrow
Trend
Ploughing
Drainage
Detail survey extents
Site boundary - Gradiometer
Site boundary - Caesium Vapour

0 50 m

Date:	11/03/2022
Revision Number:	0
Scale:	1:1,500 at A3
Illustrator:	RP
Path:	K:\Geophysics_Terrestrial\
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Detailed gradiometer survey results: interpretation (Area 3 South)

Figure 3

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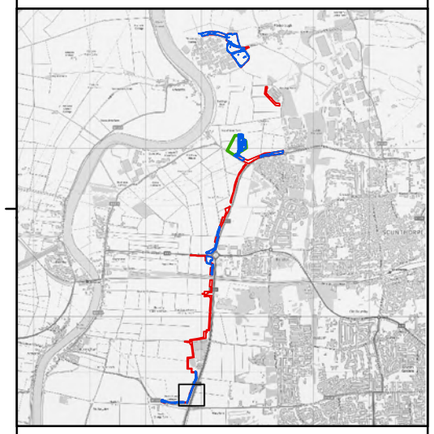
485700
485800
485900
486000
408700
408600
408500
408400



Detail survey extents
Site boundary - Gradiometer
Site boundary - Caesium Vapour

-2 nT
3 nT

0
50 m

Coordinate system: OSGB36

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Revision Number:	0
Scale:	1:1,500 at A3
Illustrator:	RP
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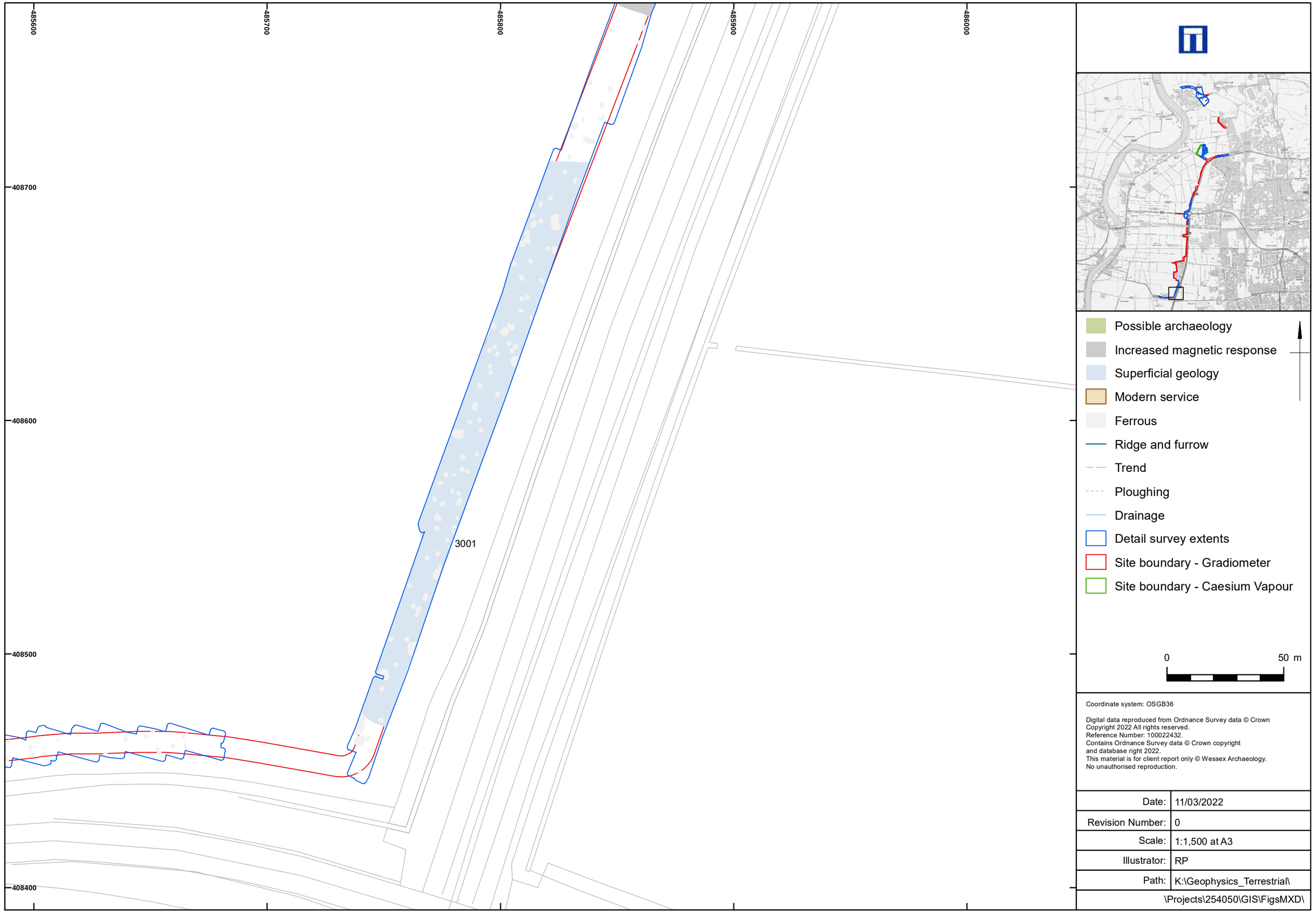
Detailed gradiometer survey results: greyscale plot (Area 3 South)

Figure 4



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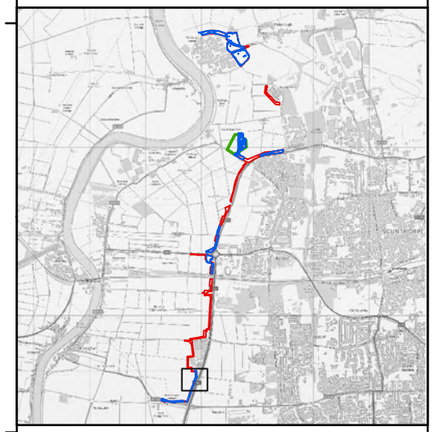
Detailed gradiometer survey results: interpretation (Area 3 South)

Figure 5

485700
485800
485900
486000
486100
409000
408900
408800
408700



Detail survey extents
Site boundary - Gradiometer
Site boundary - Caesium Vapour

-2 nT
3 nT

0
50 m

Date:	11/03/2022
Revision Number:	0
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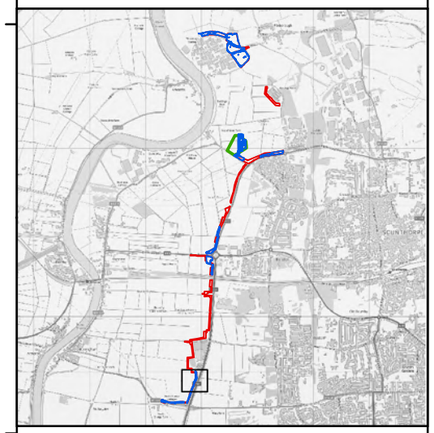
Detailed gradiometer survey results: greyscale plot (Area 3 South)

Figure 6

485700
485800
485900
486000
486100
409000
408900
408800
408700
3002



Possible archaeology
Increased magnetic response
Superficial geology
Modern service
Ferrous
Ridge and furrow
Trend
Ploughing
Drainage
Detail survey extents
Site boundary - Gradiometer
Site boundary - Caesium Vapour

0 50 m

Coordinate system: OSGB36

Date:	11/03/2022
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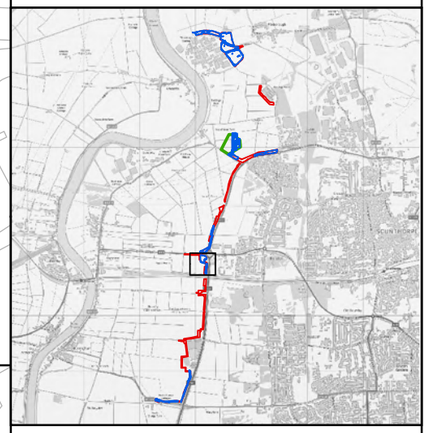
Detailed gradiometer survey results: interpretation (Area 3 South)

Figure 7



Detail survey extents

Site boundary - Gradiometer

Site boundary - Caesium Vapour

-2 nT

3 nT

0

50 m

Coordinate system: OSGB36

Date:	11/03/2022
Revision Number:	0
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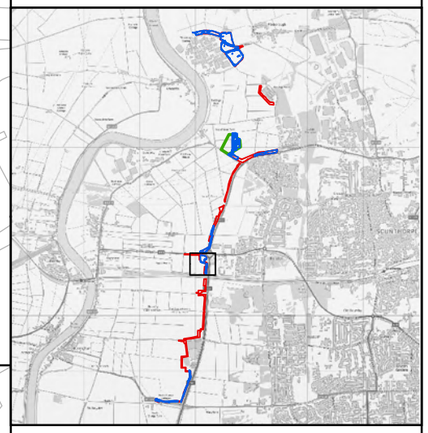
Detailed gradiometer survey results: greyscale plot (Area 3 Centre - south)

Figure 8



Possible archaeology
Increased magnetic response
Superficial geology
Modern service
Ferrous
Ridge and furrow
Trend
Ploughing
Drainage
Detail survey extents
Site boundary - Gradiometer
Site boundary - Caesium Vapour

0 50 m

Date:	11/03/2022
Revision Number:	0
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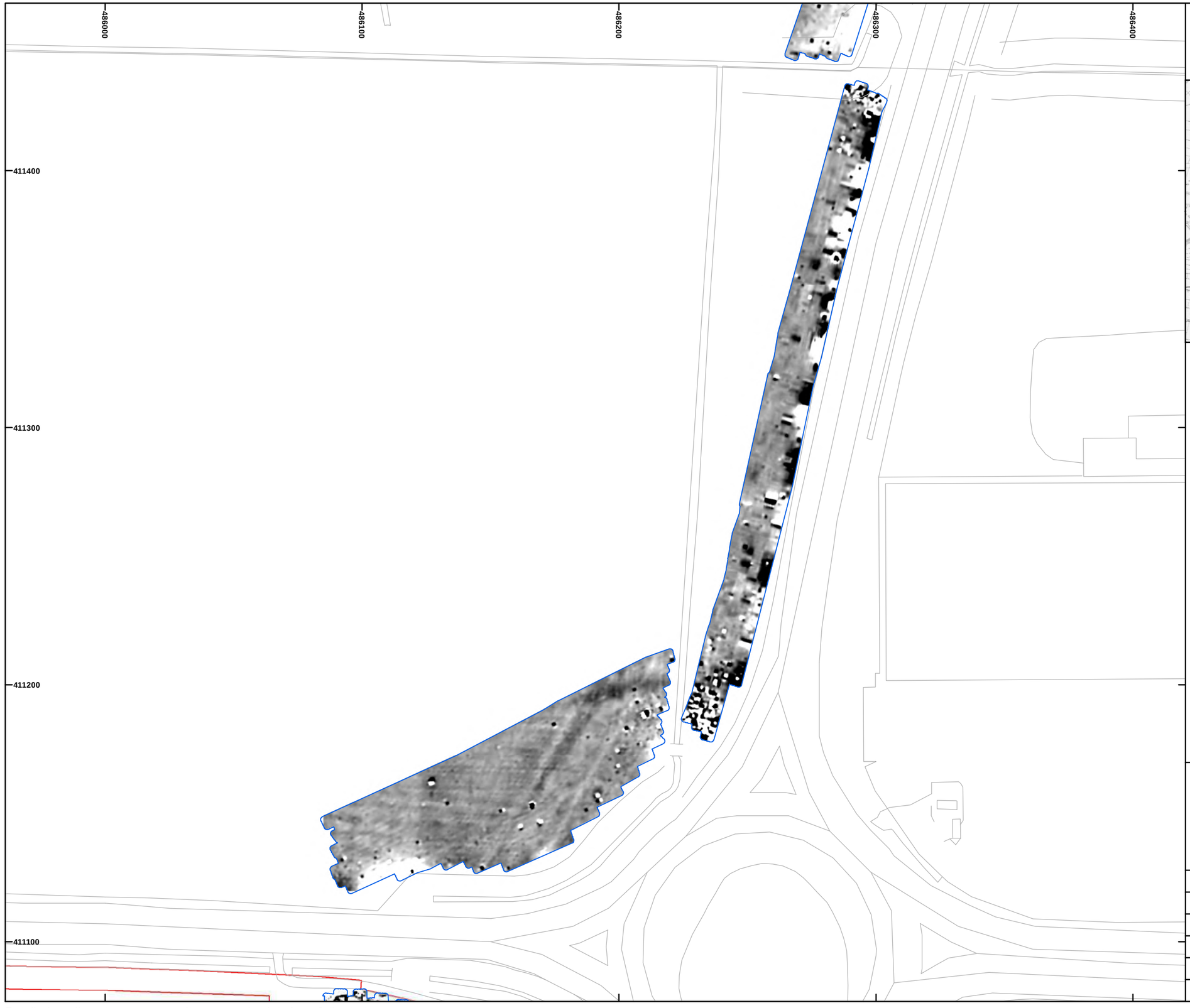
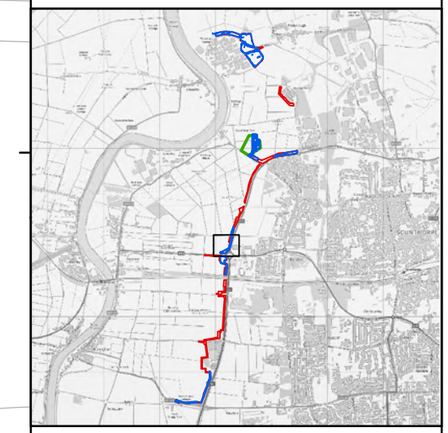
Detailed gradiometer survey results: interpretation (Area 3 Centre - south)

Figure 9





Detail survey extents

Site boundary - Gradiometer

Site boundary - Caesium Vapour

-2 nT

3 nT

0

50 m

Coordinate system: OSGB36

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Revision Number:	0
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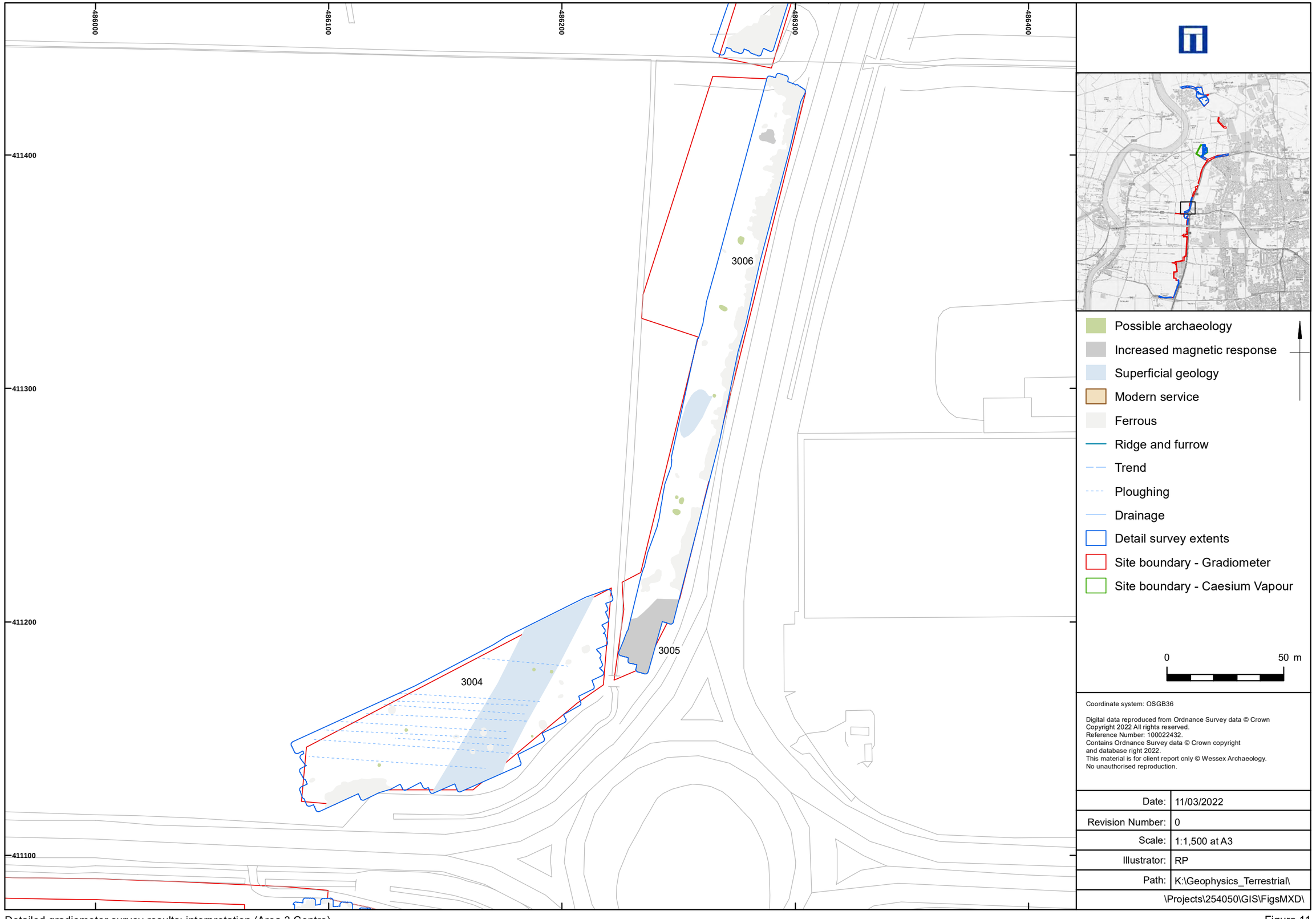
Detailed gradiometer survey results: greyscale plot (Area 3 Centre)

Figure 10



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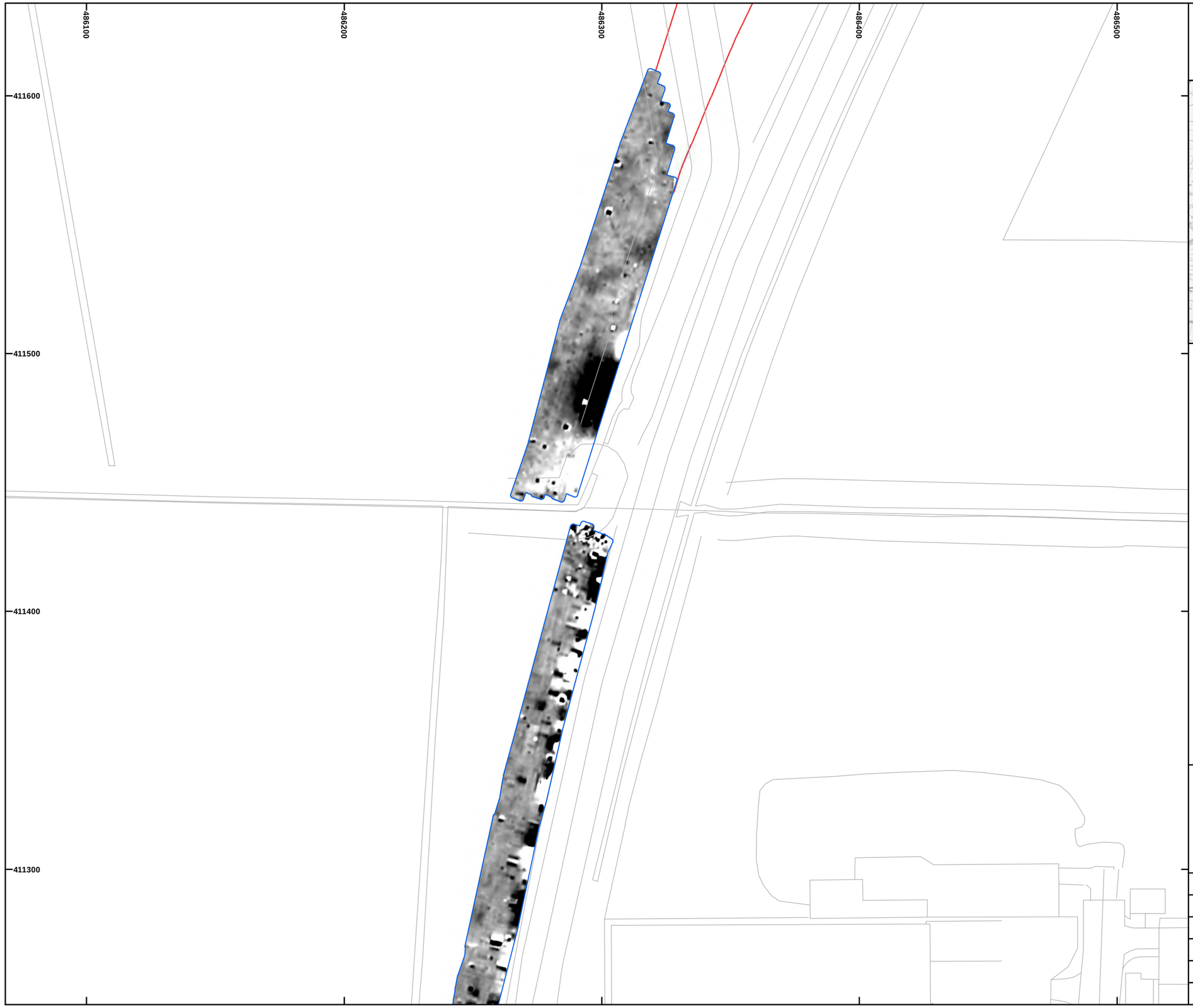
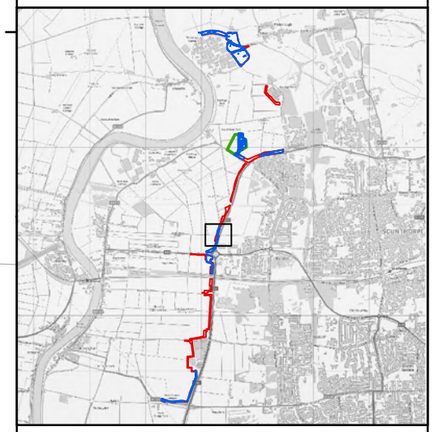
Detailed gradiometer survey results: interpretation (Area 3 Centre)

Figure 11





Detail survey extents
Site boundary - Gradiometer
Site boundary - Caesium Vapour

-2 nT 3 nT

0 50 m

Date:	11/03/2022
Revision Number:	0
Scale:	1:1,500 at A3
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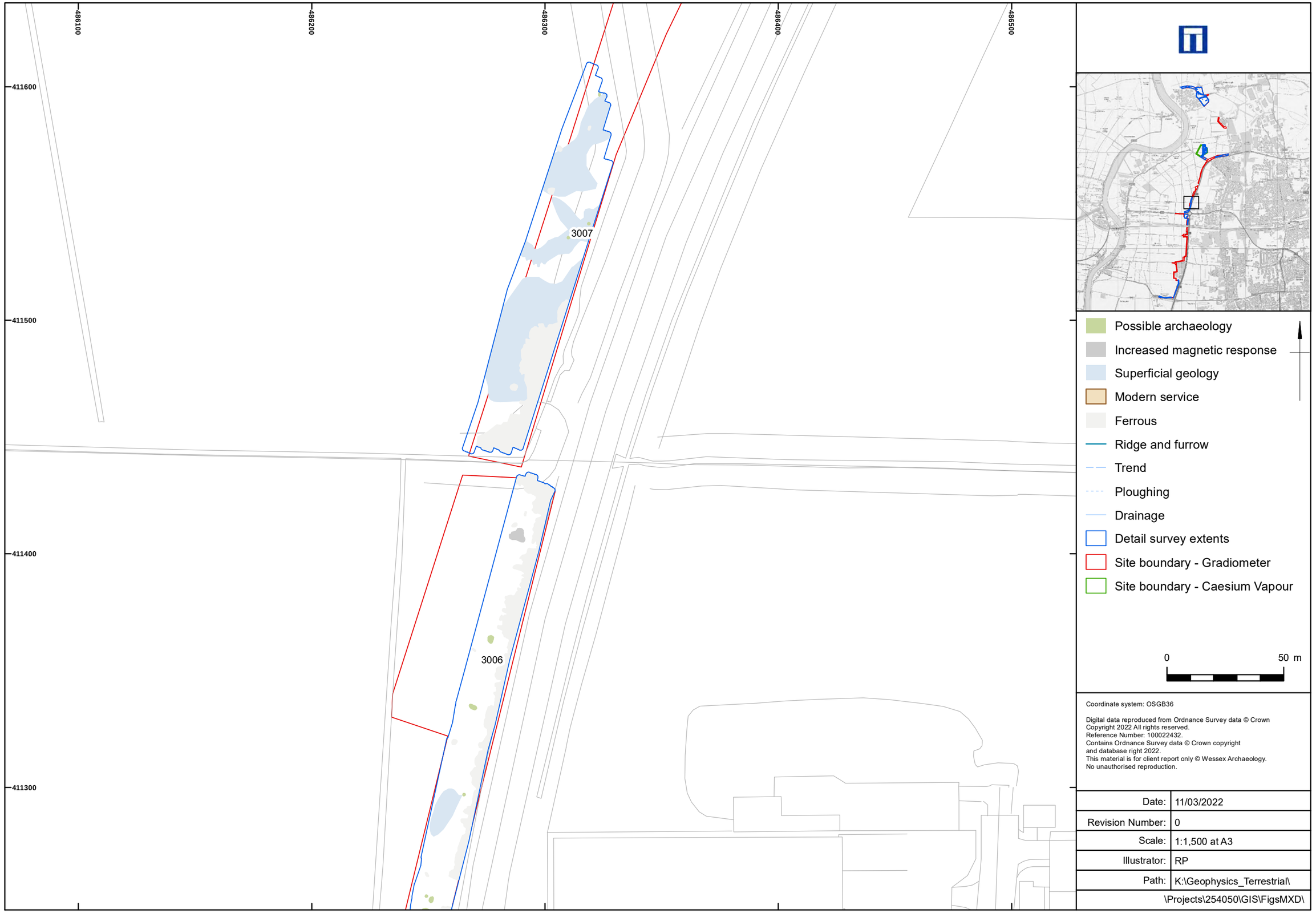
Detailed gradiometer survey results: greyscale plot (Area 3 Centre - north)

Figure 12



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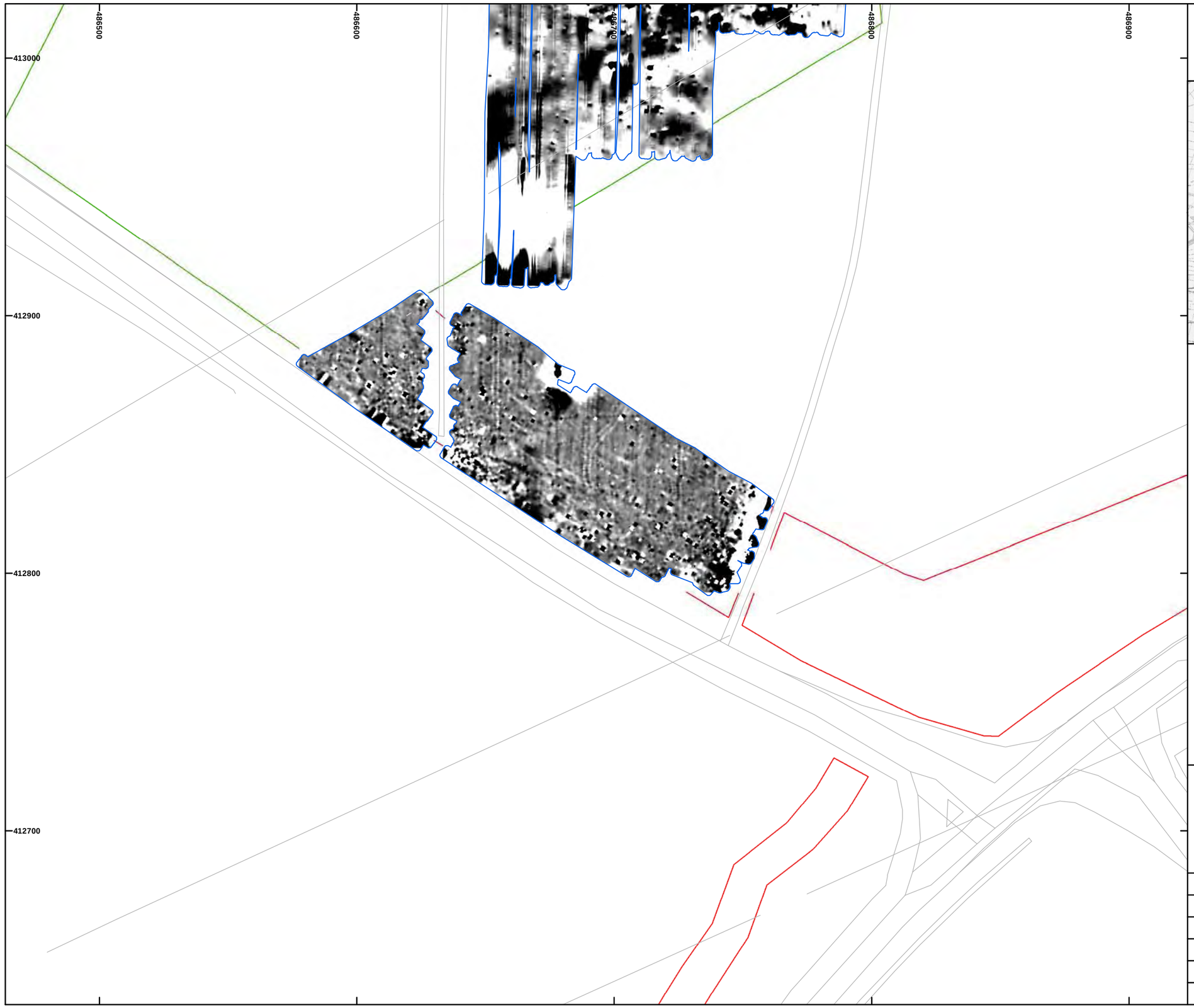
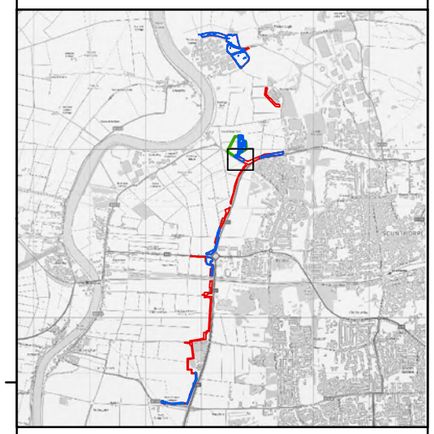
Detailed gradiometer survey results: interpretation (Area 3 Centre - north))

Figure 13





Detail survey extents

Site boundary - Gradiometer

Site boundary - Caesium Vapour

-2 nT

3 nT

0

50 m

Coordinate system: OSGB36

Date:	11/03/2022
Revision Number:	0
Scale:	1:1,500 at A3
Illustrator:	RP
Path:	K:\Geophysics_Terrestrial\
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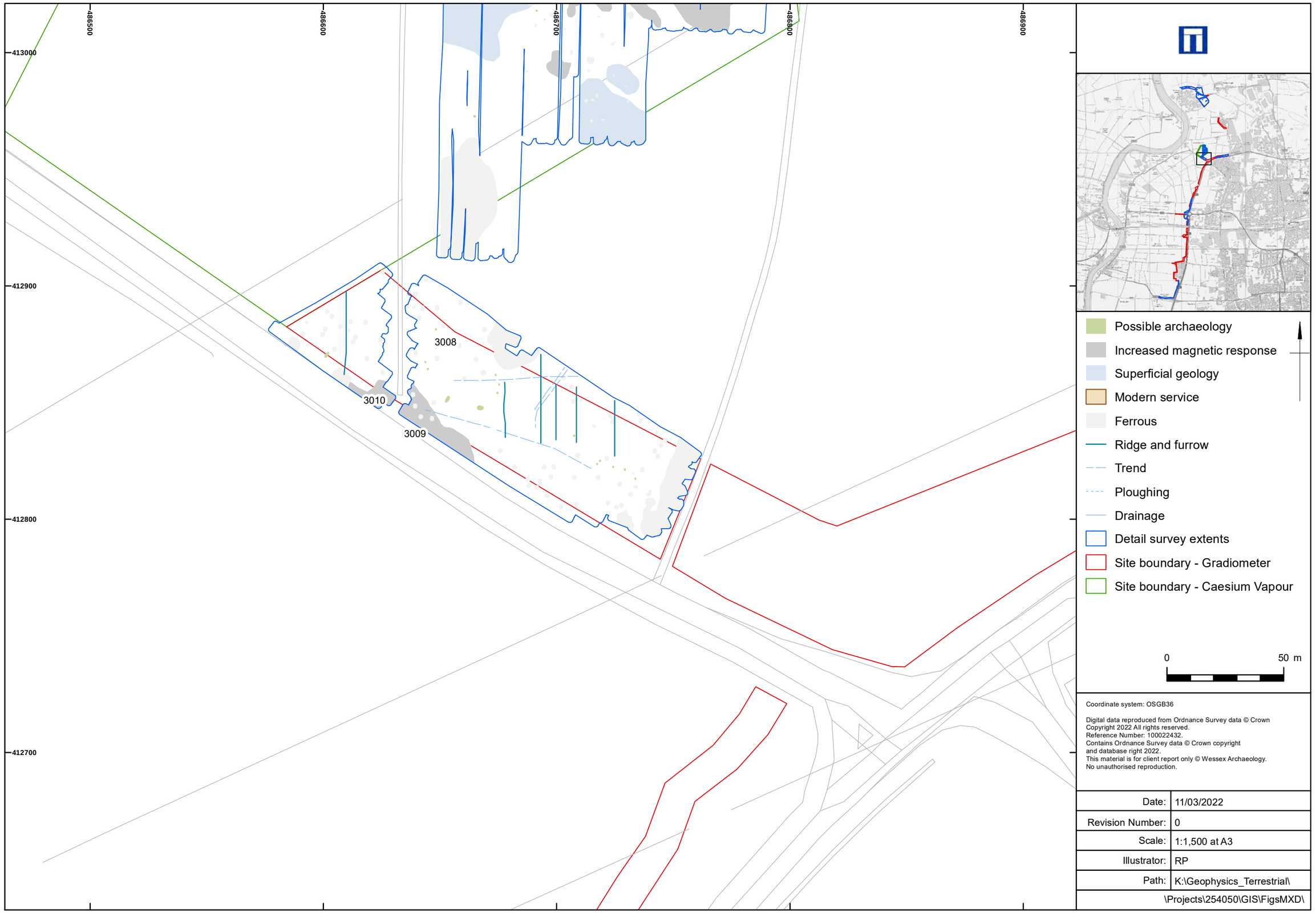
Caesium vapour survey results: greyscale plot (Area 3 North)

Figure 14



- Possible archaeology
- Increased magnetic response
- Superficial geology
- Modern service
- Ferrous
- Ridge and furrow
- Trend
- Ploughing
- Drainage
- Detail survey extents
- Site boundary - Gradiometer
- Site boundary - Caesium Vapour

0 50 m

Date:	11/03/2022
Revision Number:	0
Scale:	1:1,500 at A3
Illustrator:	RP
Path:	K:\Geophysics_Terrestrial\
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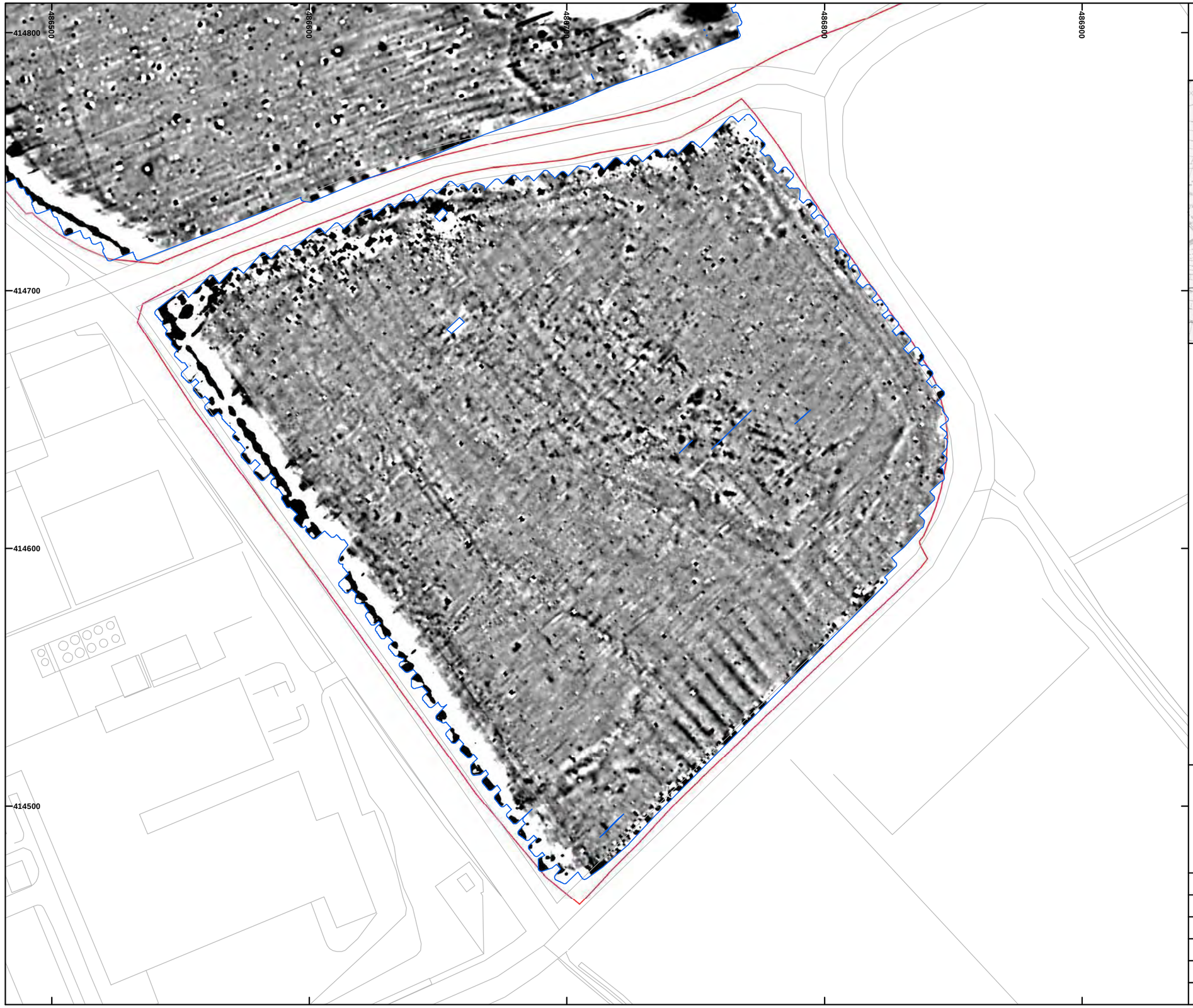
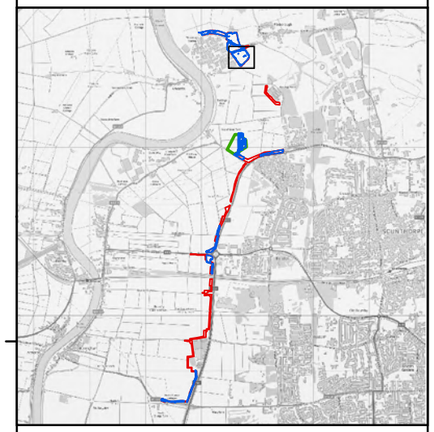
Caesium vapour survey results: interpretation (Area 3 North)

Figure 15





Detail survey extents
Site boundary - Gradiometer
Site boundary - Caesium Vapour

-2 nT
3 nT

0
50 m

Coordinate system: OSGB36

Date:	11/03/2022
Revision Number:	0
Scale:	1:1,500 at A3
Illustrator:	RP
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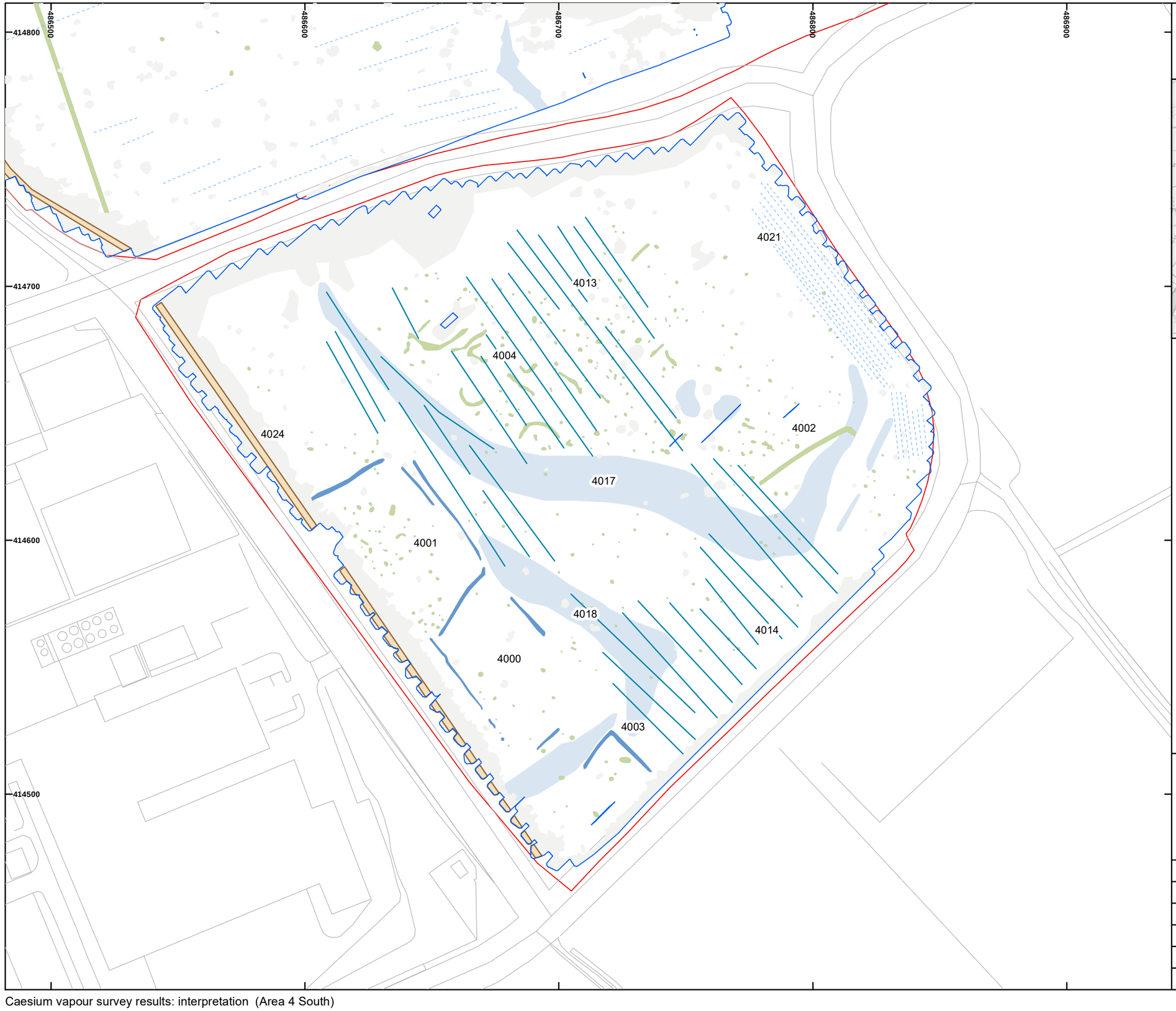
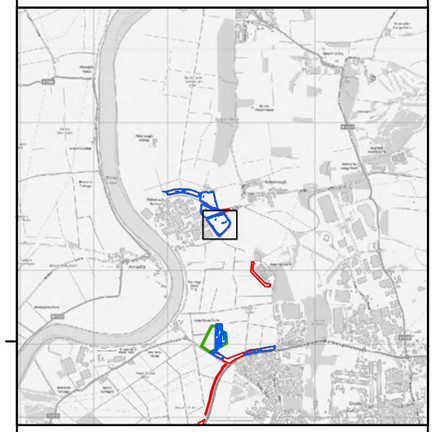
Detailed gradiometer survey results: greyscale plot (Area 4 South)

Figure 16





- Archaeology
- Possible archaeology
- Increased magnetic response
- Superficial geology
- Modern service
- Ferrous
- Ridge and furrow
- Trend
- Ploughing
- Drainage
- Detail survey extents
- Site boundary - Gradiometer
- Site boundary - Caesium Vapour

0 50 m

Date:	17/05/2022
Revision Number:	0
Scale:	1:1,500 at A3
Illustrator:	RP
Path:	K:\Geophysics_Terrestrial\
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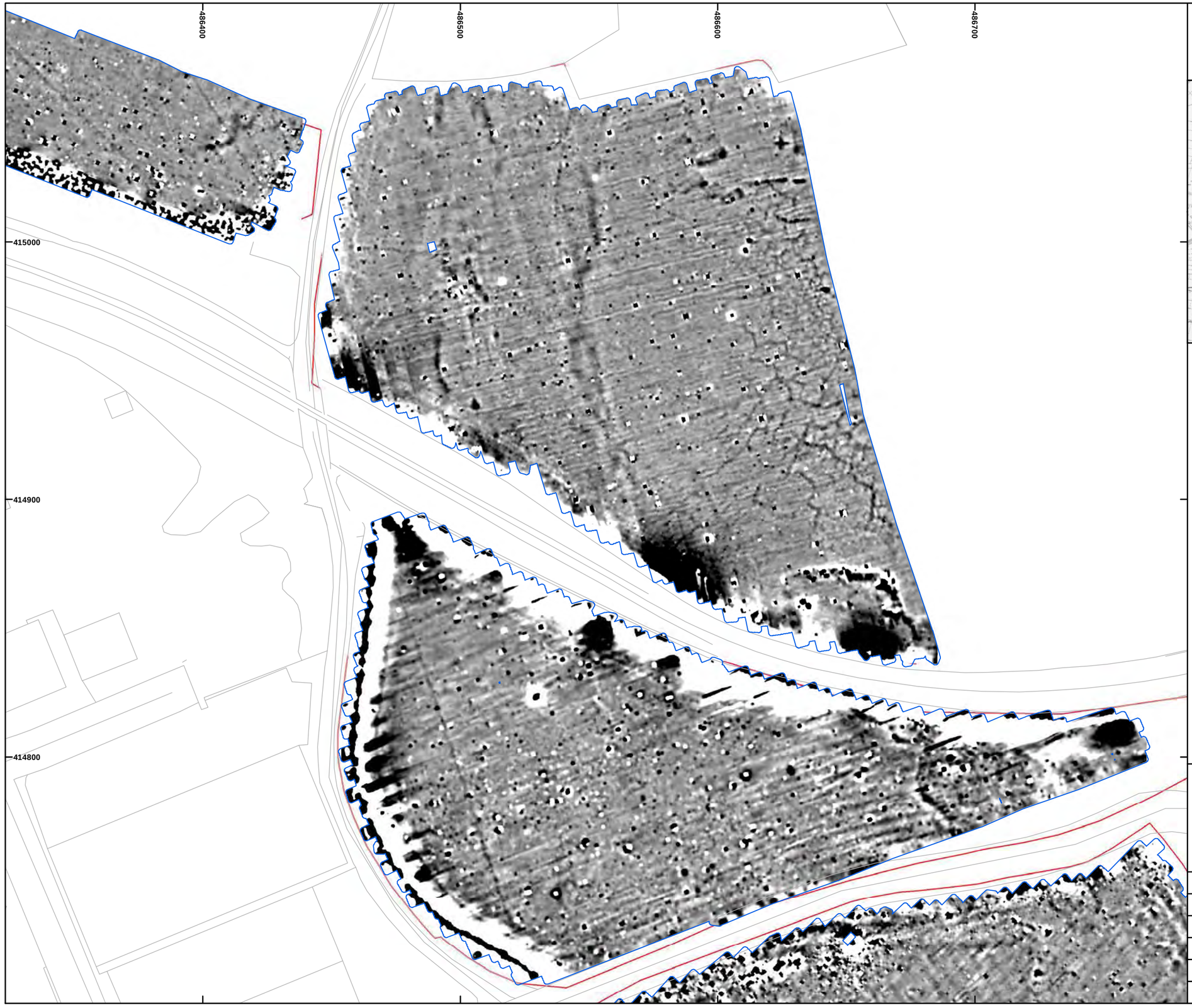
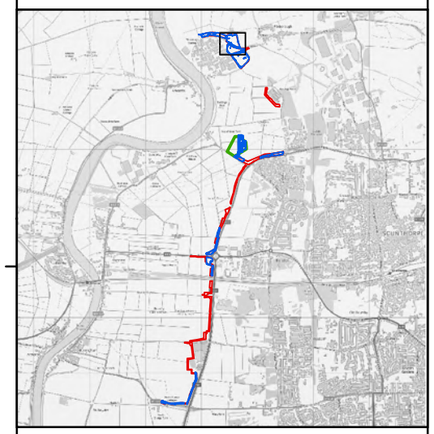
Caesium vapour survey results: interpretation (Area 4 South)

Figure 17





Detail survey extents
Site boundary - Gradiometer
Site boundary - Caesium Vapour

-2 nT
3 nT

0
50 m

Date:	11/03/2022
Revision Number:	0
Scale:	1:1,500 at A3
Illustrator:	RP
Path:	K:\Geophysics_Terrestrial\
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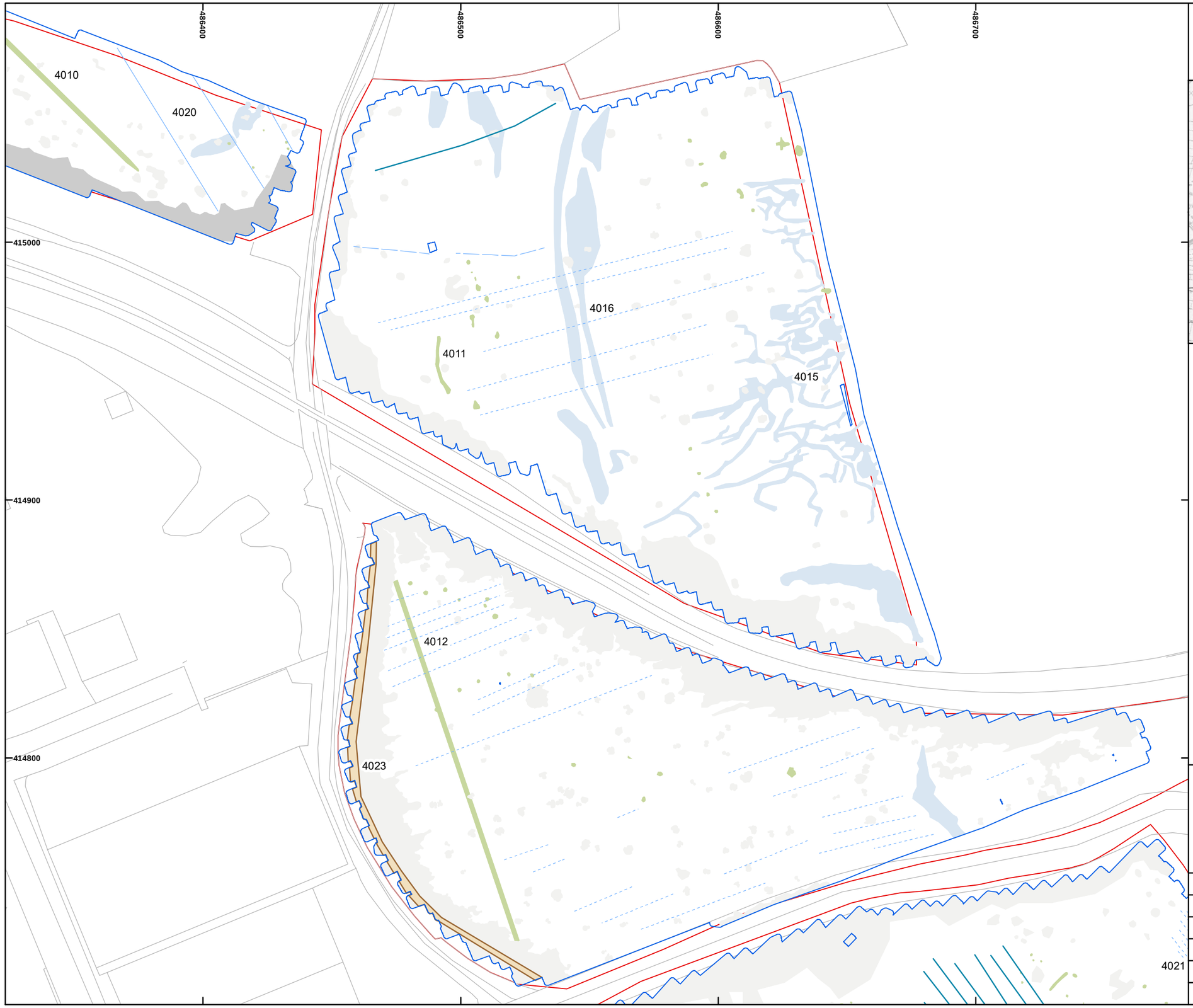
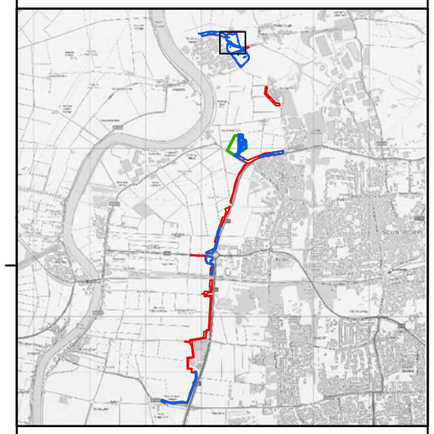
Detailed gradiometer survey results: greyscale plot (Area 4 North-east)

Figure 18





- Possible archaeology
- Increased magnetic response
- Superficial geology
- Modern service
- Ferrous
- Ridge and furrow
- Trend
- Ploughing
- Drainage
- Detail survey extents
- Site boundary - Gradiometer
- Site boundary - Caesium Vapour

0 50 m

Coordinate system: OSGB36

Date:	11/03/2022
Revision Number:	0
Scale:	1:1,500 at A3
Illustrator:	RP
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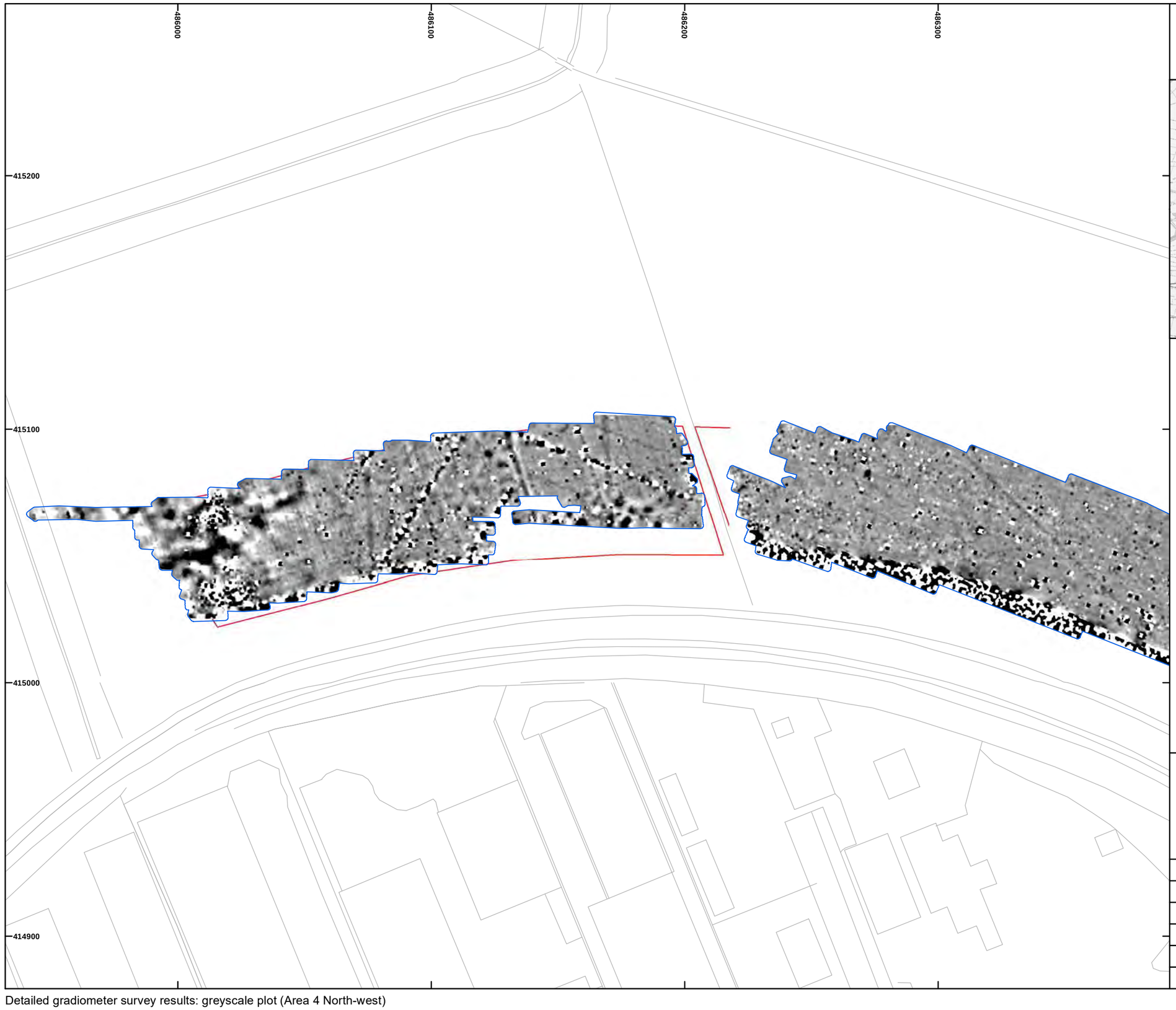
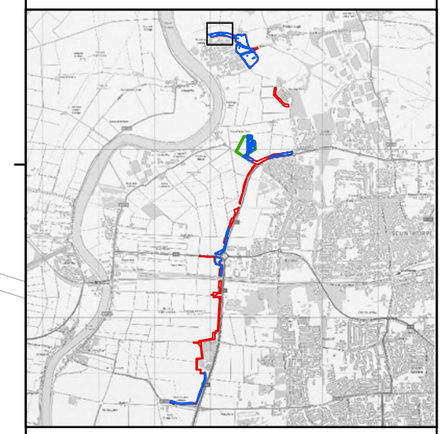
Caesium vapour survey results: interpretation (Area 4 North-east)

Figure 19





Detail survey extents

Site boundary - Gradiometer

Site boundary - Caesium Vapour

-2 nT 3 nT

0 50 m

Coordinate system: OSGB36

Date:	11/03/2022
Revision Number:	0
Scale:	1:1,500 at A3
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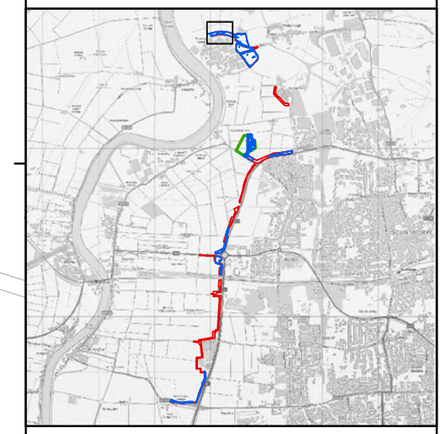
Detailed gradiometer survey results: greyscale plot (Area 4 North-west)

Figure 20



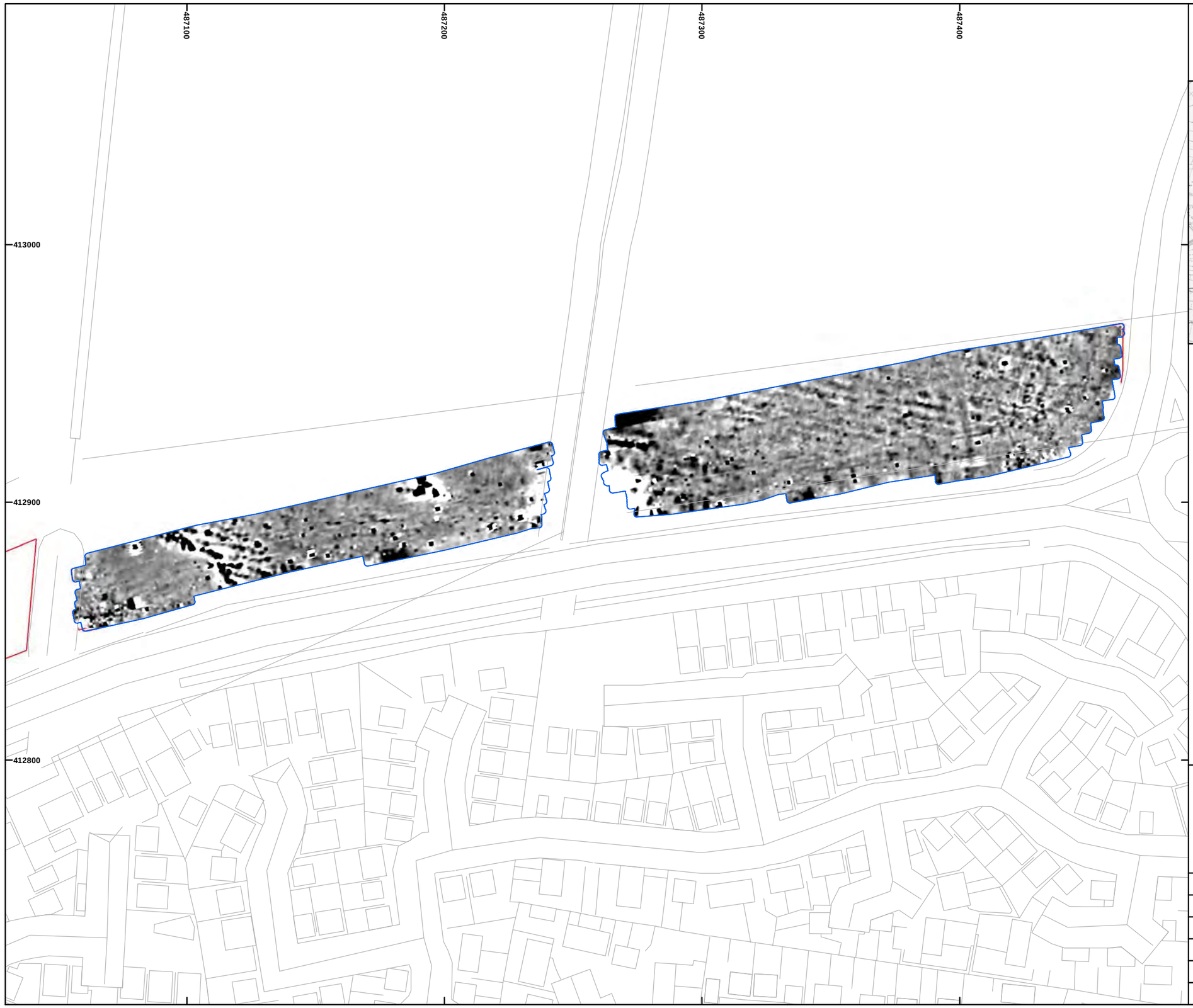
- Possible archaeology
- Increased magnetic response
- Superficial geology
- Modern service
- Ferrous
- Ridge and furrow
- Trend
- Ploughing
- Drainage
- Detail survey extents
- Site boundary - Gradiometer
- Site boundary - Caesium Vapour

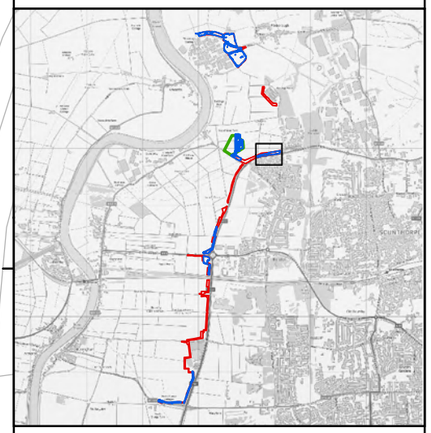
0 50 m

Date:	11/03/2022
Revision Number:	0
Scale:	1:1,500 at A3
Illustrator:	RP
Path:	K:\Geophysics_Terrestrial\
	\Projects\254050\GIS\FigsMXD\

Caesium vapour survey results: interpretation (Area 4 North-west)

Figure 21





Detail survey extents
Site boundary - Gradiometer
Site boundary - Caesium Vapour

-2 nT 3 nT

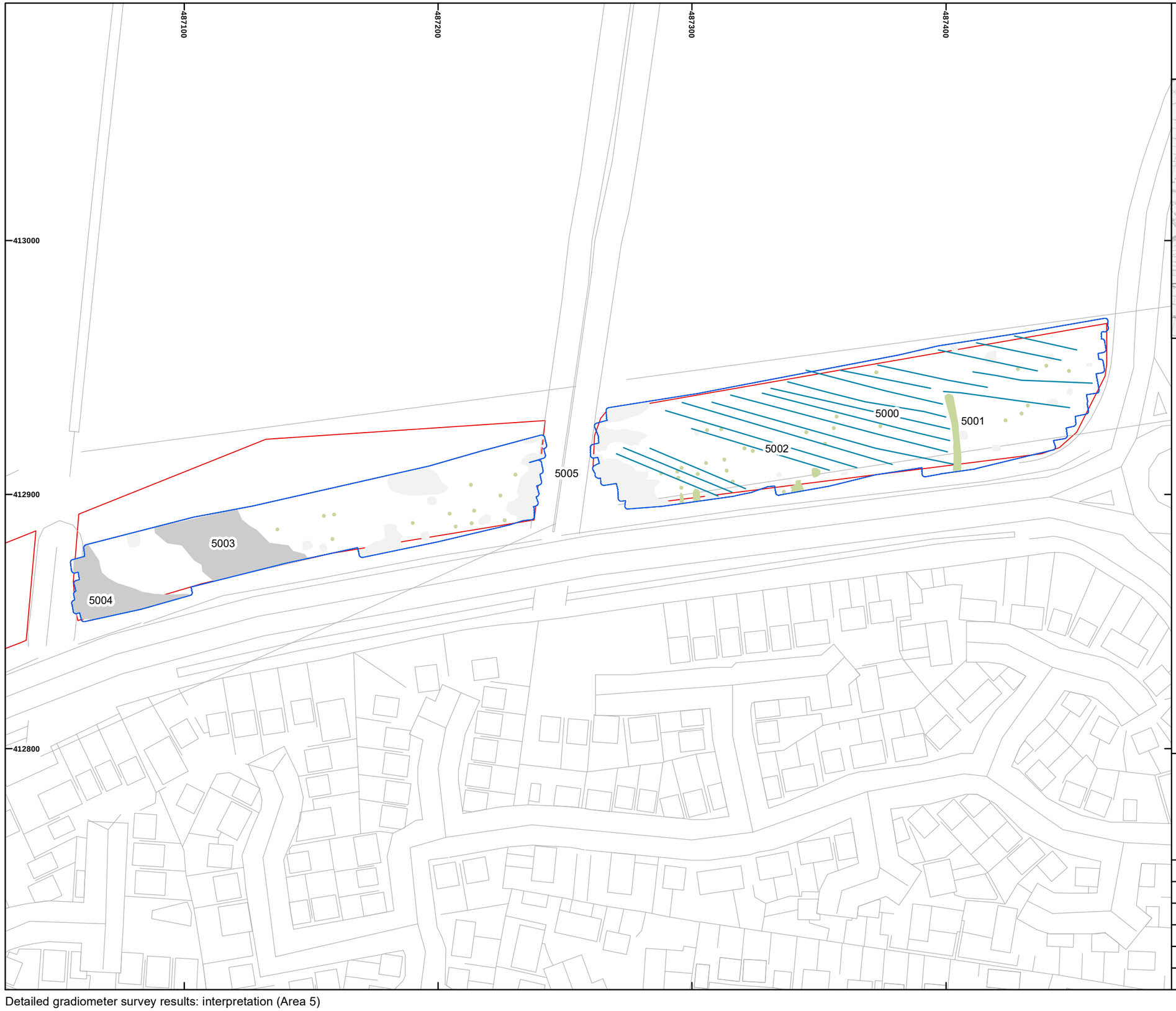
0 50 m

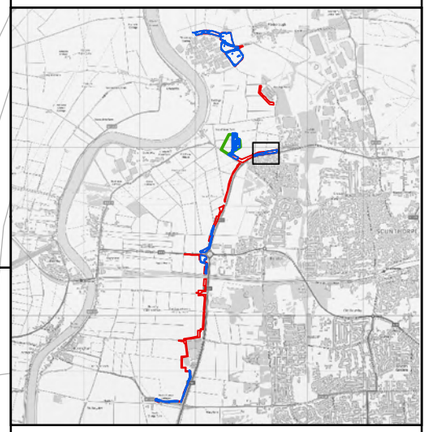
Coordinate system: OSGB36

Date:	11/03/2022
Revision Number:	0
Scale:	1:1,500 at A3
Illustrator:	RP
Path:	K:\Geophysics_Terrestrial\
	\Projects\254050\GIS\FigsMXD\

Detailed gradiometer survey results: greyscale plot (Area 5)

Figure 22





Possible archaeology
Increased magnetic response
Superficial geology
Modern service
Ferrous
Ridge and furrow
Trend
Ploughing
Drainage
Detail survey extents
Site boundary - Gradiometer
Site boundary - Caesium Vapour

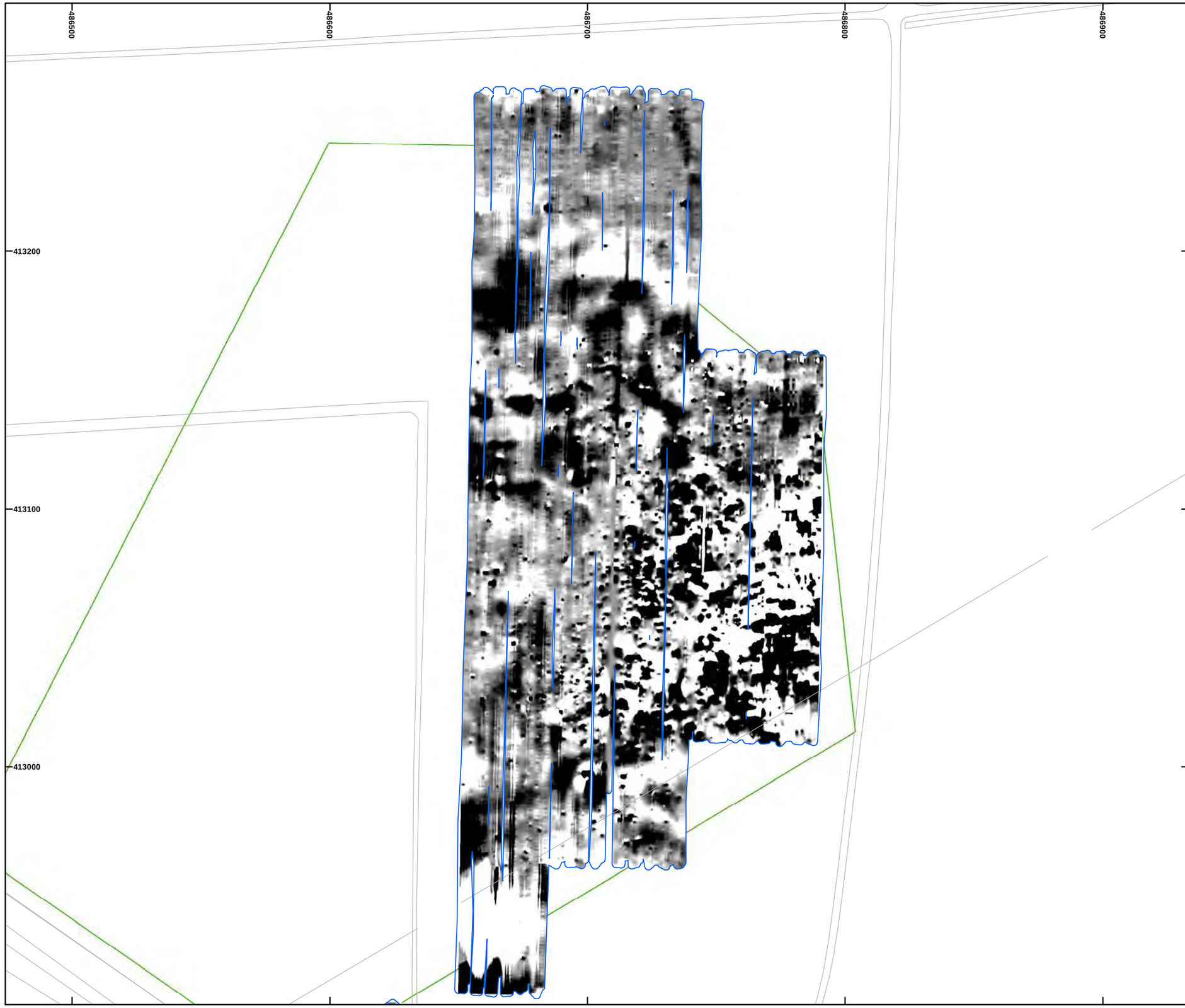
0 50 m

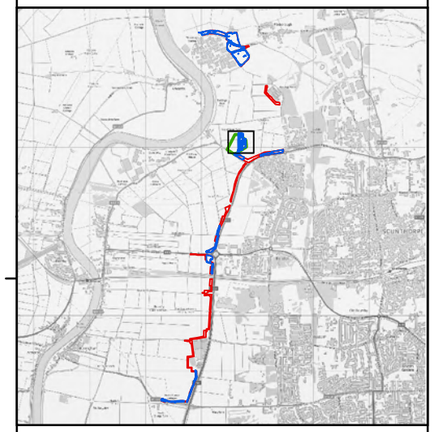
Coordinate system: OSGB36

Date:	11/03/2022
Revision Number:	0
Scale:	1:1,500 at A3
Illustrator:	RP
Path:	K:\Geophysics_Terrestrial\
	\Projects\254050\GIS\FigsMXD\

Detailed gradiometer survey results: interpretation (Area 5)

Figure 23





Detail survey extents

Site boundary - Gradiometer

Site boundary - Caesium Vapour

-2 nT 3 nT

0 50 m

Coordinate system: OSGB36

Date:	11/03/2022
Revision Number:	0
Scale:	1:1,500 at A3
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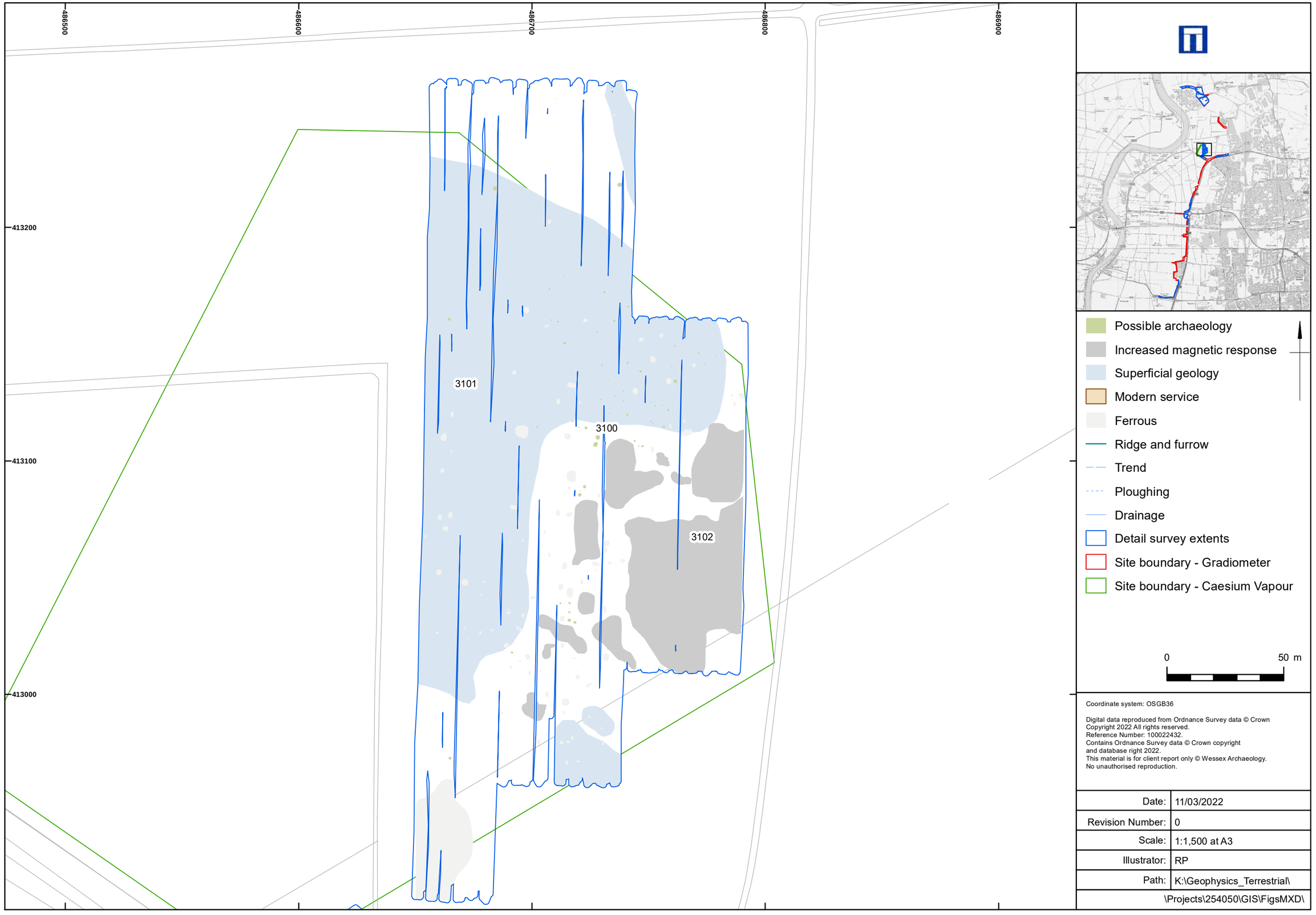
Caesium vapour survey results: greyscale plot (Area 3)

Figure 24



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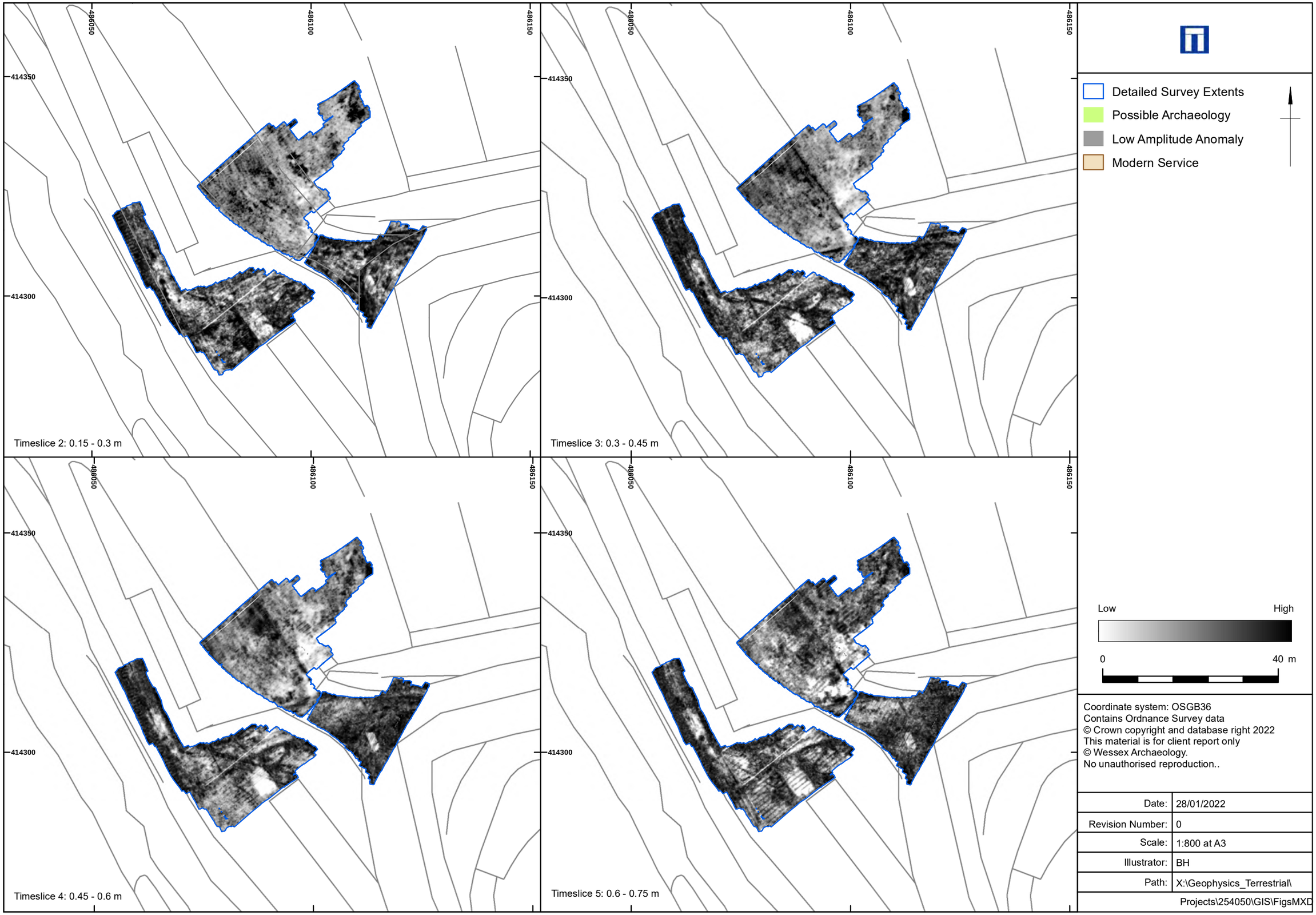
Caesium vapour survey results: interpretation (Area 3)

Figure 25

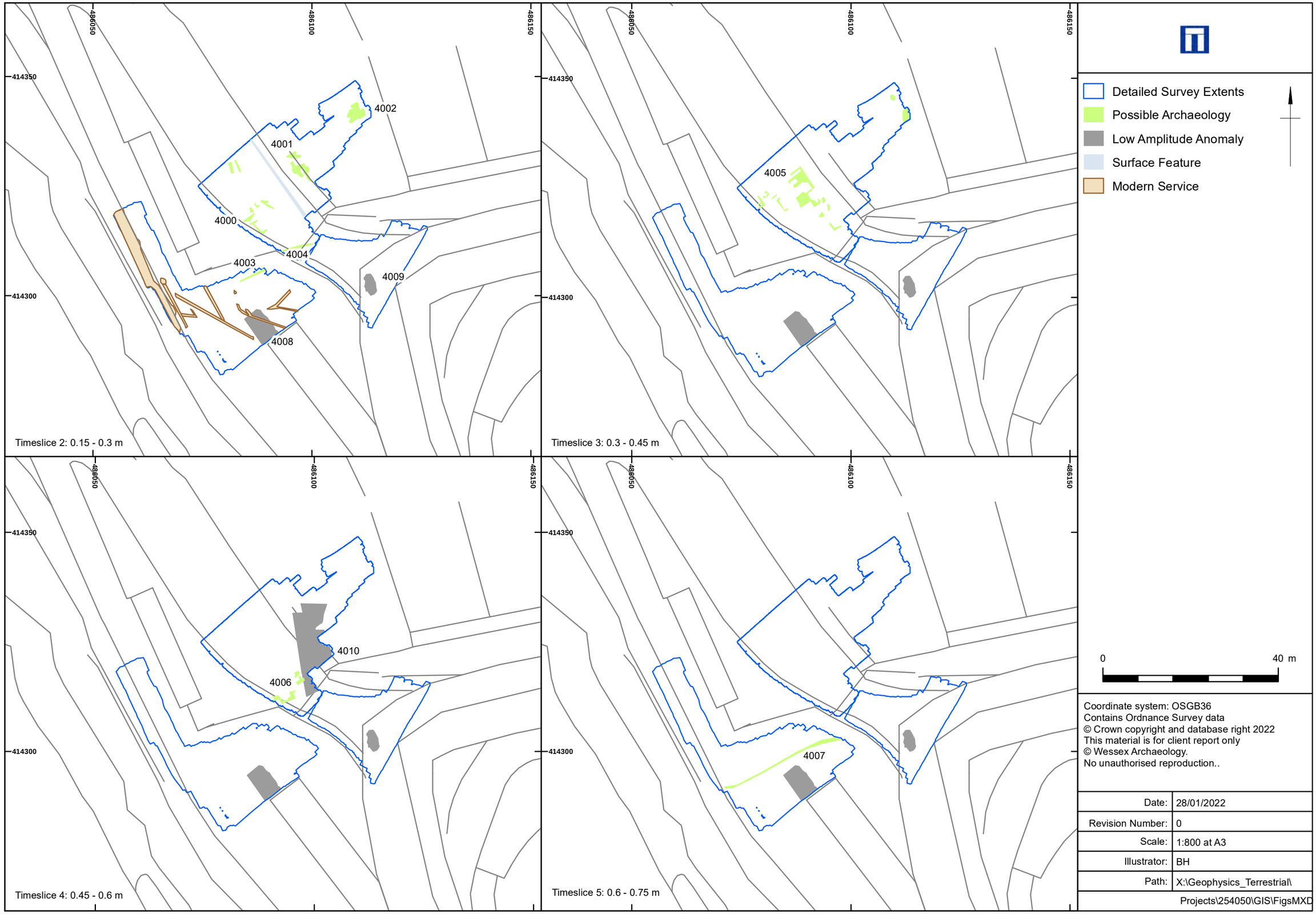


Coordinate system: OSGB36
Contains Ordnance Survey data

Date:	28/01/2022
Revision Number:	0
Scale:	1:800 at A3
Illustrator:	BH
Path:	X:\Geophysics_Terrestrial\
	Projects\254050\GIS\FigsMXD

Ground penetrating radar survey results: greyscale plot

Figure 26



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Revision Number:	0
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Illustrator:	BH
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Ground penetrating radar survey results: interpretation

Figure 27

Coordinate system: OSGB36
Contains Ordnance Survey data
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Date:	28/01/2022
Revision Number:	0
Scale:	1:300 at A3
Illustrator:	BH
Path:	X:\Geophysics_Terrestrial\
	Projects\254050\GIS\FigsMXD

Ground penetrating radar survey results:overall interpretation

Figure 28

Wessex Archaeology Ltd registered office Portway House, Old Sarum Park, Salisbury, Wiltshire SP4 6EB
Tel: 01722 326867 Fax: 01722 337562 info@wessexarch.co.uk [redacted]

FS 606559

APPENDIX E GEOARCHAEOLOGICAL BOREHOLE AND ERT SURVEY WSI

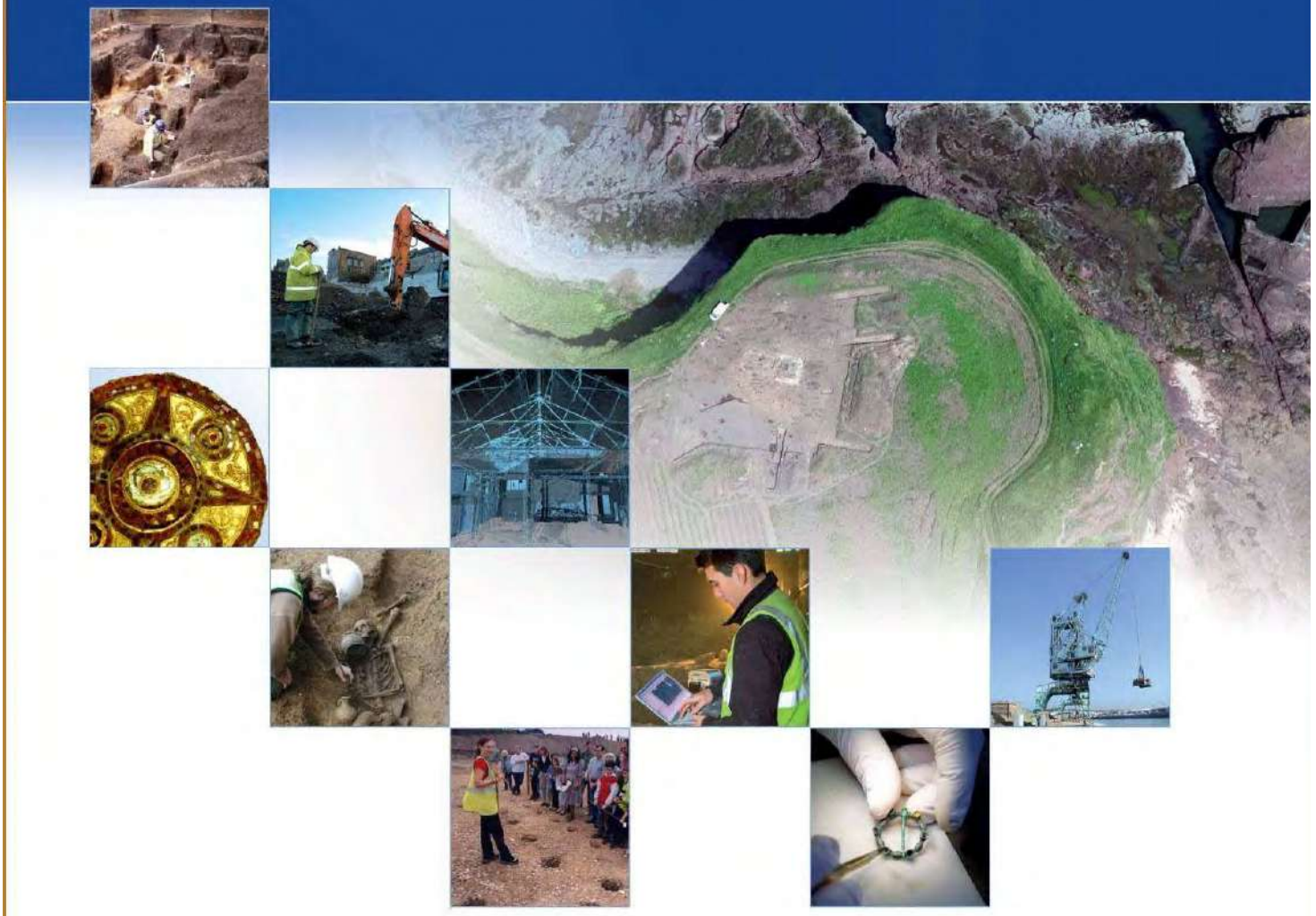
Solar 21: Written Scheme of Investigation for a Geoarchaeological Borehole and ERT Surveys

National Grid Reference Number: 486862 413617

AOC Project No: 53056

Site Code: AOC SOL21

March 2022



AOC Archaeology Group

ARCHAEOLOGY | HERITAGE | CONSERVATION

Solar 21:
Written Scheme of Investigation for a Geoarchaeological Borehole Survey

On Behalf of:	**ERM** **2nd Floor Exchequer Court,** **33 St Mary Axe,** **London** **EC3A 8AA**
National Grid Reference (NGR):	**TA 1676 6108** **(centre)**
AOC Project No:	**53056**
Prepared by:	**Virgil Yendel** **with contributions from Chris Breeden (Wessex Archaeology) concerning ERT**
Illustration by:	**Virgil Yendell**
Date:	**28 March 2022**

This document has been prepared in accordance with AOC standard operating procedures.

Author: Virgil Yendell	**Date: 28 March 2022**
Approved by: Virgil Yendell	**Date: 28 March 2022**
Draft/Final Report Stage: Final	**Date: 28 March 2022**

Enquiries to: AOC Archaeology Group
The Raylor Centre
James Street
York
YO10 3DW

AOC Archaeology Group

[redacted]

Table of Contents

Illustrations

1 Introduction

1.1 This Written Scheme of Investigation (WSI) has been prepared by AOC Archaeology Group for ERM. A previous WSI AOC (2021a) detailed the methodology for undertaking a geoarchaeological borehole and ERT survey during the implementation of the first phase of a multiphase Contamination Testing and Geotechnical Investigation works at the North Lincolnshire Green Energy Park (NLGEP). This WSI covers the follow-up phase of purposive geoarchaeological boreholes, the results of which will be used to update the existing deposit model (AOC 2021b) in order to inform any further mitigation strategy. This WSI specifically covers:

i) Purposive geoarchaeological borehole survey site work

ii) Electrical Resistivity Tomography (ERT) transects

iii) Targeted radiocarbon dating of key sediments

iv) Deposit model update and geoarchaeological survey reporting, including recommendations for specialist palaeoenvironmental assessment

v) Specialist palaeoenvironmental assessment

vi) Analysis and/or publication

1.2 The NLGEP will be located on land adjacent to the existing Flixborough Industrial Estate, situated at Stather Rd, Flixborough, Scunthorpe. The associated District Heat and Private Wire Networks (DHPWN) will run from the NLGEP site and terminate at two locations; the first located in Scunthorpe town centre, at the offices of North Lincolnshire Council, and the other at land adjacent to the M181, to the west of Scunthorpe.

1.3 For the purposes of the geoarchaeological borehole and ERT survey works the project has been split into six Impact Areas, and 3 Archaeological Zones (see section 3, and Figures 1 and 2):

1.4 The archaeological investigation will be undertaken in accordance with the professional guidance on best practice outlined in the Chartered Institute for Archaeologists' (CIfA) publications Standard and guidance for an archaeological watching brief (2014e), and Standard and Guidance for Field Evaluation (CIfA 2020); it will also comply with guidance for environmental archaeology, geoarchaeology and deposit modelling (Historic England 2015c, 015d and 2020), the Standard and Guidance for Archaeological Excavation (CIfA 2014b) and the Standard and Guidance for the Creation, Compilation, Transfer and Deposition of Archaeological Archives (CIfA 2014d). This WSI relates to the stages outlined above. Any further stages of work or would need to be subject to separate approved documents.

1.5 This WSI details how the geoarchaeological borehole and ERT surveys will proceed how that will be combined with any previous desk based deposit modelling. The works will be undertaken by a suitably qualified geoarchaeologist or team of geoarchaeologists. The site work will be managed in accordance with the standards laid down in Historic England's publication Management of Research Projects in the Historic Environment (MoRPHE): Project Managers Guide (2015e). The project will also adhere to the requirements of the National Planning Policy Framework (NPPF) (MHCLG 2019).

2 Planning Background

2.1 The Applicant is proposing a new Energy Recovery Facility (ERF) and Associated Development (the Project) which constitutes a thermal combustion combined heat and power plant with a potential power output capacity of up to 100 MWe from a total thermal capacity of 316 MWth together with Associated Developments. The location of the project is illustrated on Figure 1.

2.2 The NLGEP will be located on land adjacent to the existing Flixborough Industrial Estate, situated at Stather Rd, Flixborough, Scunthorpe. The associated District Heat and Private Wire Networks (DHPWN) will run from the NLGEP site and terminate at two locations; the first located in Scunthorpe town centre, at the offices of North Lincolnshire Council, and the other at land adjacent to the M181, to the west of Scunthorpe. Full details on the project description are presented within the Preliminary Environmental Impact Report (PEIR), specifically in Volume 1, Chapter 3: Project Description.

2.3 The Site lies within the administrative area of North Lincolnshire Council. Alison Williams provides archaeological advice to North Lincolnshire Council.

2.4 This WSI sets out the methodology for a geoarchaeological borehole survey in order to assess the presence or absence of archaeological remains and palaeoenvironmental deposits, and to investigate their extent, nature, quality, date, and character. All works will be undertaken by suitably qualified professional geo/archaeologist in accordance with current best practice and guidance. The results will be published online via the Archaeological Data Service (ADS).

3 Location and Proposed Impacts

3.1 Here follows a summary of the location of the development areas as they relate to the proposed development works, for more information on the development surroundings see Chapter 3 of the PEIR (ERM 2021), the NLGEP (2021) brochure, and ERM 2022.

3.2 There are six impact areas (Figure 1), outlined below

- Impact Area 1 (IA1) is located at the southwestern corner of the current Flixborough Industrial Estate and the proposed impacts include:
    - The energy recovery facility (ERF), including carbon capture, storage and utilisation plant. The Bunker Hall lies within this facility will require the excavation of a shaft up to 10m bgl. Additional impacts are expected from piling associated with the ERF and related tower cranes.
- Impact Area 2 (IA2) is located between Stather Road and the B1216 and the proposed impacts include:
    - A concrete block manufacturing plant and ash treatment facility in the north and from which the main below ground impacts are expected to be from piling.
    - A plastic recycling facility, also in the north and from which the main below ground impacts are expected to be from piling.
    - A visitor centre, also in the north and from which the main below ground impacts are expected to be excavation of the building footprint to

formation level (depth currently unspecified).

- A railhead along the western edge of the northern part and from which the main below ground impacts are expected to be excavation of the footprint to formation level (depth currently unspecified).
- Several large ponds associated with the wetland conservation area (depth currently unspecified).

- Impact Area 3 (IA3) Stretches from just north of the B1216 southwards down to the B1450 and the proposed impacts include:
  - A hydrogen production facility (nature and depth of impact currently undefined).
  - A hydrogen refuelling facility (nature and depth of impact currently undefined).
  - A battery storage (nature and depth of impact currently undefined).
  - EV vehicle charging (nature and depth of impact currently undefined).
  - The southern district heating and private wire network (DHPWN), consisting of linear impacts alongside existing roads (depth currently undefined).
- Impact Area 4 (IA4) is located immediately east of the Flixborough Industrial Estate, in a field to the south of First Avenue and the proposed impacts include:
  - An electrical substation (footprint excavation to unknown depths)
  - A hydrogen and natural gas above ground installation (AGI); (nature and depth of impact currently undefined).
  - Landscaping (below ground impact currently unknown).
- Impact Area 5 (IA5) runs along the A1077 from the Skippingdale Roundabout to Phoenix Parkway, the and the proposed impacts include:
  - The northern DHPWN, consisting of linear impacts alongside existing roads (depth currently undefined).
- Impact Area 6 (IA6) is located just over 300m north west of the Skippingdale Retail Park and the proposed impacts include:
  - The construction of a flood bund over the whole footprint of the area.

4 Geology

4.1 A north-south aligned mudstone ridge dominates the geology of the study area, upon which the historic settlements of Flixborough, Crosby and Scunthorpe are situated. The mudstone and Ironstone bedrocks are shallow to full marine deposits from the Triassic (c. 251-201 Mya) and Jurassic (c. 201-145 Mya). The mudstone ridge forms the eastern edge of the meandering Trent Valley, which is filled with deep Holocene (12,000 years ago – present) alluvium (clay, silt, sand, and peat) and overall represents uniform to varied riverine deposition across a floodplain. The eastern edge of the valley and west side of the mudstone ridge is characterised by thick drifts of 'windblown sand', which appear to have derived from late glacial sands (BGS 2021) and in some cases are overlain by alluvium. The sand, occasionally classified as Sutton Sand Formation, is a fine silty sand formed during the Devensian to Holocene (115 thousand years ago onwards) and

represents an aeolian or wind-blown redeposition of underlying glaciolacustrine deposits or bedrock.

4.2 The superficial deposits recorded across the area also consist of clay and silt Warp (BGS 2021), which Burke et al (2015) describe as "an artificially deposited silt and clay sequence formed in the last two or three centuries by controlled flooding to raise the land level and improve the quality of agricultural land." Warping is part of a programme of labour-intensive and largescale engineering, evidenced by historical accounts and relic engineering/drainage features (Van de Noort 2004). However, definitively applying the term to strata primarily based on lithological description of deposits alone may be problematic. The BGS themselves say, that lithologically, Warp is indistinguishable from any other 'natural' tidal deposit (Burke et al 2015). This highlights the specific difficulty of identifying at what depth a unit of Warp begins and ends. As such, this term appears to be of limited use in initially categorising or interpreting deposits without supporting chronostratigraphy, evidence of relic engineering/drainage features, and specific historical accounts.

4.3 The British Geological Survey (BGS 2021) indicates that IA1 and IA2 are underlain by bedrock of Mercia Mudstone. This is a predominantly red siltstone, of a semi-terrestrial to shallow marine origin, which formed approximately 52 to 247 Mya in the Early Triassic Period, and now rises to form the north-south ridge.

4.4 IA4 is underlain by the Scunthorpe Mudstone and Penarth Group limestones (c. 206-201 Mya, BGS 2021), of brackish and fully marine origin, and Scunthorpe Mudstone of marine origin (also c. 206-201 Mya).

4.5 The superficial deposits across IA1 and IA2 mostly consist of alluvial deposits and are identified as being in the region of 3 to 17m thickness (BGS borehole SE81SE21). Limited deposits of windblown sands are identified as being approximately 3m in thickness and lie in the south of the development area between IA1 and the B1216 (BGS borehole SE81SE77).

4.6 In IA4 the superficial deposits include some limited Hemingbrough Glaciolacustrine Formation. The later was probably deposited in a low energy, pro-glacial lake environment that developed during the Devensian (c. 0.116 to 0.0118 Mya), ahead of the southward advancing ice sheet (Ford et 2003). As well windblown sand formed during the Devensian to Holocene (115 thousand years ago onwards) as underlying glaciolacustrine deposits or bedrock was reworked.

4.7 The British Geological Survey (BGS 2021) indicates that most of the northern Laydown area is underlain by the marine Charmouth Mudstone Formation (c. 199-182 Mya). To the west and east lie the Frodingham Ironstone Member and Pleistocene Ironstone, marine shoal/shallow marine deposits of the early Jurassic, which formed c. 199-190 Mya. The superficial deposits to the east and west of the northern Laydown area consist of Devensian to Holocene (115 thousand years ago onwards) windblown sands, however, within the northern Laydown area the superficial deposits were previously removed by the cutting for the Dragonby Railway.

4.8 The British Geological Survey (BGS 2021) indicates that the southern Laydown area, within IA3, is entirely underlain by Mercia Mudstone Formation. The superficial deposits in this area consist mostly of Warp with some very limited alluvial survival in the south.

5 Archaeological and Historical Background

5.1 The following is a summary extract from Chapter 12 of the PEIR Archaeology and Cultural Heritage Assessment and the DCO (pers. Comms. ERM 04/08/21). This should be read in conjunction with these documents.

Prehistoric and Roman (pre AD410)

5.2 A single Palaeolithic asset is located approximately 780m outside the nearest part of the Order Limits. It comprises the findspot of a tanged flint blade of Late Upper Palaeolithic date, i.e., from the end of the Palaeolithic period. It was said to have been found on windblown sand at Risby Warren/Crosby Warren, along with a cache of obliquely backed points. These artefacts may indicate the site of a temporary hunting camp. Early prehistoric activity is known within the region through pollen analysis, which indicates that forests were beginning to be cleared during the Mesolithic period. Evidence for seasonal occupation during the Mesolithic and Neolithic period is also evident in environmental remains and flint scatters. Many of the Mesolithic flint scatters in the vicinity of the Site, are located on or immediately adjacent to (and reference sandy contexts in their descriptions) deposits of wind-blown sand depicted in BGS data. These sandy deposits mantle the high ground overlooking the Trent Valley. Notable Neolithic to Bronze Age flints and Roman pottery have been found in Willow Holt Sand Quarry, immediately to SE of IA4 (PEIR Chapter 3). There is considerable evidence of human activity dating from the Mesolithic onwards, comprising findspots, evidence of occupation sites and the potential for significant peat deposits and palaeoenvironmental remains to be buried under alluvium.

Early Medieval and Medieval (AD410 – AD 1485)

5.3 The scheduled monument of Flixborough Saxon nunnery and site of All Saints medieval church and burial ground is located adjacent to the Order Limits and was partially excavated between 1989 and 1991. Excavations uncovered parts of 40 buildings, 39 of which were of early medieval date. During the 8th and earlier 9th centuries, two rows of modest buildings arranged end to end stood either side of a shallow depression in which accumulated a large amount of refuse. This asset was first observed in section in a commercial sand pit. Prior to archaeological excavation, two metres of windblown sand overburden (aeolian reworking of post-glacial sands) had to be removed my mechanical excavation from above the archaeological remains. This overburden preserved but also concealed the site from view before it was exposed by sand quarrying. The scheduled monument also contains the site of the church that served the deserted village of North or Little Conesby. A hoard of Middle-Saxon woodworking tools (DBA asset 221) deposited within two lead tanks was found during sand quarrying at Flixborough in 1994 adjacent to the southwestern side of the scheduled monument, adjacent to where early medieval occupation remains were excavated in 1933 ahead of destruction for sand extraction.

5.4 During the late medieval period, a worsening climate (known as the ‘Little Ice Age’) and poor rural economic stability, along with outbreaks of the Bubonic Plague, reduced the quantity and quality of grain production, leading to land being lain to pasture and creating opportunity to encourage peasant migration to urban centres. Deserted settlements are relatively common within the region, including those found at the village of North or Little Conesby and Swalcliffe. Flixborough Stathe was the historic river port linked to Flixborough on the high ground to the east by road. Shallow

buried remains of the medieval port are likely to have been disturbeded by twentieth century development of the wharf.

Post Medieval and Modern (1485 – Present)

5.5 The study area comprises expanses of 20th century light industrial activity, agricultural activity, including evidence of historic agricultural practices; including field patterns, hedgerows, tracks, and post-medieval and modern housing; including commercial buildings and road and rail infrastructure; and Flixborough Staithe river port.

5.6 On 1 June 1974, an explosion in a cyclohexane plant at Nypro UK (a chemical plant) occurred at the Flixborough industrial estate, resulting in the deaths of 28 people, with 36 people seriously injured. At the time of the disaster, Nypro UK produced the chemical caprolactam, used in the production of nylon, from cyclohexanone. Cyclohexanone was produced by partially oxidising hot liquid. The HSE website summarises the incident 'The cyclohexane formed a flammable mixture and subsequently found a source of ignition. At about 16:53 hours there was a massive vapour cloud explosion which caused extensive damage and started numerous fires on the site". Fall-out from the explosion is a potential source of historical contamination.

5.7 The ERF facility is being developed on a site at Flixborough Stathe, formerly occupied by a series of large round storage tanks, which are likely to have contained fuels, other process chemicals, and where large quantities of coal and other solid fuels were also formerly stored.

6 Geoarchaeological and Palaeoenvironmental Background

6.1 The character and distribution of past human activity can be better understood through the consideration of the past landscape or environmental context. The topography and nature of the ancient land surface during the early Holocene, the current geological epoch and equivalent to the early Mesolithic (c. 11,500 BP or 10,000 BC), is dictated by and inferred from the surface of the Pleistocene superficial deposits (the previous epoch) and older solid geology (e.g. gravel or chalk). Overlying the Pleistocene - or older - deposits, Holocene deposits may preserve palaeoenvironmental evidence (e.g. pollen, diatoms, ostracods) of landscape development, from local channel migration and vegetation change to regional effects of climate and relative sea level change. In combination, likely preservation of palaeoenvironmental remains and deposit data (e.g. depth and character) provides a comparative framework to assess archaeological potential. Peat represents vegetated and waterlogged landscapes (e.g. marshland) which developed, within local or regional fluctuations of hydrology. The anaerobic and acidic conditions of the deposit are particularly conducive to organic preservation. Palaeoenvironmental remains from floodplain deposits, especially peat, provide information on the nature and timing of environmental change and the interplay with past human activity (HE 2015a, 2015b).

6.2 During the latter stages of the last (Devensian) Ice Age (18000BP), Lincolnshire was covered by an ice lobe (North Sea Lobe) extending down the eastern margins of the North Sea Basin as far as North Norfolk, depositing extensive till and glaciofluvial sands and gravels across the region. The ice lobe blocked the Humber Gap and thus the natural drainage eastwards and northward to the North Sea was prevented. This prevention of drainage into the sea resulted in the formation of a large ice-dammed lake known as Lake Humber within which deposits of lacustrine clays, silts and

sands were laid down some of which are mapped by the BGS to extend into the north-east of the Site. The cold dry conditions of the late Devensian period also resulted in the aeolian (windblown) transportation of fine-grained silt sized material which was deposited on to the Lincoln Edge east of the Site. The melting of the ice sheet at the end of the Devensian led to the gradual silting up of Lake Humber. By c11000BP the flow of the River Trent north across the lacustrine deposits towards the North Sea was re-established. The River Trent was initially characterised by braided channels. There was limited vegetation cover and the sediments on the floodplain were susceptible to wind erosion which in turn led to the deposition of aeolian sands. At the start of the Holocene as sea level began to rise, rivers incised through the lake deposits to reach base level. The channels thus transformed from wide braided stream to narrow single channels. As sea levels continued to rise the river channels aggraded and the deeply incised river valleys became infilled with the alluvium which now covers the Trent valley floor (Ellis 1998 10-12). Gaunt (1994) estimates the depth of channel incision and fill to be in excess of 20m in the area. Climatic amelioration and continued rising sea levels results in the development of wetlands at about 5000BP. A combination of impeded runoff and overbank flooding led to the development of extensive floodplain peats during the later prehistoric and early historic periods. No absolute dates are currently available for the onset of peat development in the lower Trent valley north of Gainsborough. Extensive areas of floodplain mire peats and alluvium would have characterised the Trent floodplain from the mid-Holocene until the introduction of drainage and warping on the post-medieval periods.

6.3 The study area lies at no more than 4.5m AOD and the wider landscape is notable for its vast expanses of flat featureless terrain. There is a paucity of securely dated paleoenvironmental analyses from the lower Trent valley. Limited detailed information exists about the nature extent and depth of the depositional sequences in the lower Trent valley. The influence of riverine alluviation and the exact location of abandoned meanders required further elucidation. The spatial and temporal development of the wetlands and the nature of the pre-wetland landscape remain poorly understood. The paleoenvironmental record for the earliest part of the Holocene in the Trent valley is sparse, with data available from Girton, Bole Ings (Dinnin 1997) and Lake L1 of the Lincolnshire Lakes Project. Radiocarbon dating in correlation with pollen samples from the Lincolnshire Lakes project east of the southern part of IA3 dates the lower pollen samples to approximately 7000BP, and upper samples to approximately 300BP. Comparable organic deposits in the lower Trent Valley began to accumulate around the same time as channel stabilisation approximately 8500BP (Stein 2014). Correlation between the depth and date of deposits at different locations across the Lake L1 Site proved to be somewhat variable, suggesting that either peat accumulated at different rates at different locations, or perhaps material has become truncated through erosion (AOC 2017).

6.4 Bole Ings, located towards Nottinghamshire provides a comparable early Holocene pollen record (Brayshay and Dinnin 1999; Dinnin 1997) dating from 8240 ± 60 BP to 2780 ± 60 BP. Zone 1 of the sequence (8240±60 BP to 6280 ±70 BP) provides evidence of a landscape dominated by Pinus, Ulmus, and Corylus with some Quercus. These species represent a wooded environment, with a dense deciduous woodland canopy (Brayshay and Dinnin 1999, 119). A similar landscape dominated by woodland is also found in the sequences from Lake L1 (AOC 2017).

6.5 The presence of Corylus, and gradual rise in Alnus at Bole Ings, also indicates an increasingly wet environment. Corylus frequently inhabits dry and basic pH level soils suggesting that Corylus was

occupying drier areas of the wetland margin and the surrounding landscape (Brayshay and Dinnin 1999, 119). Alnus and Corylus were found to be consistently present at Lake L1 and gradually increase throughout the sequence suggesting a similar wet environment (AOC 2017).

6.6 Marine environments continued to reach into the Lower Trent Valley throughout the Mesolithic, as evidenced by alternating marine and freshwater deposits as far upstream as Gainsborough (Knight and Howard 2004, 31; Lillie and Neumann 1998, 22). Pollen sequences from this period demonstrate expanding reed swamp and fen carr landscapes, with additional evidence of densely wooded areas on dryer land (Knight and Howard 2004, 31). A similar stabilising riverine environment continued into the Neolithic with dense woodland located on drier land. Evidence of occupation from as early as the Mesolithic has been recovered from the area of Flixborough including a large concentration of Late Mesolithic and Neolithic flint found at Sand Pits, Flixborough in 1928.

6.7 Coring undertaken at Flixborough as part of the Humber Wetlands Project (Lillie 1998 45-52) revealed a complex stratigraphic sequence of intercalated peats and clays which documented periods of alluvial deposition and periods of stabilisation. Similarly, archaeological evaluation and coring at the Lake L1 site, to the east of the southern section of IA3, as part of the Lincolnshire Lakes project revealed a complex sequence of interbedded peats and clays overlain by warped sediments. Numerous layers of buried organic peats, and finely laminated sections containing sands and clays were apparent. Changes appeared to be abrupt with no gradual transition between varying deposition types. This was interpreted as a possible indication that the sediments had been truncated or eroded, but it was also considered possible that rapid environmental change took place e.g. inundation of marine waters (AOC 2017).

6.8 It is possible that occupation of the lower areas of the Trent valley was intermittent prior to the post-medieval period due to the nature of the wetland environment and the rise and fall in sea level, and therefore settlements of medieval or earlier date would often be situated on slightly higher ground. However, periods of low sea level allowed regular cultivation and exploitation of this resource-rich environment which can be seen from previous finds of tools and pottery. Palaeoenvironmental survey undertaken as part of the Humber Wetlands Project indicated that some of the wetlands dried out during the Mesolithic period (Van de Noort et. al., 1995: 359) allowing for a wider range of land use, and woodland clearance during the Bronze Age indicates a shift towards agriculture (ibid). A bog-body is known from the Amcotts area (Lillie 1998,45)

6.9 Roman occupation of the area is known from various finds including Romano British pottery on the modern surface of the floodplain at Amcotts (Lillie 1998, 52)

6.10 The Early Medieval site at Flixborough provides ample evidence for the exploitation of the River Trent floodplain into the historical period. Historically there have been brick and tile manufacturers operating at various scales along the Trent and the nearby Keadby Canal.

6.11 Fletcher writing in 1858 about the course of the River Trent in the vicinity of the Site notes that it had considerably altered its course in the 18th century noting that 'in earlier times' it was at this point a large expanse of water that during the ebb of the tide occupied more than one channel. In 1836, between Hook Staithe and the Amcott windmill, on the western side of the modern River Trent, an old staithe was excavated and removed. It appears that this staithe and associated embankment

were built to alter the course of the river and reclaim the land for the estate as farmland. A borehole transect excavated as part of the paleoenvironmental survey of the lower Trent valley revealed deposits relating to alluvial channel infill near Amcott and thus likely relate to this earlier channel (Lillie 1998, 48). Pollen and diatom samples taken from deposits within this channel provide some evidence of the channel environment and diatoms indicate that both freshwater and brackish flow was present in this channel from the middle Mesolithic until 1858.

6.12 Sir Cornelius Vermuyden, born Tholen, Netherlands in 1590, was a Dutch engineer who carried out the initial drainage and recovery of the land in the vicinity of the Site. This was started in 1626, by means of digging drainage dykes and leading them to nearby rivers, in order to drain the land. The land was more workable but swampy and boggy areas remained in many places. Makin Durham was commissioned under the first Dun Drainage Act of the 1830s, to warp certain areas of Yorkshire and Lincolnshire, as he had perfected the adequate and technical procedure of 'warping' (Armstrong 1981, 20).

6.13 Large-scale drainage of the area was undertaken during the post-medieval period and by the nineteenth century, with the construction of drains such as the Burton and Flixborough Drain and the Lysaght's Drain along with the warping of fields, the area was successfully transformed from wetland into farmland (Lillie, 1998b 103). Warping was the practice of letting turbid river water flood onto arable land, so that its suspended sediment could settle to form a fertile layer, before letting the water drain away. In this way poor soils were covered with fine silt, and their rentable value was increased (Smith 2014, 83). Two types of warping were employed within the vicinity of the Site; flood warping and cart warping. Flood warping involved enclosing the fields within embankments and allowing flooding of the field over several years in order to deposit silt and raise the level of the land to reduce the flood risk (Shephard, 1976). Cart warping involved the manual excavation of alluvial sources such as an infilled palaeochannel and its deposition or spreading across the ground surface. Warping in the vicinity of the Site was commenced in 1835 from the inlet of the Neap House drain, with warping on the south side of the drain carried out between 1840 and 1845, and on the north side between 1845 and 1850 (Lillie 1998b 110). Further records for the Flixborough area record evidence of the Sheffield family employing additional cart warping to further improve higher ground within the Site to the north of Neap House in 1869 (Lillie 1998b 104).

6.14 Deposits of warp also served to mask the peaty and acidic soils that had developed on the alluvial deposits either side of the Trent. The warping also helped to reduce the impact of waterlogging that resulted from seasonal tidal regimes (Lillie 1998b 103). Deposits up to 2.5m in depth have been recorded between Flixborough and the Flixborough Industrial Estate with deeper deposits extending eastwards within the Site towards the modern channel where depths of up to 6m of warp have been recorded.

6.15 Drainage and ploughing within the Site in the post medieval and modern periods resulted in changing water regimes and likely desiccation of Holocene organic deposits. To date, the most recent part of the paleoenvironmental record spanning the last 200 years has received only limited investigation (Lillie and Neumann 1998).

6.16 The flat land adjacent to the Trent with ample cooling water and excellent communication links with the Yorkshire coalfields provided ideal sites for the large power station at Keadby and also the

chemical plant at Flixborough which in 1974 was the site of Britain's worst industrial explosion.

Previous works

6.17 During the course of the Humber Wetland project, a borehole transect was placed across the Trent and extended into the north part of the Site. A total of 24 boreholes were excavated over a distance of just over 5km from borehole SE827140 north-west of Amcotts Grange to Flixborough at SE875142 (Lillie 1998, 45). Where sufficient data on depth and character of deposits in the Humber Wetland project is available these have been added to the deposit model and are discussed with reference to the results of monitoring below. On the western side of the River Trent near Amcott the boreholes excavated revealed evidence for the aforementioned earlier channel of the Trent. On the eastern side of the modern course of the River at Flixborough 13 boreholes were excavated and provided insight into the nature of the floodplain.

6.18 The BGS has recorded a wide range of boreholes in the vicinity of the Site. Boreholes SE81SE41-SE81SE53 located between IA2 and IA3 were all sunk to depths of less than 5m and revealed a topsoil overlying organic clays with some peat which in turn overlay medium to fine sand deposits. Boreholes sunk at the jetty at Flixborough Stather (SE81SE214- SE81SE217) revealed a stratigraphy of peaty clay and sand with a basal gravel resting on Mercia Mudstone at c -15m AOD.

6.19 Further works were undertaken in the vicinity of Flixborough Stather within IA1 by Ian Farmer Associates in 2018. Six boreholes, designated BH1 to BH6 were sunk in this area. Made Ground was encountered in all boreholes to a maximum thickness of 2.10m and consisted of a gravelly sand/sandy gravel with brick, concrete, slag, sandstone and mudstone content. The alluvial deposits consisted of soft laminated sandy clays often found to contain peat fibres and were occasionally organic. These upper laminated clays were underlain in boreholes BH3, 4 and 6 by a peat deposit at depths of between 4.70 to 6.70mbgl extending to depths of between 11.70 to 12.30mbgl. The peat and organic clays were underlain by a gravelly sand deposit at 11.70 to 12.50mbgl and for a thickness of between 4.90 to 7.10m. Weathered Mercia Mudstone was encountered at 17.10 to 19.40mbgl generally as a red brown sandy gravelly clay. Mercia Mudstone bedrock was encountered at depths of between 20.10 to 22.60mbgl (IFA 2018, 7-8).

6.20 Recently a programme of borehole and test pit monitoring, in combination with previous work undertaken on the Humber Wetlands project, revealed basal deposits of fine sand of probable aeolian origin which was likely deposited during the late glacial period. The sands were encountered intermittently across the boreholes and could not always be distinguished from alluvial deposits. Overlying the sands and in some case cut into the sands are a series of organic deposits which likely represent the presence of a number of Late Glacial to Early Holocene infilled channels or wetland areas. The channels/wetlands are infilled with between 0.5m to 7m of peat and intercalated organic silts and clays which are indicative of stable periods of vegetated wetland development along the floodplain of the late glacial/early Holocene River Trent. The organic deposits are overlain by up to 8m of silty sand to clay representing natural overbank deposition or human induced floodplain accretion (Warp).

6.21 Development impacts may affect buried Holocene horizons or deposits of archaeological or palaeoenvironmental significance. Although it is difficult to ascertain with certainty the potential of the deposits to contain archaeological remains, the nature of the deposits observed suggested any

archaeological remains present within the alluvial floodplain areas may take the form of prehistoric localised dryland activity (i.e. short-lived flint and/or faunal 'camp site' assemblages) to floodplain exploitation (i.e., brushwood trackways and platforms, fish traps, etc). Archaeological remains are more likely to be found in the sandier drier areas to the east of the floodplain.

7 Zones of Archaeological Potential (Figure 2)

7.1 Based on the known geological and archaeological setting of the site three linear north-south aligned zones were previously identified and are taken here from the DCO (pers. Comms. ERM 04/08/21), these represent varying archaeological potential within which the main development impacts are proposed and are here combined with the findings of the geoarchaeological monitoring of GI works (AOC 2021b):

Archaeological Zone 1

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

7.1 The organic deposits found across the zone could indicate short-lived periods of stabilisation and wetland development within a more active fluvial environment, later fluvial erosion of well-formed peats, periods of soil development and waterlogging atop previously dry land surfaces. The latter being the least likely considering the generally low-lying floodplain nature of the landscape in question. Alternatively, they could be related to the warp also known in the area. Investigations to the north of the site (Lillie 2008, Lillie and Bunting 2016) recorded organic deposits on the eastern margins of the floodplain, similar to that recorded in IA2 and IA3, they were interpreted as either channel abandonment and infilling, or floodplain margin deposits (mire) but paleoenvironmental investigation (diatom and pollen) could not determine the precise nature of their formation.

7.2 Either way the peat represents a stabilisation or cessation of sediment accumulation and could record possible horizons of human activity; provide an environmental context for any human activity or landscape development (i.e. through pollen and other botanical remains, diatoms, ostracods and insects); and through radiocarbon dating could provide a chronology for the sequence of alluvial or sand deposition; placing any nearby archaeological finds within a developing landscape context and contributing to the regional palaeoenvironmental record.

7.3 Impact areas IA1, IA2 and the northern part of IA3 fall within this zone (see section 3 for more detail on the impacts).

Archaeological Zone 1 - Impact Area 1

7.4 The main ERF plant, including piling and the excavation of a shaft up to 10m bgl – falls within Archaeological Zone 1 as outlined above. The ERF facility is being developed on a site at Flixborough Stathe, formerly occupied by a series of large round storage tanks, which are likely to have contained fuels, other process chemicals, and where large quantities of coal and other solid fuels were also formerly stored. Flixborough Stathe was the historic river port linked to Flixborough on the high ground to the east by road. It seems likely that any remains of the medieval port will have been relatively shallow and therefore disturbed or destroyed by twentieth century activity at the wharf.

7.5 A ground investigation comprising 6 boreholes was carried out at the main ERF plant (IA1), within this zone in 2018 (IFA 2018). This revealed the presence of varying depths of made ground (0.75m-2.1m) containing brick, concrete, tarmac, slag, mudstone and sandstone. This lay above some 4-5m of alluvial silty clay with occasional organic content. From around 6m below ground level to c.12.5m all boreholes encountered a deep deposit of fibrous peat including large pieces of wood. This correlates with observations of peat deposits and potential palaeochannels of the Trent at the site of the proposed wind farm at Flixborough Grange to the north and in the area of the Lincolnshire Lakes to the south. Carbon dating of the peat deposits at Flixborough Grange indicate dates early in the fourth millennium BC (during the Neolithic period) for its early formation and the 8th-6th centuries BC (Early Iron Age) for its later phases. Given that the proposals include the excavation of a bunker hall to a depth of 10m below ground level, there will be significant disturbance caused to these deposits which have archaeological potential as well as palaeoenvironmental significance.

7.6 The thickest, deep peat deposits were located in BH6 (4.7-11.7m bgl) during investigations by IFA in 2018 and peat deposits in MW7 (AOC 2021b) were not bottomed during the recent monitoring programme. Development proposals include the excavation of a bunker hall to a depth of 10m below ground level within IA1, and thus there will be risk of disturbance of these deposits which have high palaeoenvironmental potential. The report on the GI monitoring (AOC 2021b) recommended locating a further geoarchaeological borehole within this area between these two points in order to retrieve samples from the full Holocene sequence.

Archaeological Zone 1 - Impact Area 2 and 3

7.7 The development area between the ERF plant and the B1216 (IA2) falls within archaeological Zone 1 and includes piling associated with a concrete block manufacturing plant, ash treatment facility, a plastic recycling facility; and footprint excavation to unknown depths for a visitor centre, a railhead, and several large ponds.

7.8 The northern part of IA3, just to the north of the B1216, also lies just within Archaeological Zone 1 and includes a hydrogen production facility, hydrogen refuelling facility, battery storage, EV vehicle charging, and the start of the southern DHPWN.

7.9 The report on the GI monitoring (AOC 2021b) recommended, that in order to improve the distribution of data points across IA1 and IA2 it may be beneficial to undertake a number of purposive geoarchaeological boreholes running west to east across these areas and drilling to the base of the Holocene sequence. This would have the added benefit of extending the Humber Wetlands transect (Lillie 1998), thus providing a more robust understanding of the paleoenvironmental context and archaeological potential of the site and any archaeological remains

found by ongoing investigations. In IA2 a west to east hand auger transect could also be beneficial, broadly following the route of Transect 5 (Figure 8) with interventions at 25 to 50m intervals over c. 1200m.

7.10 The report on the GI monitoring (AOC 2021b) also recommended Electrical Resistivity Tomography (ERT) transects in the location of previous or proposed borehole transects and another ERT transect between the two (Figure 6). These may be able to identify sub-surface structures and lithological changes, which in combination with any new or existing borehole data could then fill in the gaps between the borehole locations and provide a more robust and complete cross section of the deposits.

Archaeological Zone 2

7.11 The majority of IA3 lies within this Archaeological Zone. Predominantly the impacts over much of the area will be from the southern DHPWN, which are so far undefined. In the very north of IA3 the proposed development includes a hydrogen production facility, a hydrogen refuelling facility, battery storage, and EV vehicle charging. Deposit records show thinner but relatively well-preserved organic alluvial deposits interleaved between the Upper and Lower alluvium/warp/sand (AOC 2021b). IA3 is predominantly located within 'Archaeological Potential Zone 2' which lies on the edge of the Trent valley and extends from 'Archaeological Potential Zone 1' in the west to the base of the west-facing slopes of 'Archaeological Potential Zone 3' in the east. Much of this zone was historically occupied by uncultivated and unenclosed common land, including areas of sandhills on Brumby Common, at the southern end of the Site. There is the potential for significant archaeological remains to occur in this zone, from settlement of the Neolithic or Bronze Age periods, to potentially seasonal occupation in the Iron Age, Roman and medieval periods. There are a number of cropmark sites in the area to the west of the Foxhills Industrial Estate which may be late prehistoric or Roman in date.

7.12 The report on the GI monitoring (AOC 2021b) recommended a purposive geoarchaeological borehole survey retrieving continuous cored samples in a location between TP12 and TP14 in order to target the possible infilled channel/wetland sequence of high palaeoenvironmental potential and also possibly retrieve OSL dates from the underlying sands (at least 5m bgl). The aim being to help reconstruct the changing prehistoric to post-medieval landscape across the project area, enabling any nearby archaeological finds to be placed within a developing landscape context and contributing to the regional palaeoenvironmental record.

7.13 Recent work at Brumby Common (Trent and Peak Archaeology 2021) recorded varied thickness of peat in the vicinity, up to c.1.2m, but did not record peat below 2.53m OD. The peat samples from Brumby Common did not produce plant macros fossils for radiocarbon dating and at least one of the humic/humin radiocarbon dating couplets were erroneous. The GI monitoring (AOC 2021b) of TP12 recorded peat below c. -1m OD. Therefore, it seems prudent to undertake a borehole as close to TP12 in order to sample this deep peat and tie it into and improve the chronology of the other numerous records of peat deposits already existing for part of IA3.

Archaeological Zone 3

7.14 Impact areas IA4, IA5, and IA6 lie within this zone. The main impacts in archaeological zone 3 lie within IA4, including a hydrogen and natural gas above ground installation (AGI), an electrical

substation, and extensive tree planting. IA5 includes the northern DHPWN, consisting of linear impacts alongside existing roads (depth currently undefined) and impacts for IA6 involve the construction of a flood bund over the whole footprint of the area.

Archaeological Zone 3 - Impact Area 4

7.15 IA4 recorded a single intervention, during the GI monitoring (MW08, AOC 2021b), which indicated depths of windblown sand extending below 5m bgl. IA4 is located within 'Archaeological Potential Zone 3' on the sandy slopes to the east of the valley. These slopes are rich in archaeological remains, including significant multi-period remains of Neolithic, Bronze Age, Iron Age and Roman date from the sand and gravel quarry at Willow Halt and the mid-late Anglo-Saxon settlement at Flixborough. Purposive geoarchaeological boreholes retrieving continuous cored samples would allow for OSL dating of the sand sequence and also allow for palaeoenvironmental assessment of deep and potentially better-preserved deposits within IA4. Any core taken for OSL will be taken in opaque liners or immediately wrapped in black plastic once drilled. A further round of geoarchaeological works (hand augering or machine drilled boreholes) in this area would provide a more comprehensive distribution of deposit sequences for the deposit model in this area and extend the mapping in IA4.

Archaeological Zone 3 - Impact Area 5

7.16 IA5 lies within Archaeological Zone 3 no interventions were undertaken in this area during the monitored GI works, although previous BGS interventions to the south (SE81SE1, AOC 2021b) recorded only windblown sand and Mudstone. It is likely that there is little geoarchaeological potential within deeply buried deposits in this area. The northern DHPWN runs through this area, consisting of linear impacts alongside existing roads (depth currently undefined). The near surface archaeological potential will be covered by a comprehensive watching brief covered under another WSI (ERM 2022).

Archaeological Zone 3 - Impact Area 6

7.17 IA6 pertains to the footprint of a flood bund to be constructed in front of a poultry farm less than 400m north of the Skippingdale Retail Park. An area specific evaluation and mitigation plan will be designed when impacts are known. The area lies within Archaeological Zone 3, and on the boundary with Zone 2 Previous BGS interventions to the northwest (SE81SE46, BGS 2022) does record c.1.5m of clayey peat, over suspected windblown sand. The results of the purposive geoarchaeological boreholes in IA4 and the eastern part of Archaeological Zone 4, mentioned above, as well as a trial trench evaluation in IA4 (ERM 2022), will inform the evaluation and mitigation plan. However, a single auger hole will be driven in this area in order to link up the sequences from previous known and proposed locations.

8 Scope of Works and Strategy

8.1 The programme of geoarchaeological works has been separated into multiple stages, summarised below.

i) Purposive geoarchaeological borehole survey site work

ii) Electrical Resistivity Tomography (ERT) transects

iii) Targeted radiocarbon dating of key sediments

iv) Deposit model update and geoarchaeological survey reporting, including recommendations for specialist palaeoenvironmental assessment

v) Specialist palaeoenvironmental assessment

vi) Analysis and/or publication

8.2 This WSI specifically covers stages i) to iv) of the sequence outlined above, general statements and likely approaches will be provided for stage v) and vi), but these may be modified in light of the results and recommendations of earlier stages.

i) Purposive geoarchaeological borehole survey site work

8.3 Additional geoarchaeological hand auger and machine drilled boreholes have been recommended (AOC 2021b) to fill in data gaps within the previous deposit model; to provide a west to east transect that would locate and link the low-lying channel/wetland areas and deep alluvial sequences, of high palaeoenvironmental potential, with the higher ground of greater potential for past settlement and occupation; and to provide samples of the full Holocene sequence. An updated deposit model, and particularly a transect, linking the areas of differing potential across the site, in combination with specialist palaeoenvironmental investigation of sampled deposit sequences, would provide a chronological framework and understanding of the palaeoenvironmental and landscape changes in which the local human activity and settlement developed. Further details on the scope for the different areas can be found below and the methodology for taking purposive geoarchaeological boreholes can be found in section 10.

Impact Area 1 (Figure 2, and Figure 3)

8.4 IA1 already has a good distribution of detailed logs from the 2018 GI report (IFA 2018) and these show a relatively uniform sequence. Therefore, a single extra borehole (BH1) to c. 15m bgl in order to retrieve continuous core samples for possible future palaeoenvironmental assessment is recommended. The thickest peat deposit was located in BH6 (4.7-11.7m bgl, IFA 2018), so locating the geoarchaeological borehole adjacent to that sample would seem the most useful. In addition, special attention will be focused upon the distinguish the depth of modern made ground and modern truncation in respect to any deposits or remains surviving from the medieval port activity in the location.

Impact Area 2 and north of Impact Area 3 (Figure 2, and Figure 4)

8.5 IA2 has a sparse distribution of sequences that rarely record down to bedrock or in enough detail to differentiate in situ Pleistocene windblown sands from Holocene deposits. A single transect of 23 geoarchaeological hand drilled auger holes (AH1-23, to maximum 4-5m bgl) at 50m intervals will be undertaken across the southern part of IA2 and three additional locations across the northern part of the site (AH24-26, to maximum 4-5m bgl), in order to provide a higher resolution cross-section of the near surface organic deposits of palaeoenvironmental interest in areas of possible impact. Deep organic and minerogenic deposits are indicated in the area down to c. 9m bgl (HW6, AOC 2021b). Where deep or continuous landscape features (e.g. relic channels) or deposits (e.g. peats) are indicated, provision will be made to discus with the client and Historic Environment

Officer about the benefits of reducing the interval distance to 25m in specific locations in order to locate the edges of those features/deposits.

8.6 A purposive geoarchaeological machine drilled borehole (BH3, to maximum of 10-15m bgl) will be undertaken once the hand drilled transect is complete, to retrieve continuous cored samples for possible future palaeoenvironmental assessment of any deep organic deposits of higher palaeoenvironmental interest. The final location of BH3 will be decided onsite based on the preliminary results of the auger hole transects but an indication of the location is given in Figure 4. Any core taken from the surface of the sands for OSL will be retrieved in opaque liners or immediately wrapped in black plastic once drilled.

South of Impact Area 3 (Figure 2, and Figure 5)

8.7 A single purposive geoarchaeological machine borehole (BH4, Figure 5) should be undertaken retrieving continuous cored samples near to TP12 (AOC 2021b) down to c. 6-7m bgl. This will allow samples of the possible infilled channel/wetland sequence of palaeoenvironmental potential to be retrieved for radiocarbon dating and also to acquire future OSL dating samples of the underlying sands. This would aid in further understanding the dates of formation of the deposits and the landscape evolution within this zone, but also in respect to palaeoenvironmental sequences already investigated at Brumby Common (Trent and Peak Archaeology 2021) and to the south as part of the Lincolnshire Lakes project (AOC 2020). Any dryland archaeology that other avenues of archaeological investigation may uncover can then be placed within a local and wider landscape context in order to investigate how past humans interacted with that changing landscape. Radiocarbon dating would preferably be undertaken on suitable plant macrofossils from the peat would be undertaken after discussions with the client and the Historic Environment Officer.

Impact Area 4 (Figure 2, and Figure 3)

8.8 Glaciolacustrine deposits of potential paleoenvironmental interest are mapped in IA4 by the BGS (2022). One BGS borehole (SE81SE41) in the vicinity of First Avenue records laminated clays below 3.5m bgl, which may represent the glaciolacustrine deposits. IA4 recorded a single intervention during the GI monitoring (MW08, AOC2021) which indicated depths of windblown sand extending from below topsoil down to 5m bgl, although these deposits were not bottomed during the GI monitoring their depth suggests the glaciolacustrine deposits do not extend across the whole area.

8.9 Four geoarchaeological hand drilled auger holes across (AH28-31, 4-6m bgl) will form one NW to SE transects across IA4 in order to ascertain and map any surviving near surface glaciolacustrine deposits and to compliment the evaluation trenches already planned (ERM 2022). A purposive geoarchaeological machine drilled borehole (BH2, to maximum of 6m bgl) will be undertaken once the hand drilled transects are complete in order to retrieve continuous cored samples of any glaciolacustrine deposits or soil horizons within the near surface sands. Sampling the upper glaciolacustrine deposits would enable us to potentially tie the deposits to know geological investigations from similar Hemingbrough Glaciolacustrine sequences, should the need arise to contextualise any Palaeolithic or early Mesolithic archaeology found during the proposed trenching

(ERM 2022). The final location of BH2 will be decided onsite based on the preliminary results of the auger hole transects but an indication of the location is given in Figure 3. Any core taken from the surface of the sands for OSL will be retrieved in opaque liners or immediately wrapped in black plastic once drilled. Future OSL dating of upper glaciolacustrine deposits and overlying windblown sands could enable an assessment of the potential for associated Palaeolithic or later archaeology, as well as complimenting the stratigraphic chronology and archaeology recorded during the proposed trenches (ERM 2022) and will be discussed with the Historic Environment Officer after completion of fieldwork.

Impact Area 6 (Figure 2, and Figure 4)

8.10 A single augerhole (AH27, to maximum 4-5m bgl) will be driven within IA6. This location, along with those proposed for the north of IA2, and those previously monitored (AOC 2021a), will provide additional data across the areas improving the distribution of sequences and in particular within the impact areas.

ii) Electrical Resistivity Tomography (ERT) transects

8.11 Four ERT transects of variable length are proposed. These are located in the gaps between the proposed borehole locations (Transect 1-4; Figure 6) and are intended to provide a more robust and complete cross section of the deposits across the scheme. They are focussed on locations where there is potential to provide information regarding any relevant sub-surface structures and lithological changes, which can, in turn, help to clarify aspects of the deposit model.

8.12 Transect 1 measures approximately 240 m in length and traverses IA4 on an NE to SW alignment, which is perpendicular to the 8 proposed geoarchaeological hand drilled auger holes (AH24-31). This will help to detail the extent of any near surface glaciolacustrine deposits as well as any potential soil horizons within the sands, if they are distinctly different in terms of their geophysical character. Theoretically, sandier deposits will produce higher resistivity values than those with a higher clay content, however, the specific resistivity values for any material are dependent on lithology, ground-water content, and porosity. Whilst it would be advantageous to continue Transect 1 to the southwest, towards IA1, the present land use prevents the insertion of electrodes into the ground and it is, therefore, not possible to carry out an ERT survey in this area.

8.13 Transect 2 and 3 are positioned to the south of IA1, where there is currently only a sparse distribution of boreholes that rarely record down to bedrock. Transect 2 measures approximately 500 m in length and Transect 3 is the longest at *c.* 1000 m. This covers a large part of IA2 and Transect 3 extends eastwards to IA6. These profiles will help to detail the overall depth of the sediment sequence and highlight any deeper (potentially organic) deposits of higher palaeoenvironmental interest. In addition, it will provide an indication of the sub-surface (Pleistocene) topography, and may differentiate areas of variable alluvial sedimentation together with any more specific alluvial landforms such as former channels.

8.14 Transect 4 is 450 m long and traverses the south of IA2 and the north of IA3, where there is a sparse distribution of existing boreholes and an auger transect. The transect also passes through

the northern end of areas of caesium vapour and fluxgate gradiometer data. This will help to detail the depth and extent of deposits in the area of blown sands. Theoretically, sandier deposits will produce higher resistivity values than those with a higher clay content, however, the specific resistivity values for any material are dependent on lithology, ground-water content, and porosity.

iii) Targeted radiocarbon dating of key sediments

8.15 Once the borehole survey has been completed, as outlined above, a short summary proposal will be submitted to the Historic Environment Officer to select four samples for radiocarbon dating. Preferably these radiocarbon dates will be undertaken on identified freshwater plant macrofossils. It is envisaged that this initial round of dating would act as range finders for the sequences and their paleoenvironmental/archaeological potential and in order to best compare the onsite sequences with those known from adjacent sites (e.g. Flixborough Solar Farm, Brumby Common and Lincolnshire Lakes). As such they will focus on:

- Any organic soil horizons located in IA4 in order to ascertain the potential for archaeology related to the mid-late Anglo-Saxon settlement at Flixborough.
- Basal organic deposits sampled in IA1 to provide the maximum chronology range of the sequence.
- Basal organic deposits sampled in IA2 or northern part of IA3 to provide the maximum chronology range of the sequence.
- Basal organic deposits sampled in the south of IA3 to provide the maximum chronology range of the sequence.

8.16 It should be noted that if plant suitable macrofossils for radiocarbon dating are not recovered from the cores, alternative dating techniques such as OSL, or coupled dates of humic/humin factions, may be required. No scientific dating will be undertaken without agreement between the Client and the Historic Environment Officer.

iv) Deposit model update and geoarchaeological survey reporting

8.17 Once the borehole and ERT surveys has been completed, as outlined above, a report will be produced. This report will include all useful and accessible deposit data within the vicinity of the site from geotechnical reports (as supplied by the client), BGS data, and archaeological reports/publications (e.g. Humber Wetlands surveys, Lincolnshire Lakes project, Flixborough Solar Farm) to create an illustrative deposit model of the project area; including elevation and thickness plots as well as borehole transects/sections. The deposit model will culminate in mapped zones/areas concerning the below ground archaeological potential of the site, including a scientifically dated chronological framework. Recommendations will be made concerning the palaeoenvironmental potential of the deposits and any further assessment, analysis and/or publication as appropriate. It is understood that the report will be part of the wider investigation for the site area and will require liaison and data sharing with other archaeological organisations. Further details concerning the deposit modelling and reporting can be found in sections 10 and 11.

v) Specialist palaeoenvironmental assessment

8.18 The borehole survey reporting does not currently include palaeoenvironmental assessment. However, once the fieldwork has been undertaken and preliminary sequences established, the stage iv) report will make recommendations concerning further palaeoenvironmental assessment.

As part of any future assessment, it is expected that at least one sequence in IA1, IA2 and/or IA3, where deposits are already known to be deep and to include organic sediments, will undergo palaeoenvironmental assessment, although additional sequences across the project may also be required. This assessment would include the analysis of an appropriate sample (e.g. 12 pollen, 12 ostracods, 12 diatoms and plant macrofossils), alongside further scientific dating if appropriate. Any specialist palaeoenvironmental report will make initial recommendations concerning further work, including analysis and/or publication.

vi) Analysis and/or publication

8.19 Any detailed recommendations for analysis and publication are likely to be more appropriately incorporated as part of a later updated project design for the mitigation works, which would be decided in discussion with the Client and Historic Environment Officer.

9 Aims and Objectives of the Investigation

9.1 The stage iii) and iv) works will consist of a geoarchaeological borehole survey undertaken in order to inform and provide samples for further phases of geoarchaeological and archaeological investigation.

9.2 Geoarchaeology is the application of earth science principles and techniques to the understanding of the archaeological record (HE 2015d). It involves the examination of sub-surface deposit sequences, through coring or exposed sections, in order to identify site formation processes or landscape features of archaeological interest. Deposit models are often employed in geoarchaeology, these are conjectural maps and cross-sections used to investigate the archaeological significance, potential impact, or accessibility of buried deposits (HE 2020). Geoarchaeological approaches often form part of a wider programme of archaeological investigation.

9.3 The general aims of the investigation at the Site are defined as:

- To identify and characterise the Pleistocene and Holocene geoarchaeological and palaeoenvironmental potential of deposits within the Site.
- To use this information to provide a Site wide understanding of landscape evolution and human activity across the area through time.
- Produce a comprehensive site archive and report.
- To enable the archaeological advisor to North Lincolnshire Council to make an informed decision on the requirement for any further work.
- To make available to interested parties the results of the investigation.

9.4 The specific aims of the stage iii) and iv) investigation at the Site are defined as:

- To update the deposit model for the Site mapping areas of and retaining samples from the alluvial deposits and potentially areas of peat or waterlogged material within the deeper areas of the Trent Valley.

- To update the deposit model for the Site mapping areas of and retaining samples from the windblown sand on the rising mudstone ridge and edge of the Trent Valley, and record potential old land surfaces that may highlight horizons of possible past human activity buried by, within, or atop those sequences.
- Inform the potential for, and likely location of, archaeological remains within the Site.
- To provide samples for and undertake range finder scientific dating in order to construct a chronostratigraphic framework for the site and in reference to previous investigations in the area.
- To establish a chronologically robust understanding of the palaeoenvironmental sequence affected by the development.
- To provide a transect linking the low-lying and deep alluvial sequences, of high palaeoenvironmental potential, with the higher ground of greater potential for past settlement and occupation.

9.5 The specific research questions of the stage iii) and iv) investigation at the Site are defined as:

- RQ1: What does the deposit sequence on the site reveal about the landscape evolution of the site and the River Trent, especially in relation to previous investigations?
- RQ2: How do the deposits recorded within the site relate to each other and how do they contribute to our understanding of the landscape evolution of the project area?
- RQ3: How does the character, extent, and scientific dating of organic horizons compare to those located in the vicinity of the site and do any samples retained have further potential for scientific dating (radiocarbon or OSL) and contributing to the project wide chronology?
- RQ4: Can greater differentiation in the warp/alluvial/windblown deposits be ascertained, by character, date or depositional context?
- RQ5: Can the palaeoenvironmental sequences sampled provided any further information about past channel routes or wetland onsite?
- RQ6: Can the ERT data provided any further information about past channel routes or wetland onsite?

9.6 The final aim is to make public the results of the investigation, subject to any confidentiality restrictions, through the ADS and OASIS website.

10 Methodology

Introduction

10.1 This WSI details the methods and standards that the archaeological contractor will follow in order to fulfil the requirements of the project and has been produced in reference to all current and best archaeological practice, standards and guidelines.

- Historic England – Archaeological Assessment and Evaluation Reports (Guidelines) (HE 2015a).

- Historic England – Archaeological Guidance Paper 3: Standards and Practices in Archaeological Fieldwork (HE 2015b).
- Historic England – Environmental Archaeology: A guide to the theory and practice of methods, from sampling and recovery to post-excavation (HE 2015c).
- Historic England – Geoarchaeology: Using Earth Sciences to Understand the Archaeological Record (HE 2015d).
- Historic England – Deposit modelling and archaeology: Guidance for Mapping Buried Deposits (HE 2020).
- Chartered Institute for Archaeologists – Standard and Guidance for Archaeological Field Evaluation (CIfA 2020).
- Chartered Institute for Archaeologists - Standard and guidance for the collection, documentation, conservation and research of archaeological materials (CIfA 2014a).
- Chartered Institute for Archaeologists – Standard and Guidance for the Creation, Compilation, Transfer and Deposition of Archaeological Archives (CIfA 2014b).
- Chartered Institute for Archaeologists – Code of Conduct (CIfA 2019).
- Museum of London – Archaeological Site Manual (MoL 1994)
- RESCUE & ICON – First Aid for Finds (RESCUE & ICON 2001).
- United Kingdom Institute for Conservation – Conservation Guidelines No.2 (UKIC 1983).
- United Kingdom Institute for Conservation – Guidance for Archaeological Conservation Practice (UKIC 1990).

10.2 An archive deposition site code should be obtained from North Lincolnshire Museum prior to commencement of the stage i) GI monitoring and will be used as the site identifier for all records produced.

10.3 A copy of the approved WSI will be held on site along with a detailed site risk assessment. All site staff will be made aware of, and will have reviewed, both documents.

10.4 Alison Williams on behalf of North Lincolnshire Council will be responsible for monitoring the project and will be afforded the opportunity to inspect the site and all records at any stage of the work.

10.5 The geoarchaeological auger and borehole survey will be undertaken by experienced Project Supervisor Kim Hosking under the guidance of Senior Geoarchaeologist Virgil Yendell. The project will be undertaken under the overall direction of Virgil Yendell, Project Manager Geoarchaeology, and Stephen Potten, Operations Manager. Further staff will be made available as required.

10.6 All archaeological/geoarchaeological work will be managed by ERM, who are the point of contact with AW – this work forms part of a larger scheme of work including geophysical survey, trial

trenching and desk-based investigations that ERM are managing.

Purposive Geoarchaeological Boreholes

10.7 Locations for purposive geoarchaeological boreholes are provided in Figures 3-5. Any proposed locations may have to be modified in the light of service runs and/or other constraints on the site, as necessary.

10.8 Machine boreholes BH1 BH3 and BH4 will need to be drilled to top of pre-Holocene superficial or solid geology (e.g. Sutton Sand or mudstone bedrock), whichever is encountered first and can be identified. Where possible the pre-Holocene deposits will be drilled into a further c. 0.5m to prove they are in situ. Drilling may be required to go below the surface of the pre-Holocene deposits where Palaeolithic potential is expected. For instance, BH2 will be drilled to the maximum depth as specified in the scope (Section 6) in order to ascertain the presence of near surface glaciolacustrine deposits of pre-Holocene date. Continuous core samples will be collected throughout the drilled deposit sequence. The cores will be retained by AOC.

10.9 The locations will be drilled with by hand auger (e.g. AH) or tracked rotary rig (e.g. Comacchio style rig, and e.g. BH) taking window-less samples (1.5m long cores). If machine drilled, the locations will be drilled by a sub-contracted drilling crew, under the supervision of a geoarchaeologist/environmental archaeologist. If hand drilled the locations will be undertaken by a geoarchaeologist/environmental archaeologist with a supporting archaeological technician/site assistant. Where appropriate, service pits (approximately 300mm x 300mm) will be hand-dug to c 1.2m at each location, and the holes CAT-scanned for live services at regular intervals by the sub-contractor or by AOC during this process.

10.10 On site, the geoarchaeologist will photograph and log the sediments revealed in the cores according to standard geological criteria (Troels-Smith 1955; Jones et al 1999; Tucker 2003). The geoarchaeologist will keep a field log of the boreholes and a photographic record of the site and cores. Preliminary interpretation of the deposit sequence sampled in the cores will be made on site and an overview of the lithology produced that will characterise the stratigraphy and identify formation processes.

10.11 As a minimum all logs will be tabulated to include the following descriptive information:

- Sample Unique Identification Number
- Location (XY coordinates)
- Level of the top of the sample (e.g. m OD)
- Depth for top and bottom of each lithological unit
- Depths for poor / no sediment retrieval
- Description of each lithological unit, follow conventional standards (see Historic England 2015) and including sediment structure;
- Colour;
- Texture; and
- Sorting and boundary characteristics.

10.12 While the machine drilling rig is running the geoarchaeologist will remain outside the active working area of the rig. The geoarchaeologist will signal the lead driller when they wish to approach the rig and will approach only when it is safe to do so. Upcast or core samples will be brought by the machine drilling crew outside of the active drilling area, to a safe designated area, and made available to the geoarchaeologist for recording.

10.13 The borehole locations will be surveyed in by AOC and each position located using a GPS with sub metre accuracy to provide national grid location and ordnance datum height data.

10.14 The machine drilled borehole cores will be adequately sealed and labelled and taken to the AOC laboratories cold storage for retention during the subsequent stages of the project. As a general rule, cores have a shelf life limited to 3-4 years. Once in the AOC laboratories, the cores may require extrusion or further cleaning/examination.

10.15 Because the timing of the evaluation is dependent on the client it remains the client's responsibility to give adequate notice to AOC of when access is possible.

Electrical Resistivity Tomography (ERT) transects

10.16 The geophysical survey will be undertaken by Wessex Archaeology's in-house geophysics team. The client will make all access arrangements for the works and Wessex Archaeology will not deal directly with any landowners etc. unless instructed to do so. Any changes in the agreed written scheme of investigation will be discussed and agreed with before implementation.

10.17 The methods and standards employed throughout the geophysical survey conform to current best practice, and guidance outlined by the Chartered Institute for Archaeologists' (CIfA 2014f) and European Archaeologiae Consilium (Schmidt et al. 2015).

10.18 The ERT data will be collected using either an IRIS Syscal Pro with 72 electrodes or an Allied Tigre with up to 128 electrodes. Each transect will be arranged with a spacing of 2 - 5 m between electrodes, dependant on the desired target depth within each area. These will be positioned along a series of linear transects distributed across the accessible parts of the site. Where required, it may be necessary to divide into separate transects, particularly for the longest transects.

10.19 ERT works by injecting electrical current into the ground between a pair of electrodes and measuring the voltage between another pair. By repeating these measurements along an array of probes on the surface, and using a number of different electrode separations, it is possible determine changes in resistivity (Ω·m) with increasing depth. Different subsurface materials respond differently to this applied electrical current and generally, areas with high clay content are characterised by lower resistivity values, and those with low clay content, such as sands and gravel or bedrock, will be displayed as higher resistivity. However, the specific resistivity values for any material are dependent on lithology, ground-water content, and porosity.

10.20 Prior to the recording of ERT data points a resistance measurement (Rs check) is taken of the whole dipoles in order to check that all the electrodes are correctly connected and that there is good ground contact. If this indicated that the line was open (electrode not correctly connected), improvements were made to the contact resistances at the ground surface, thus reducing the collection of 'bad' data points.

10.21 A Leica RTK GNSS GPS instrument, which is precise to approximately 0.02 m, will be used to record the position of each electrode. This GPS data will then be used to correct the ERT profiles for topographic changes.

10.22 Data from the ERT survey will be processed using the commercially available RES2DINV software to produce topographically corrected pseudo-sections. This will comprise an inversion process to convert the apparent resistivity values into pseudo-sections of estimated subsurface resistivity. The inversion routine used by the RES2DINV program is an iterative process based on the smoothness-constrained least-squares method. The results of this are then plotted against the depth for each midpoint in the electrode configuration. The main advantage of this method is that the damping factor and roughness filters can be adjusted to suit different types of data.

10.23 Where necessary, 'bad' data points were exterminated to remove erroneously high or low data values before the calculation of an inverted model. Such values do not represent true resistivity measurements and are usually caused by systematic or random noise due to poor ground contact.

10.24 The ERT survey results will be presented as a series of colour-scale pseudo-sections with annotative interpretations and will be compiled into an illustrated report in Wessex Archaeology's house style.

Deposit model

10.25 A summary of the origin and purpose of deposit modelling in archaeology is given in Appendix C. In order to create the deposit model, the geotechnical data will be entered into a digital database (Rockworks 20). Any recent geotechnical logs supplied by the client or previous archaeological work onsite or in the immediate vicinity will be included. Interventions will be given the prefix 'SA' for shell and auger boreholes, 'RT' for rotary boreholes, 'WS' for window samples, 'AH' for auger holes, 'TP' for test pits, 'TR' for trenches or those already designated. BGS logs (BGS 2021) added to the database will be given a prefix relating to the two-letter grid square of its national grid reference e.g. TQ. The distribution of this data set will be presented and the data references for the sedimentary logs provided.

10.26 Each lithology type (gravel, sand, silt, clay etc.) will be given a unique colour (primary component) and pattern (secondary component) enabling visual correlation of the sediment components of deposits across the site. By examining the relationship of the lithology types (both horizontally and vertical) in preliminary and iterative transects, correlations can inform the site-wide deposit groups. The grouping of these deposits will be based on the lithological descriptions, which represent distinct depositional environments, coupled with a wider understanding of the local floodplain sequences. Thus, a sequence of stratigraphic units ('facies'), representing certain depositional environments, and/or landforms can be reconstructed both laterally and through time.

10.27 Inverse distance weighted (IDW, weighting =2, number of points =12) digital elevation model (DEM) and thickness (Isopach) plots will be produced for key deposits (i.e. units defining major changes in the environment and modes of deposition) and surface horizons. These highlight major features of the topography through time. In this respect, the most common surface plot depicts the surface of the Pleistocene (or older) deposits and gives an approximation of the topography of the site as it existed at the beginning of the early Mesolithic period c 10,000 years ago. The development of

the Holocene floodplain is likely to have been influenced by the topography inherited from the Pleistocene/Late glacial period. This surface would have dictated the course of later channels, with gravel high points forming areas of dry land within the wetlands, and lower lying areas forming the main threads of later channels. Many of the additional surface or thickness plots provided will likely be more representative of deposit survival than time-specific landscapes (Yendell 2020).

10.28 The overlying deposit sequence across the site depicted by the stratigraphic units, as representative of specific depositional environments and/or landforms laterally and through time for the site and immediate vicinity, will also be illustrated in profile or transect form. Such transects present a straight-line correlation between the data points, extrapolating the stratigraphic units identified within each borehole.

10.29 By examining the surface and thickness plots in combination with the vertical deposition shown in the transects, areas of archaeological potential can be mapped. These will characterise the differing geoarchaeological and archaeological potential and significance of single stratigraphic units, deposit sequences containing multiple stratigraphic units, or specific landforms and depositional environments.

10.30 The results of fieldwork, initial scientific dating and subsequent palaeoenvironmental assessment will be presented in a way that identifies the potential of any deposits to include palaeoenvironmental remains capable of allowing further landscape reconstruction and dating. It should also describe the potential for identifying, recording and sampling any associated cultural material (e.g. lithics).

10.31 The ERT results, as detailed in a separate report (supplied by Wessex Archaeology), will be incorporated into the deposit modelling.

Unexpectedly significant or complex discoveries

10.32 Should there be, in the professional judgement of the archaeologist on site, unexpectedly significant or complex discoveries during the excavation which warrant more detailed recording, AOC Archaeology will contact the client with the relevant information to enable a suitable, fully costed, mitigation strategy to be agreed.

10.33 Any unexpectedly significant or complex discoveries will also include the immediate notification of the NLHER and Historic England Science Advisor (Matt Nicholas, Midlands Region). A site meeting will be arranged with all parties present to agree a methodology for further assessment; to establish the significance of the discovery as necessary, and to inform a decision – and an agreement with the client – regarding the treatment of the remains to ensure their preservation. The preferred mitigation option should be in situ preservation but where that is not feasible or desirable relative to the significance of the remains, preservation by record may be necessary (including full excavation of remains).

11 Report and Archive Preparation

11.1 The results of the geoarchaeological borehole survey and initial scientific dating will be detailed in a report, followed by a further report on the subsequent palaeoenvironmental assessment. Both

reports will be prepared in accordance with AOC Archaeology's standard procedures. The initial report will be produced within six weeks of instruction on stage iii). Any subsequent assessment report will be produced within a minimum of 12 weeks of instruction on stage iv). A list of the potential specialists that may be used in this and/or any later stages is presented in Appendix D.

11.2 The reports will include as a minimum:

- A concise non-technical summary of the results of the work, and its aims and objectives.
- A frontispiece including the site code/project number, planning reference number, dates when the fieldwork took place and a full National Grid Reference
- A full descriptive text detailing the aims and objectives of the project, methodologies employed, the work undertaken, and the results obtained, including a full discussion of the features identified and an interpretation of their date and purpose.
- All text will be cross-referenced with plans, photographs and other illustrative material
- The interpretation will be phased, where possible, and the results placed in a local and regional context.
- The results of the initial scientific dating and any specialist assessments will be considered and incorporated into the relevant stage iii) and iv) reports (including laboratory certificates of any scientific dating).
- A location plan of the site including plans of the areas of investigation.
- Plans and sections at an appropriate scale showing features, deposits and extent of archaeology identified.
- Appropriate lists and diagrams summarising the contexts and artefacts recovered, and the records made of them.
- A table summarising the deposits, features, classes and numbers of artefacts encountered and spot dating of significant finds.
- Proposals and recommendations for any further works.
- A description of the site archive and the name of the institution with which it will be deposited.
- A summary of the OASIS form.

11.3 The report will involve a geoarchaeological deposit model, which will include as a minimum:

- Inputting representative deposit logs of both borehole and trench type interventions from inside/the vicinity of the site into a site-wide deposit database, where one already exists it should be maintained and updated.

- Illustrations of representative profiles/transects and surface/thickness plots across the site or surrounding area.

- An evaluation of the geoarchaeological/palaeoenvironmental potential of the site-wide deposit sequence, and therefore the preliminary potential of any geoarchaeological samples, if retrieved and prior to explicit palaeoenvironmental (e.g. post-excavation) assessment by specialists.

11.4 Copies of reports will be issued to Allison Williams at North Lincolnshire Council for approval, whilst a paper and hard copy will be supplied to North Lincolnshire HER, on the understanding that it will become a public document after an appropriate period of time.

11.5 Publication of the results will be pursued. Should archaeology be encountered that may warrant further dissemination, AOC will seek to implement a scheme of public outreach to be agreed with all parties. This may include a press release, social media, displays for local libraries/museums and public talks

11.6 An OASIS form has been initiated (Appendix C). This will be completed and an electronic copy of the report deposited with the Archaeological Data Service (ADS).

Archive Preparation

11.7 The site archive will comprise all artefacts, ecofacts and written and drawn records. It will be consolidated after completion of the project, with records and finds collated and ordered as a permanent record. Archaeological finds rarely have any monetary value, but they are an important source of information for future research, included in museum exhibits and teaching collections. The Chartered Institute of Archaeologists (CIfA 2014e) and the Society of Museum Archaeologists (SMA 1993, 1995) recommend that finds are publicly accessible and that landowners donate archaeological finds to a local museum. It is proposed that the entire archive (including any finds) will be deposited with an appropriate museum repository, to be agreed with North Lincolnshire Council.

11.8 In the event of the legal owner(s) resolving to retain all or part of the site archive, they shall be responsible for the future preservation and maintenance of any material element of that archive. That part of the site archive in question, shall be transferred to the legal owner only after all necessary processing, research, analysis and investigative/stabilising conservation and correct packing necessary to prepare the archive for preservation and in a usable, accessible form, and to produce a full report for publication, has been completed. The owner shall ensure that all necessary provision is made for the long-term preservation of the archive in a satisfactory environment, and that it is accessible for future research. AOC will ensure that a proper record of material is kept by the landowner shall be included in the written archive and public record. The explicit (written) permission of the owner shall be obtained in order that the Data Protection Act 1984 is not contravened.

11.9 In the case where finds are retained, landowner consent will be required to allow transfer of the finds to the local museum. A Deed of Transfer will be drawn up by the museum for signing by the landowner. The complete finds inventory and further finds information can be provided to the

landowner, on request.

11.10 The site archive will be deposited with the local museum within one year of the completion of fieldwork (if no further work is required). It will then become publicly accessible. A digital copy of the archive will be submitted and deposited with ADS Oasis.

12 Health and Safety

12.1 AOC Archaeology maintains the highest standards of health and safety, both on-site and in our premises, and a copy of our Health and Safety Policy can be supplied on request. The project outlined in this WSI will be carried out in accordance with safe working practices and under the defined Health and Safety Policy. A site specific Risk Assessment/Method Statement (RAMS) will be prepared prior to the commencement of the fieldwork.

12.2 Health and Safety will take priority over all other requirements. A conditional aspect of all archaeological work is both safe access to the area of work and a safe working environment.

12.3 The Construction (Design and Management) Regulations 2015 (CDM) may apply to the archaeological work depending on whether contractors other than the archaeological team are present on the site.

12.4 Where AOC Archaeology is not the main contractor on site, the main contractor's Risk Assessment will have primacy over the AOC Archaeology document given that:

12.5 The main contractors' risk assessment takes account of AOC Archaeology's working practices and does not compromise normal and safe archaeological procedure as set out in the WSI and Risk Assessment.

12.6 AOC Archaeology is notified of the full suite of hazards present prior to arriving on site.

12.7 There is a proper induction and monitoring process in place and AOC Archaeology staff have been through this process.

12.8 There is no significant conflict between AOC Archaeology health and safety procedures and those proposed by the main contractor.

12.9 AOC Archaeology is made aware of new threats or hazards as they arise.

12.10 Where archaeological work is carried out at the same time as the work of other contractors, regard will be taken of any reasonable additional constraints that these contractors may impose.

12.11 The client will provide any available service plans for the site prior to the commencement of fieldwork. It is expected that the client's Principal Contractor will scan excavation areas with a Cable Avoidance Tool prior to excavation.

12.12 Staff present on site will be required to wear the appropriate Personal Protective Equipment (PPE), which will be issued as necessary. Welfare facilities will be provided by the Principal Contractor.

12.13 Where previous works have identified the presence of contaminated ground, AOC Archaeology

must be notified of the nature and extent of the contamination in advance of the fieldwork and given guidance as to the appropriate Health and Safety precautions required. Where these precautions comprise more than the use of thin over-suits and nitrate gloves, AOC Archaeology reserves the right to charge the client for the purchase of the necessary PPE and RPE.

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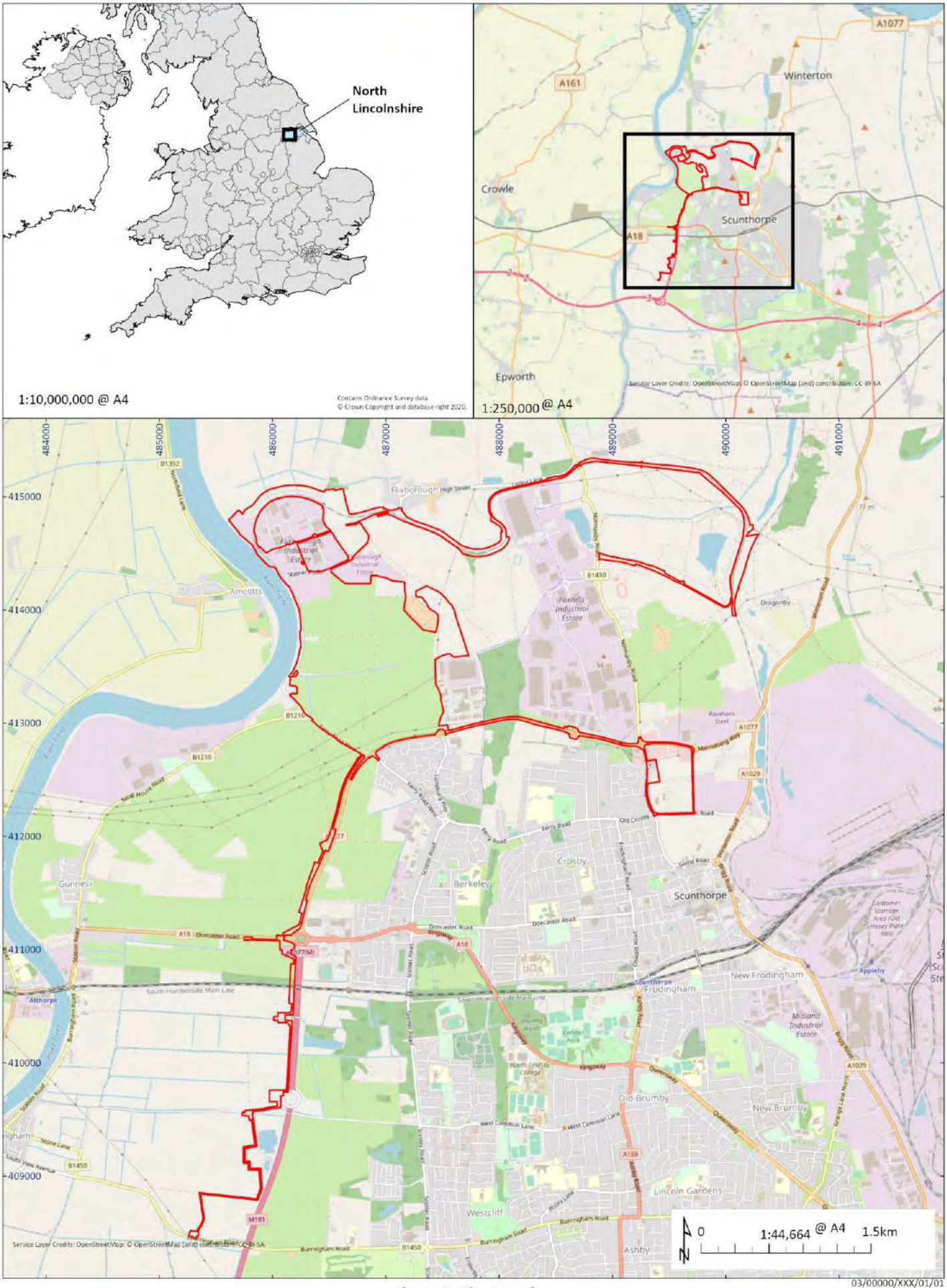

Figure 1: Site Location

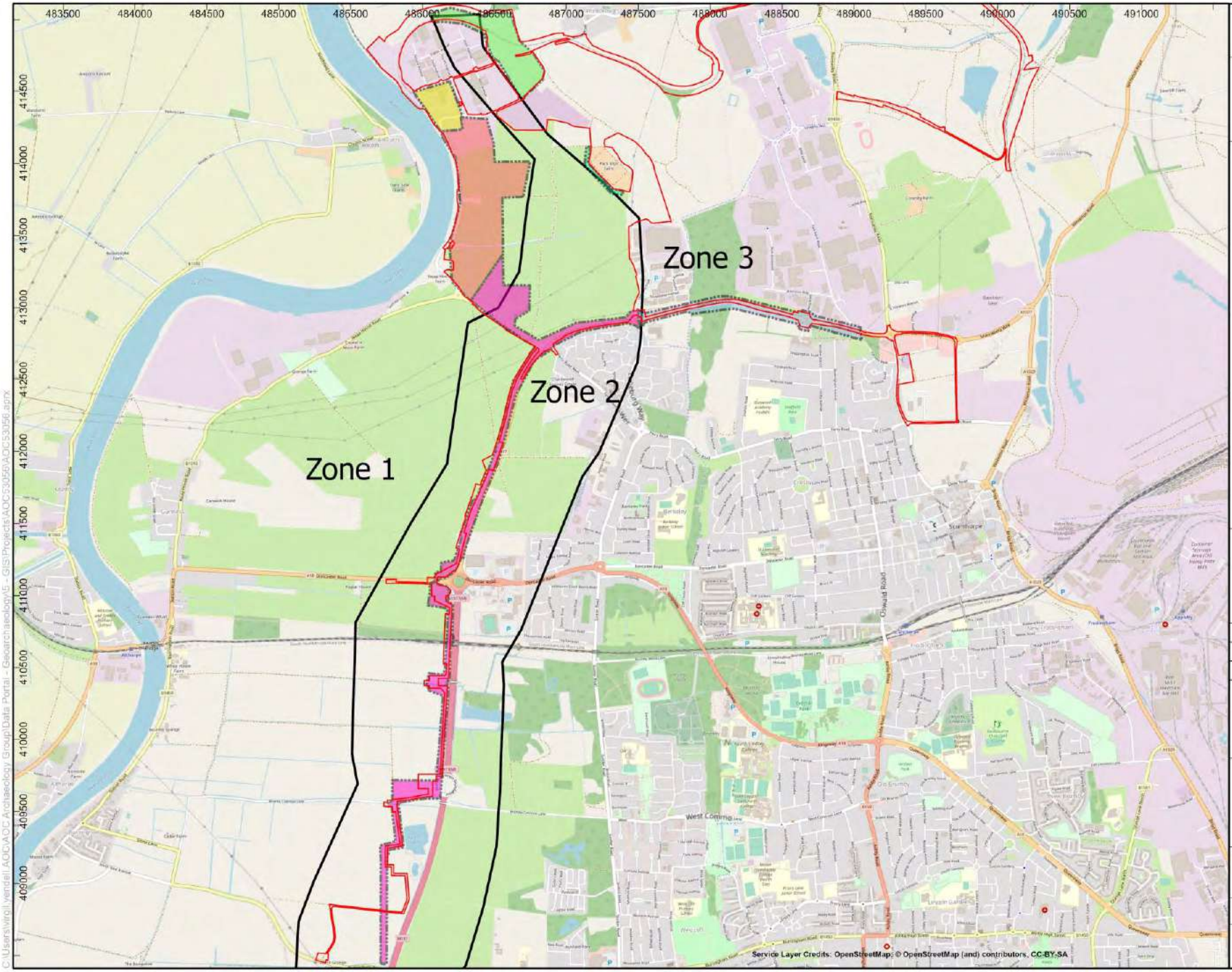

Figure 2

Archaeological Zones and Impact Areas

Legend

Order Limits

Layer

Impact Areas March 2022

- Impact Area 1
- Impact Area 2
- Impact Area 3
- Impact Area 4
- Impact Area 5
- Impact Area 6

ERM
2nd Floor Exchequer Court
33 St Mary Axe,
London
EC3A 8AA

Drawn/checked:	VY/
DWG no:	N/A
AOC Project No.:	53056

AOC Archaeology Group

N

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:25,000 @ A3

0 1,000m

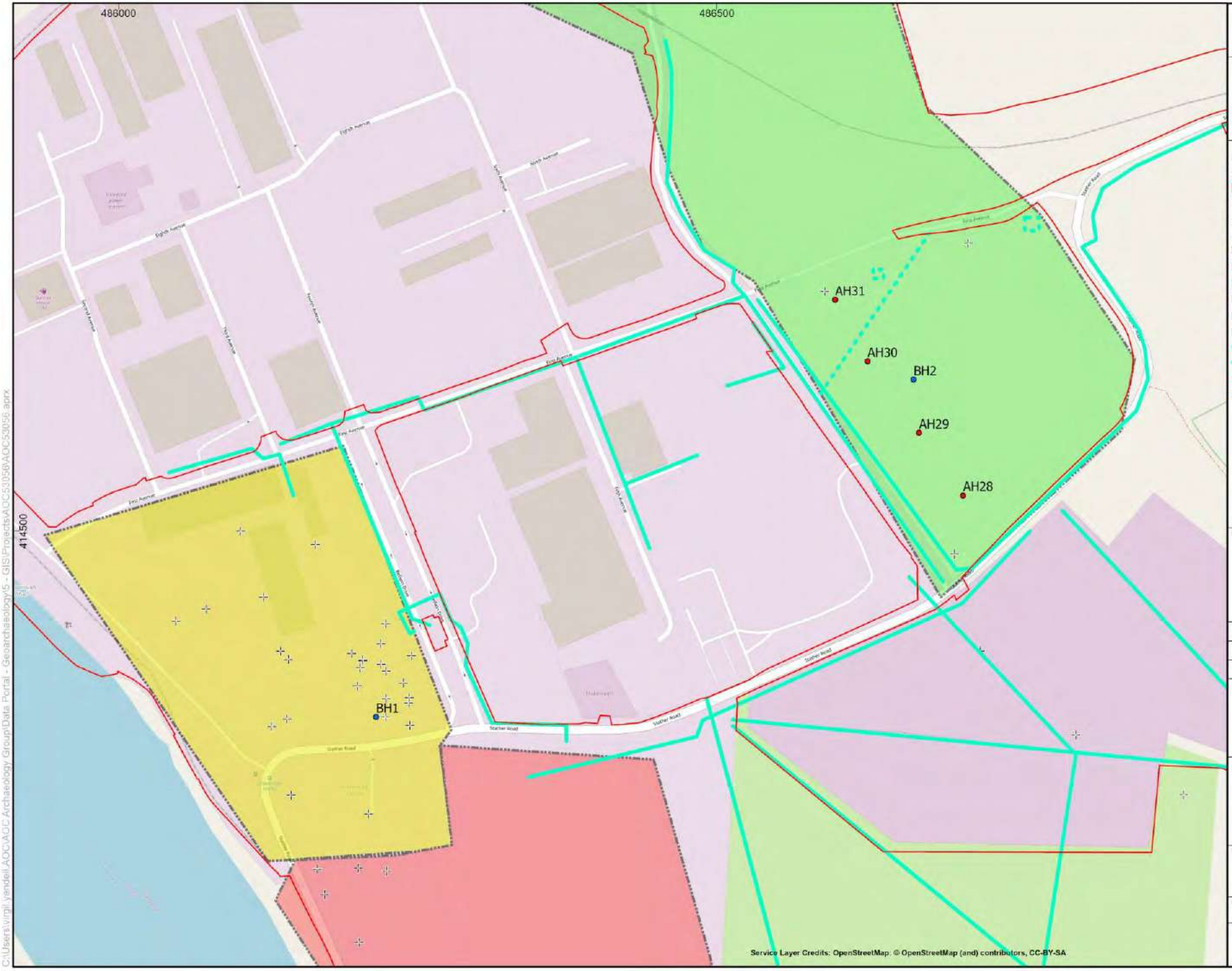

Figure 3

Proposed interventions in IA1 IA4

Legend

- Data Points
- Order Limits

Layer

Impact Areas

- Impact Area 1
- Impact Area 2
- Impact Area 3
- Impact Area 4
- Impact Area 5
- Impact Area 6
- Services mapped
- Services unmapped
- Proposed augerholes March 2022
- Proposed boreholes March 2022

FOR

ERM
2nd Floor Exchequer Court
33 St Mary Axe,
London
EC3A 8AA

Drawn/checked:	VY/
DWG no:	N/A
AOC Project No.:	53056

AOC Archaeology Group

N

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:3,000 @ A3

0 100m

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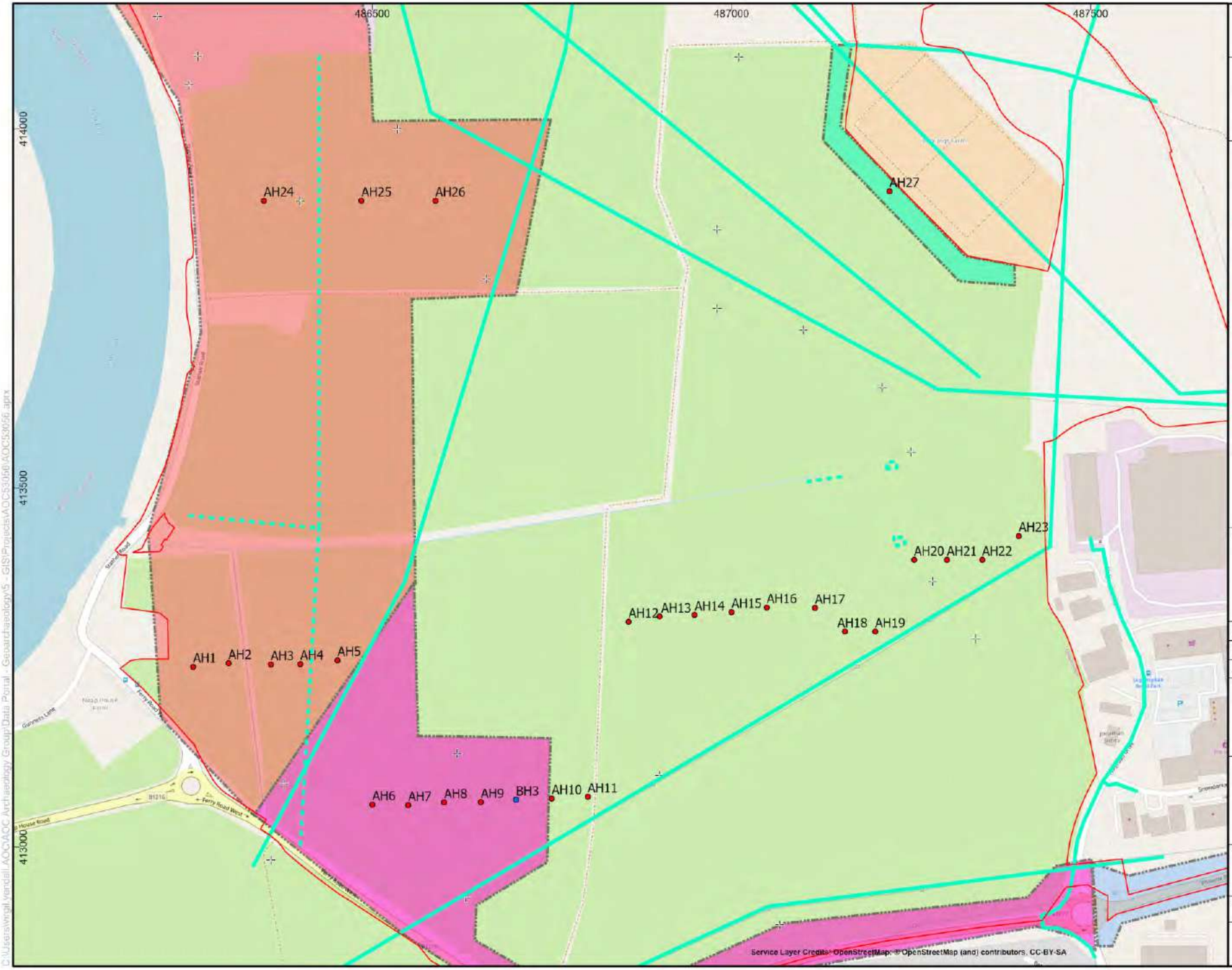

Figure	4

Proposed interventions in IA2, north of IA3, and IA6

Legend

- Data Points
- Order Limits

Layer

Impact Areas

- Impact Area 1
- Impact Area 2
- Impact Area 3
- Impact Area 4
- Impact Area 5
- Impact Area 6
- Services mapped
- Services unmapped
- Proposed augerholes March 2022
- Proposed boreholes March 2022

FOR

ERM
2nd Floor Exchequer Court
33 St Mary Axe,
London
EC3A 8AA

Drawn/checked:	VY/
DWG no:	N/A
AOC Project No.:	53056

AOC Archaeology Group

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

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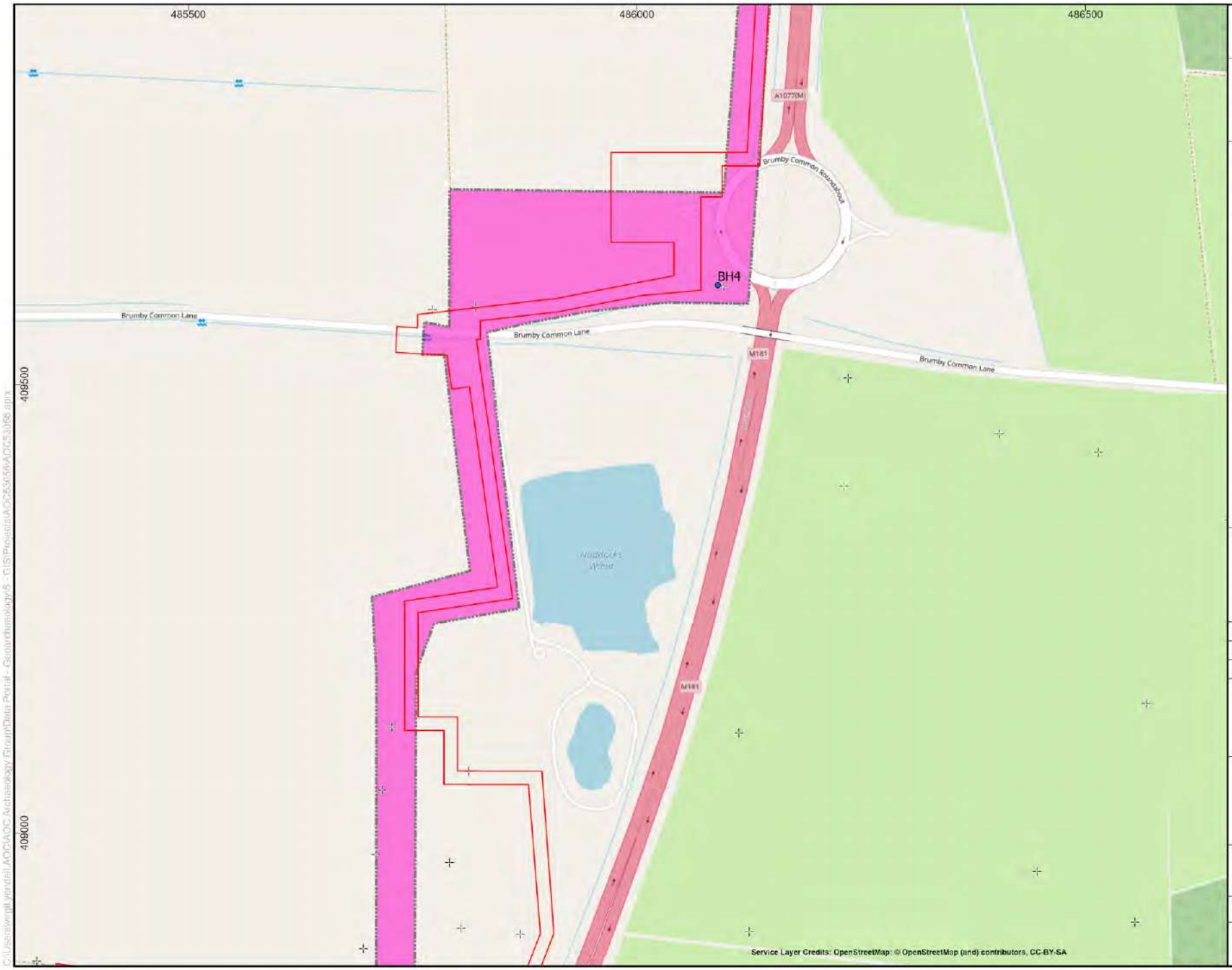

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Figure 5

Proposed interventions in the south of IA3

Legend

- Data Points
- Order Limits

Layer

Impact Areas

- Impact Area 1
- Impact Area 2
- Impact Area 3
- Impact Area 4
- Impact Area 5
- Impact Area 6
- Services mapped
- Services unmapped
- Proposed augerholes March 2022
- Proposed boreholes March 2022

FOR

ERM
2nd Floor Exchequer Court
33 St Mary Axe,
London
EC3A 8AA

Drawn/checked:	VY/
DWG no:	N/A
AOC Project No.:	53056

AOC Archaeology Group

N

SYSTEM

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Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

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0 100m

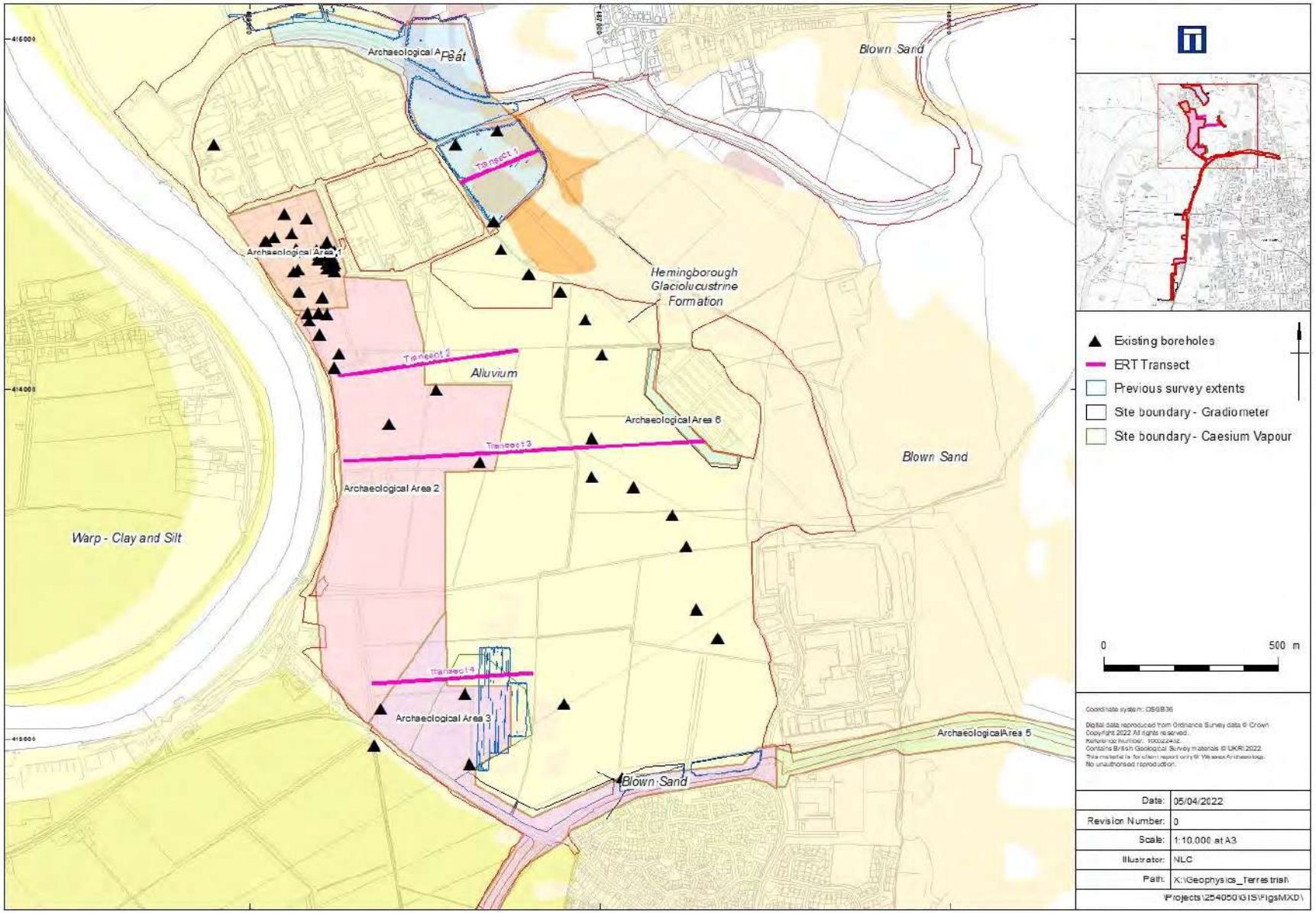

Figure 6: ERT transects and location of previous geophysical surveys

Appendices

14 Appendix A – General

Insurances

1. AOC holds Employers Liability Insurance, Public Liability Insurance and Professional Indemnity Insurance. Details can be supplied on request.

2. AOC will not be liable to indemnify the client against any compensation or damages for or with respect to:

   - damage to crops being on the Area or Areas of Work (save in so far as possession has not been given to the Archaeological Contractor)
   - the use or occupation of land (which has been provided by the Client) by the Project or for the purposes of completing the Project (including consequent loss of crops) or interference whether temporary or permanent with any right of way light air or other easement or quasi easement which are the unavoidable result of the Project in accordance with the Agreement
   - any other damage which is the unavoidable result of the Project in accordance with the Agreement
   - injuries or damage to persons or property resulting from any act or neglect or breach of statutory duty done or committed by the client or his agents servants or their contractors (not being employed by AOC Archaeology or for or in respect of any claims demands proceedings damages costs charges and expenses in respect thereof or in relation thereto

3. Where excavation has taken place trial pits will be backfilled with excavated material but will otherwise not be reinstated unless other arrangements have previously been agreed. Open area excavations normally will not be backfilled but left in a secure manner unless otherwise agreed.

Copyright and Confidentiality

4. AOC Archaeology will retain full copyright of any commissioned reports, tender documents or other project documents under the Copyright, Designs and Patents Act 1988 with all rights reserved; excepting that it will provide an exclusive license to the Client in all matters directly relating to the project as described in the Written Scheme of Investigation.

5. AOC will assign copyright to the client upon written request but retains the right to be identified as the author of all project documentation and reports as defined in the Copyright, Designs and Patents Act 1988.

6. AOC will advise the Client of any such materials supplied in the course of projects, which are not AOC's copyright.

7. AOC undertake to respect all requirements for confidentiality about the Client's proposals provided that these are clearly stated. In addition AOC further undertakes to keep confidential

any conclusions about the likely implications of such proposals for the historic environment. It is expected that Clients respect AOC's and the Institute of Field Archaeologists' general ethical obligations not to suppress significant archaeological data for an unreasonable period.

Standards

8. AOC conforms to the standards of professional conduct outlined in the Institute of Field Archaeologists' Code of Conduct, the IFA Code of Approved Practice for the Regulation of Contractual Arrangements in Field Archaeology, the IFA Standards and Guidance for Desk Based Assessments, Field Evaluations etc., and the British Archaeologists and Developers Liaison Group Code of Practice.

9. Where practicable AOC will liaise with local archaeological bodies (both professional and amateur) in order that information about particular sites is disseminated both ways (subject to client confidentiality).

15 Appendix C – Origin and Purpose of Deposit Modelling in Archaeology

15.1 The purpose of a geoarchaeological deposit model as outlined by Historic England (HE 2020) is to:

- identify areas of low or high archaeological potential
- avoid blanket evaluation coverage and inform appropriate mitigation strategies
- aid communication with construction professionals
- facilitate palaeoenvironmental reconstruction

15.2 The character and distribution of past human activity can be better understood through the consideration of the past landscape or environmental context. Such an approach is often required by archaeological advisors and the local planning authority on floodplains where the deposit sequence can vary from thin alluvium or peat, with shallowly exposed ancient land surfaces, to complex and thick sequences of interchanging alluvium and peat, covering deeply buried ancient land surfaces.

15.3 The topography and nature of the ancient land surface during the early Holocene, the current geological epoch and equivalent to the early Mesolithic (c. 11,500 BP or 10,000 BC), is dictated by and inferred from the surface of the Pleistocene superficial deposits (the previous epoch) and older solid geology (e.g. mudstone, brickearth, gravel or chalk). Overlying the Pleistocene – or older – deposits, Holocene alluvium may preserve palaeoenvironmental evidence (e.g. pollen, diatoms, ostracods) of landscape development, from local channel migration and vegetation change to regional effects of climate and relative sea level (RSL) change. In combination, likely preservation of palaeoenvironmental remains and deposit data (e.g. depth and character) provides a comparative framework to assess archaeological potential. Peat represents vegetated and waterlogged landscapes (e.g. marshland) which developed, within local or regional fluctuations of hydrology. The anaerobic and acidic conditions of the deposit are particularly conducive to organic preservation. Palaeoenvironmental remains from floodplain deposits, especially peat, provide information on the nature and timing of environmental change and the interplay with past human activity (HE 2015a, 2015b).

15.4 Modelling software (Rockworks & ArcGIS) is often used to create two and three-dimensional deposit models of the buried topography and overlying strata on the site. The data used may be readily available British Geological Survey (BGS 2020) geological information, recent geotechnical data from the client, or data past archaeological investigations. The depth and distribution of the various deposits is mapped in schematic cross-sections (transects) or plan, showing the elevation (Digital Elevation Model, DEM) or thickness (Isopach), of deposits or stratigraphic units. The model often culminates in schematics maps showing areas of archaeological potential.

16 Appendix D – Specialist Staff

The following specialist staff may be used on this project depending on the type of artefacts and soil samples recovered during the course of the fieldwork.

Building material	Les Capon	AOC
Conservation	Gretel Evans	AOC
Geoarchaeology	Virgil Yendell	AOC
Glass	TBC	AOC
Human remains	Mara Tesorieri	AOC
Lithics	Jon Cotton	Freelance
Macroscopic plant remains	TBC	Freelance
Mammal and bird bone	Jackie Robertson	AOC
Medieval	Peter Thompson	Archaeological Solutions
Metal	Dawn McLaren	AOC
Palaeoenvironmental archaeology	Paula Milburn	AOC
Post-medieval pottery	Kylie McDermott	AOC
Prehistoric pottery	John Cotton	Freelance
Roman pottery	Anna Doherty	ASE

AOC Archaeology Group, **Unit 7, St Margarets Business Centre, Moor Mead Road, Twickenham TW1 1JS**
tel: **020 8843 7380** | fax: **020 8829 0549** | e-mail: **london@aocarchaeology.com**

[redacted]

APPENDIX F ARCHAEOLOGICAL TRIAL TRENCH EVALUATION WSI

North Lincolnshire Green Energy Park

Archaeological Evaluation, Written Scheme of Investigation

26 May 2022

Project No.: EN010116

The business of sustainability

ERM

Document details	
Project title	North Lincolnshire Green Energy Park
Document title	Archaeological Evaluation, Written Scheme of Investigation
PINS No.	EN010116
Date	26 May 2022
Version	03
Author	Charles Arthur
Client Name	North Lincolnshire Green Energy Park

Document history

				ERM approval to issue		
Version	Revision	Author	Reviewed by	Name	Date	Comments
Draft	01	Charles Arthur	Charles Le Quesne		25/02/22	DRAFT
Draft	02	Charles Arthur			15/03/22	DRAFT
Draft	03	Charles Arthur			26/05/22	DRAFT

CONTENTS

LIST OF FIGURES

1. EXECUTIVE SUMMARY

This document provides a generic Written Scheme of Investigation (WSI) for archaeological trial trenching evaluation at the proposed the North Lincolnshire Green Energy Park (NLGEP).

Solar 21 proposes to construct a multi-technology integrated energy park, the North Lincolnshire Green Energy Park (NLGEP) on land at and to the south of Flixborough Wharf and Industrial Estate, near Scunthorpe.

A total of one hundred and eighty-two trenches are proposed. Sixty-seven of which are aimed at assessing the archaeological potential of possible features identified through geophysical survey. One trench is positioned to test a historically known location and a further one hundred and fourteen trenches to evaluate areas that have not been subjected to geophysical survey and do not contain currently known sites.

Together with a complementary geoarchaeological evaluation (AOC, 2022), these trenches will inform the extent and nature of further investigations to evaluate the archaeological potential of the Project site.

The archaeological work that this WSI describes is anticipated to be a 90-day programme of work.

The area of investigation lies within the administrative boundary of North Lincolnshire Council (NLC), which is advised on archaeological matters by Alison Williams, the Historic Environment Officer.

2. INTRODUCTION

2.1 General

2.1.1.1 This document provides a generic Written Scheme of Investigation (WSI) for an archaeological trial trenching evaluation at the proposed Lincolnshire Green Energy Park (NLGEP), near Scunthorpe (Figure 1). The archaeological trial trench evaluation, part of a broader historic environment assessment that includes a Historic Environment Desk Based Assessment (ERM 2021), geoarchaeological investigation (AOC 2021) and deposit modelling, and geophysical survey (Wessex Archaeology 2022), is aimed at assessing the archaeological potential of the Project Impacts.

2.1.1.2 Together with a complimentary geoarchaeological evaluation (AOC 2022), these trenches will inform the extent and nature of further investigations that may be required to evaluate the archaeological potential of the Project site, including additional trial trenching and the pre-construction (mitigation) phases of archaeological works.

2.1.1.3 At the time of writing of this WSI, the geoarchaeological evaluation (AOC 2022) is ongoing. Only preliminary results were available to inform the strategy of trial trench evaluation described here. As such, the extent and location of the trial trench evaluation described will be reviewed when these results are fully reported.

2.1.1.4 A total of one hundred and eighty-two trenches are proposed. Sixty-seven of which are aimed at assessing the archaeological potential of possible features identified through geophysical survey. One trench is proposed to test a historically known location and a further one hundred and fourteen trenches to evaluate areas that have not been subjected to geophysical survey and do not contain currently known sites.

2.2 Project Description

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

2.2.1.2 The NSIP incorporates a switchyard, to ensure that the power created can be exported to the National Grid or to local businesses, and a water treatment facility, to take water from the mains supply or recycled process water to remove impurities and make it suitable for use in the boilers, the CCUS facility, concrete block manufacture, hydrogen production and the maintenance of the water levels in the wetland area. The main project elements are shown in Figure 3.The overarching aim of the Project is to support the UK’s transition to a low carbon economy as outlined in the Sixth Carbon Budget (December 2020), the national Ten Point Plan for a Green Industrial Revolution

(November 2020) and the North Lincolnshire prospectus for a Green Future. It will do this by enabling circular resource strategies and low-carbon infrastructure to be deployed as an integral part of the design (for example by reprocessing ash, wastewater and carbon dioxide to manufacture concrete blocks and capturing and utilising waste-heat to supply local homes and businesses with heat via a district heating network).

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

- a bottom ash and flue gas residue handling and treatment facility (RHTF)
- a concrete block manufacturing facility (CBMF)
- a plastic recycling facility (PRF)
- a hydrogen production and storage facility
- an electric vehicle (EV) and hydrogen (H2) refuelling station
- battery storage
- a hydrogen and natural gas above ground installations (AGI)
- a new access road and parking
- a gatehouse and visitor centre with elevated walkway
- railway reinstatement works including, sidings at Dragonby, reinstatement and safety improvements to the 6km private railway spur, and the construction of a new railhead with sidings south of Flixborough Wharf
- a northern and southern district heating and private wire network (DHPWN)
- habitat creation, landscaping and ecological mitigation, including green infrastructure and 65-acre wetland area
- new public rights of way and cycle ways including footbridges
- Sustainable Drainage Systems (SuDS) and flood defence
- utility constructions and diversions.

2.3 Planning background and requirements

2.3.1.1 The Project is classed as a Nationally Significant Infrastructure Project (NSIP) and therefore a Development Consent Order (DCO) is required under the Planning Act 2008. The current document and the archaeological evaluation that it describes is part of the DCO Process.

2.4 Standards and Guidance

2.4.1.1 This document conforms to the following UK standards, guidance and policy:

- Chartered Institute for Archaeologists 2019. *Code of Conduct*.
- Chartered Institute for Archaeologists 2021. *Code of Conduct*: *professional ethics in archaeology.*

- Chartered Institute for Archaeologists 2019. *Standard and guidance for archaeological advice by historic environment services*.
- Chartered Institute for Archaeologists 2020. *Standards and guidance for archaeological excavation*.
- Chartered Institute for Archaeologists 2020. *Standard and guidance for archaeological field evaluation*.
- Chartered Institute for Archaeologists 2020. *Standard and guidance for the creation, compilation, transfer and deposition of archaeological archives*.
- Chartered Institute for Archaeologists 2020. *Standards and guidance for commissioning work or providing consultancy advice on archaeology and the historic environment*.
- Chartered Institute for Archaeologists 2020. *Standards and guidance for the collection, documentation, conservation and research of archaeological materials*.
- Chartered Institute for Archaeologists 2017. Updated guidelines to the standards for recording human remains.
- Historic England 2007 Geoarchaeology: Using Earth Sciences to Understand the Archaeological Record.
- Historic England, 2011, Environmental Archaeology: A Guide to the Theory and Practice of Methods, from Sampling and Recovery to Post-Excavation (Second Edition).
- Historic England, 2015, Management of Research Projects in the Historic Environment. Archaeological Excavation (PPN3).
- Historic England, 2015, Environmental Archaeology.
- Historic England [formerly English Heritage], 2004, Human Bones from Archaeological Sites: Guidelines for Producing Assessment Documents and Analytical Reports.
- United Kingdom Institute for Conservation 1983. *Packaging and storage of freshly excavated artefacts from archaeological sites*.

2.4.2 Planning & Policy

- National Policy Statements EN-1 and EN-3.
- Ancient Monuments and Archaeological Areas Act 1979 (amended by the National Heritage Act 1983 and 2003.
- Planning (Listed Buildings and Conservation Areas) Act 1990 (amended by the Enterprise and Regulatory Reform Act 2013).
- National Planning Policy Framework Section 16 (MHCLG, 2021).
- North Lincolnshire Core Strategy (North Lincolnshire Council (NLC, 2011).
- Planning for Renewable Energy Development Supplementary Planning Document (2011) - Policy 4 Heritage Assets.

- North Lincolnshire Local Plan (NLC, 2003) (Saved Policies, 2007).

3. BACKGROUND

3.1 Geology

3.1.1.1 The British Geological Survey (BGS) indicates that the Site has an underlying bedrock composed of Mudstone. A north-south aligned mudstone ridge dominates the geology of the study area, lying to the east by, and upon which the historic settlements of Flixborough, Crosby and Scunthorpe are situated. The mudstone and Ironstone bedrocks are shallow to full marine deposits from the Triassic (c. 251-201 Mya) was and Jurassic (c. 201-145 Mya). The mudstone ridge forms the eastern edge of the meandering Trent Valley, which is filled with deep Holocene (12,000 years ago - present) alluvium (clay, silt, sand, and peat) and overall represents uniform to varied riverine deposition across a floodplain. The eastern edge of the valley and west side of the mudstone ridge is characterised by thick drifts of 'windblown sand', which appear to have derived from late glacial sands (BGS 2021) and in some cases are overlain by alluvium. The sand, occasionally classified as Sutton Sand Formation, is a fine silty sand formed during the Devensian to Holocene (115 thousand years ago onwards) and represents an aeolian or wind-blown redeposition of underlying glaciolacustrine deposits or bedrock.

3.2 Archaeological and historical background

3.2.1.1 For full background and gazetteer, see Historic Environment Desk-based Assessment (DBA, ERM 2021). See Figure 3b for the location of gazetteer sites mentioned in the text below.

3.2.1.2 Only a single find of Palaeolithic date (1,000,000-10,000 BC) has been made within the DBA study area (1 km around the Order Limits), reflecting the significant landscape changes that have taken place during the Holocene period. A number of Mesolithic (10,000-4,000BC) flint tool assemblages have been found in the windblown sand deposits overlooking the Trent Valley. The absence of Mesolithic sites in the valley itself, however, suggests they are likely to be deeply buried under alluvium (if indeed, they have survived subsequent fluvial erosion), although it may also be an accurate reflection of settlement patterns as higher lying and drier ground would have been attractive to hunter-gatherers. A similar pattern is observable for finds of Neolithic date (4,000-2,200 BC). Evidence of Neolithic settlement has been found in the aeolian sands to the east of the ERF site, including at Flixborough (site 4) 200m east of Order Limits.

3.2.1.3 There are many Bronze Age sites and findspots within the study area: again all are on the higher lying aeolian sands to the east of the alluvial deposits of the Trent Valley, including material from the Flixborough sand quarry. This site also produced evidence of Iron Age metalworking, burials and pits. Evidence for Iron Age settlement was also recovered from the Flixborough excavations at North Conesby, immediately east of Order Limits and west of the scheduled area of ‘Flixborough Nunnery’. In contrast to the earlier prehistoric period, though, there is evidence of cropmarks suggesting possible Iron Age

settlement on the fringes of the floodplain, lying within Order Limits (sites 9-14).

3.2.1.4 The evidence for Roman settlement within the study area again derives largely from the high ground to the east, with the main focus of settlement located at Dragonby. Roman material has been found immediately to the east of the proposed Gas AGI, including on the site of the former Flixborough sand quarry (sites 4,84 & 5). The cropmark enclosure sites within Order Limits on the eastern edge of the floodplain, could as easily date to the Roman period as to the Iron Age (sites 9-14). No Roman material has been found to date on the floodplain part of the study area (though a bog body of late Roman date was recovered from Amcotts in the nineteenth century).

3.2.1.5 The scheduled medieval settlement of North Conesby excavated between 1989 and 1991, is commonly referred to as Flixborough Nunnery, although it is neither at Flixborough nor is it likely to represent the remains of a nunnery. The scheduled site lies c.500m south of Flixborough village and the remains found within it, dating from the 8th-9th centuries AD, are of a settlement of some 39 buildings with evidence for literacy in the form of numerous styli (metal writing instruments). The scheduled area (sites 78, 82, 83) lies a short distance east of the Order Limits. The early medieval settlement here continued into the Norman period, when All Saints Church served the village of North Conesby (a deserted medieval village).

3.2.1.6 Many of the villages in the vicinity of the study area have medieval or early medieval origins, including Flixborough and Conesby and, to the west of the Trent, Amcotts. It is in the medieval period that there is the first substantial evidence for settlement in the floodplain, with documentary evidence indicating that Flixborough Staithe (site 7) was in existence by the fourteenth century at the latest. As in later centuries this was probably both a ferry crossing and a river port serving the village on the high ground to the east. Neap House (site 113) could also mark the site of a medieval riverside settlement, connected to Conesby on the higher ground to the east by a trackway. The river valley remained largely undrained throughout this period, providing rich grazing land for cattle and sheep during the summer months, but prone to flooding throughout the winter.

3.2.1.7 The landscape of the floodplain was transformed from the seventeenth century onwards by widespread drainage schemes. In the later eighteenth century these were enhanced to enable warping of the low-lying fields of the valley. The drainage of the floodplain enabled the development of scattered farms in the valley. Within the area of the Order Limits, though, there was little further change until the twentieth century. Early mapping shows the Ferry Boat Inn beside the ferry landing on the Flixborough side of the ferry crossing to Amcotts (site 7).

3.2.1.8 Change came with the creation of steelworks at Normanby in 1905, which were served by a light mineral railway connecting to Flixborough Staithe, which led to the gradual development of industrial facilities by the river. The iron ore for the steelworks came from ironstone mines at Dragonby, and spoil heaps from the works eventually overflowed across much of the deserted

settlement of North Conesby. In the post-war period a nitrogen fertilizer factory was built beside the river wharf, where an accident in 1974 caused an explosion which devastated the industrial estate, killing 28 people. The historic Ferry Boat Inn, which stood more or less in the location of the entrance to river wharf today, appears to have been destroyed at this time. The wooden remains of the historic ferry jetty (site 132) are believed to survive on the river front just outside the Order Limits.

3.3 Previous archaeological work

3.3.1.1 The following investigations undertaken within and on the periphery of the current Project area are relevant to the proposed work in this WSI.

Lincolnshire Lakes

3.3.1.2 Located immediately to the east of the M181, adjacent to the southern 1.2 km of the DHWPN route of the current project, a geophysical survey and trial trench evaluation was conducted by AOC Archaeology (2017a, 2017b). Upper and lower peat deposits were identified, above and below a sand. Post medieval warping deposits were also identified. Monolith samples from one trench revealed well preserved pollen. The lower peat was dated to the Mesolithic, consistent with the results from the adjacent Brumby Common West site.

Brumby Common Lane

3.3.1.3 Located 300m west of the M181, this site has been subject to palaeoenvironmental assessment of borehole samples from which a detailed deposit model was constructed. A watching brief of geotechnical test pits was also undertaken (Allen Archaeology 2015c, 2015d, 2015e).

3.3.1.4 These investigations identified the potential for the survival of prehistoric ground surfaces buried at depth across the site, as well as peats of some palaeoenvironmental potential sealed by post medieval warping deposits. No archaeological features or artefacts were identified in the watching brief but recommendations were made for the location of evaluation trenches.

3.3.1.5 The northern and eastern part of the Brumby Common Lane site overlaps with the proposed route for the DHWPN.

Brumby Common West

3.3.1.6 Located on either side of the M181, north of Brumby Common Lane, this site has been subject to desk-based assessment (Prospect Archaeology 2014), field walking and metal detecting (Allen Archaeology 2015a), geophysical surveys (Allen Archaeology 2015b, 2015c) and an archaeological evaluation. The evaluation consisted of seventeen trial trenches aimed at testing anomalies from the 2015 geophysical survey and evaluating other parts of the

site. Sixty-nine hand-dug test pits were also excavated to investigate the geological deposits on the site.

3.3.1.7 Some linear features were identified likely connected to modern agricultural activities or warping activities. Peat deposits indicative of wetland margins were identified in a number trenches, the deepest of which was 1.10m thick (1.96 to 0.86m BGL). Geoarchaeological and palaeoenvironmental analysis was undertaken on a column sample from one trench on the east side of the M181 (Trent and Peak Archaeology 2021). The peat was shown to date from the Mesolithic to the early Bronze Age. Considerable variation in the underlying sub-surface topography suggests areas of intermittent deep sedimentation within depressions in the underlying Sutton Sands, rather than a single blanket peat deposit.

3.3.1.8 The western half of the Brumby Common West Site partially overlaps with the proposed route for the DHWPN.

3.4 Development Areas

3.4.1.1 The Project site has been divided into six different Development Areas (also referred to in other Project documents as Impact Areas), the locations of which are shown in Figure 2.

3.4.2 Area 1

3.4.2.1 Area 1 (A1) comprises the location of the proposed ERF plant and the CCUS at the south-western corner of the Flixborough Industrial Estate. The Bunker Hall lies within the footprint of A1 which will require the excavation of a shaft up to 10m below current ground surface.

3.4.2.2 During the Desk Based Assessment as part of the current Project, Area 1 was found to cover much of the former site of Flixborough Staithe (site 7), the medieval and post medieval river port, including the former site of the Ferry Boat Inn. The 1778 estate map shows detail of the historic layout of this site where a small group of buildings stood to the east of the ferry wharf (site 132). One building stands immediately east of the ferry wharf with two long buildings further east on the north side of Staither Road. Later Ordnance Survey mapping identifies this group of buildings as Ferry Boat Inn, which was situated on and immediately south of the current entrance to the river port from Staither Road.

3.4.2.3 Ground Penetrating Radar (GPR) survey of this area in December 2021 as part of the current impact assessment successfully revealed a regular arrangement of buried structural remains that closely match building and road layouts shown on historical maps. These features have been numbered 6000–6007 (Wessex Archaeology 2022).

3.4.2.4 Using timeslice data, these results also demonstrate that the remains lie close to the surface, <0.5m below ground. Most significantly, in terms of assessing the archaeological potential of the area, the results indicate multiple building

alignments over several phases, and thus a high likelihood that buried medieval structures are present (Figure 2).

3.4.2.5 A1 lies in the floodplain, where there is also potential for older archaeological deposits to be buried under and within thick layers of alluvium. The ongoing geoarchaeological borehole survey carried out as part of the current Project's baseline investigation has identified peat deposits likely to date from the early Holocene to the Bronze Age buried under more than 5 metres of alluvium, and extending to 11m below ground level (BGL) (AOC pers. comm.).

3.4.3 Area 2

3.4.3.1 Area 2 (A2) covers the strip of land running south from the ERF site to the B1216. A concrete block manufacturing facility and a plastic recycling facility will be built at its northern end with a new Railhead, Visitor Centre and a new Access Road to the B1216, and the creation of wetland landscape to the south. As part of the wetland area, a number of ponds are also proposed for Area 2, which may involve the excavation of ponds. The location of these proposed ponds is not yet known.

3.4.3.2 Only one potential heritage asset was identified in A2 during the Desk Based Assessment. This is the former brick kiln, shown on the 1778 estate map to the south of the historic ferry crossing. Fieldwalking in 1997 for the Humber Wetland Project recovered a single flint flake at SE8642 1398 within Development Area 2 (NLHER ref MLS19348).

3.4.3.3 A2 lies in the floodplain, where there is potential for older archaeological deposits to be buried under and within thick layers of alluvium. The ongoing geoarchaeological borehole survey carried out as part of the current Project's baseline investigation has identified peat and organic clays between 2.28-2.38m BGL (AH24, near the proposed rail head), 1.25-2.7m BGL (AH26, near the proposed plastic recycling facility), and 0.7-1.05m BGL (AH27, under the proposed earthen bank).

3.4.4 Area 3

3.4.4.1 Area 3 (A3) stretches from the southern end of the core Project area and covers the Southern DHPWN and the western section of the Northern DWPWN (east of the junction of the B1216 and A1077). It mainly consists of a linear strip alongside existing roads but also encompasses the energy storage and refuelling station to the north of the B1216 and a number of wider areas alongside the DHPWN route for construction laydown and tunnel excavation. It extends over a total area of 43.6 hectares.

3.4.4.2 A number of sites were identified in and on the periphery of A3 during the Desk Based Assessment for the current Project, including two HER listed crop

marks identified through air photo analysis (sites 11 and 13), and a second World War searchlight battery (site 10).

3.4.4.3 Geoarchaeological modelling conducted as part of the current impact assessment has shown there is the potential for relatively shallow prehistoric/Roman remains to survive below alluvium in this area (AOC 2021).

3.4.4.4 Geophysical survey areas comprising a total of 5.5 ha within Area 3 identified a number of possible linear anomalies likely to be ditch features and several weakly positive, discrete anomalies, that may be pit features. These were found within four different parts of A3:

- Possible pits (3001) in the deep excavation area associated with the energy storage and refuelling station and adjacent hydrogen production plant.
- Possible pits (3008) on the DHPWN route immediately to the north of Ferry Road West. This area is located west of the junction between Ferry Road West (B1216) and the Phoenix Parkway (A1077).
- Possible pits (5002) in the WSW to ESE orientated part of A3. This area is located east of the junction between Ferry Road West (B1216) and the Phoenix Parkway (A1077).
- Possible pits (3006) and (3007) along the north-south aligned part of A3, immediately to the north west of the Frodingham Grange Roundabout. Previous archaeological investigations on the opposite east side of the A1077 to these features exposed a hearth structure beneath a layer of peat. The hearth was undated but considered likely to be prehistoric (site 16; NLHER ref MLS22698).

3.4.4.5 Two sets of parallel east-west orientated linear features (3000), likely to drainage features associated to warping activities, were also identified by geophysical survey located immediately to the south west of Frodingham Grange Roundabout.

3.4.4.6 A large area of increased magnetic response was also identified to the south of the possible pits (3001). Though these may be geological in origin, they correspond to the known location of the searchlight battery (site 10), and may indicate remains of structures associated to this feature.

3.4.4.7 Geoarchaeological investigations off Brumby Common Lane (Allen Archaeology 2015e) identified the edge of the lower peat deposit in part of the DHPWN route, including palaeosols and higher lying sands. An adjacent trial trench evaluation showed that the same lower peat formed during the Mesolithic to the early Bronze Age (WYAS 2021).

3.4.4.8 The ongoing geoarchaeological investigation in the location of the proposed energy storage and hydrogen production plant undertaken as part of the

current NLGEP Project (AOC 2022) have identified peat and organic clays intermittently between 0.45-2.16m BGL (AOC pers. comm.).

3.4.5 Area 4

3.4.5.1 This area is situated on the (west-facing) eastern slopes of the Trent Valley immediately east of the Flixborough Industrial Estate, in a field to the south of First Avenue (which runs east-west through the middle of the industrial estate) and extends around the northern edge of the industrial estate to the River Trent in the west.

3.4.5.2 These sandy slopes are well known to be rich in archaeological remains from all periods from later prehistory onwards. Excavations at Willow Halt sand quarry in a similar topographical situation 200m to the east encountered buried remains of Neolithic, Bronze Age, Iron Age and Roman date. Surface finds of prehistoric worked flint have also been recorded in this area.

3.4.5.3 A further 500m to the south east, the scheduled monument of Flixborough Saxon Nunnery and site of All Saints medieval church and burial ground was discovered during works associated with commercial sand pit. Prior to archaeological excavation, two metres of windblown sand overburden (aeolian reworking of post-glacial sands) had to be removed by mechanical excavation from above the archaeological remains. This overburden preserved but also concealed the site from view before it was exposed by sand quarrying.

3.4.5.4 The ongoing geoarchaeological investigation as part of the current Project has, however, shown that the windblown sand deposits in the location of the proposed Gas AGI facility and adjacent sub-station are likely to be very shallow (AOC pers. comm.).

3.4.5.5 Geophysical survey conducted as part of the current assessment programme identified convincing evidence for buried archaeological features throughout Area 4 (A4).

3.4.5.6 In the southern part of Area 4 where the Gas AGI is proposed and an area of landscaping, geophysical survey identified:

- A series of straight-sided enclosures on its west side (4000, 4001, site number 133).
- Numerous curvilinear linear features and possible pits in the centre north of this impact zone (4004) were also identified, extending outside of the AGI deep foundation area, to the south east corner (4002).

3.4.5.7 In the eastern part of Area 4, where tree planting is proposed, geophysical survey identified:

- A linear anomaly (4012), likely to indicate a ditch feature of unknown date.
- A curvilinear anomaly (4011) that may indicate an anthropogenic feature.
- Numerous possible pits in the far north east.

3.4.5.8 In the northern part of Area 4, where tree planting is proposed, geophysical survey identified:

- A recti-linear (4005) and a two linear anomalies (4006-4007) that may be associated with one another, and which may evidence boundary or enclosure features.
- Two parallel linear anomalies (4008) and 4009) up to 2m wide on a north south alignment that might evidence boundary features.
- A 90m long linear anomaly (4010) that may indicate a boundary feature.

3.4.6 Area 5

3.4.6.1 Area 5 comprises the Northern DHPWN. Here, the new utilities (insulated supply and return pipework) will be buried adjacent to the road. No trial trenching is proposed in this Development Area.

3.4.7 Area 6

3.4.7.1 Area 6 refers to the footprint of a flood bund that will be constructed in front of the poultry farm situated less than 400m north of the Skippingdale Retail Park. Development Area 6, lies 500m southwest of the scheduled Ancient monument, Flixborough Saxon Nunnery (sites 78, 82, 83). Given the location of the proposed flood bund at the base of the slope of wind-blown sand and the proximity of the potential Iron Age/Roman cropmark site (site 9) and prehistoric findspots (site 8 & 81), there is potential to encounter relatively shallow archaeology in this area.

3.4.7.2 A single borehole sample, retrieved as part of the ongoing geoarchaeological investigation, has identified a shallow 0.35m thick organic layer overlying a sand deposit likely to equate to the windblown sands known from elsewhere. The borehole confirmed that if archaeological deposits are present they will likely be encountered at a very shallow depth as bedrock was reached at 0.7m BGL (AOC pers. comm.).

4. AIMS & OBJECTIVES

4.1.1.1 The aim of this document is to present a structure for the planning, implementation and reporting of an archaeological field evaluation consisting of trial trenching. The document provides a structured model and guidance for ensuring that a consistent approach is applied to the design and management of archaeological works undertaken in relation to the Proposed Scheme.

4.1.1.2 The archaeological evaluation described in this document aims to:

- Establish the presence or absence of archaeological remains within the described Project Impact Areas.
- Establish the location, extent, date, character, condition, significance and quality of archaeological remains within the described Impact Areas.
- Establish whether further investigation of the identified archaeological remains is necessary to mitigate the impact of the Project.
- Establish whether the evaluation of the Project Impact Areas has been satisfactorily achieved or whether further evaluation is required before a decision on mitigation stage archaeological works is taken.
- Establish the potential for contributing through further research to regional research frameworks for the east midlands, as defined by the East Midlands Historic Environment Research Framework (2020): ([redacted]). See also Cooper (2006) and Knight et al. (2012).

5. METHODOLOGY

5.1 Risk Assessment and Method Statement (RAMS)

5.1.1.1 The archaeological contractor is required to prepare a Risk Assessment and Method Statement (RAMS). The Method Statement or Project Design will include a Selection Strategy, North Lincolnshire Museum Site Code, Digital Management Plan and list of all field staff and their competencies, together with a list of the project specialists. The RAMS should be submitted to the NLC HEO for approval prior to commencement of fieldwork. Sufficient notification of the commencement of fieldwork must be given to the HEO and arrangements made for site monitoring visits.

5.2 General

5.2.1.1 One hundred and eighty-two trial trenches will be positioned in the locations specified in Figures 4-32 using Global Positioning System (GPS) survey equipment accurate to +/-100mm. Occasionally the precise location and size of trenches may vary according to health and safety considerations, land owner specifications, and the proximity of obstacles or water courses.

5.3 Machine excavation

5.3.1.1 All machine excavation will be undertaken under direct archaeological supervision. Topsoil and overburden will be removed by a mechanical excavator using a 1.8m wide toothless bucket. During excavation topsoil and subsoil will be kept in separate spoil heaps. Mechanical excavation will continue until archaeological remains are encountered, and where these are absent, until the natural substrate.

5.3.1.2 The archaeologist will have an agreed visual communication system in place with the operators of machinery, so it is never necessary to approach a working machine. The archaeologist will position themselves in full view of the operator, on the open side of the digging arm. The archaeologist will remain outside of the machine excavator arm radius at all times while the machine is switched on. When the archaeologist requests the operator to stop digging, they will not approach the area of excavation until the excavator has placed the digging bucket on the ground away from the excavated area and switched off the engine. Only when the machine has been turned off can the archaeologist approach and investigate. Until this point the archaeologist will remain at least 2m away from the trench edge.

5.3.1.3 Trenches will be dug in level spits of no more than 200mm until either the top of the first archaeological horizon or undisturbed natural deposits are encountered to a maximum depth of 1.50m below present ground level. Under no circumstances will the machine be used to cut arbitrary trenches down to natural deposits. The supervising archaeologist will inspect the surface of each level spit for archaeological remains.

5.3.1.4 Where deeper excavation is required to reach possible archaeological horizons or to expose stratigraphic profiles through thick alluvium or sand

deposits, trenches will be extended with machine dug sondages at either end of the trench, excavated in 0.2m spits. If required, trenches will be widened and stepped to a maximum depth of 4m.

5.4 Geoarchaeological observation and sampling

5.4.1.1 A recognised geoarchaeologist will be present on site for at least one day during the excavation of each survey area to advise on sampling strategies and to oversee the excavation of sondage trenches through deeper deposits where appropriate. The geoarchaeological sampling strategy for laboratory assessment will be agreed in advance with the Historic Environment Officer and should follow Historic England (2007) guidelines.

5.5 Hand excavation

5.5.1.1 All investigation of archaeological horizons and possible features will be by hand, with cleaning, inspection, and recording both in plan and section. Features and deposits will be fully or partially excavated to determine their character and retrieve artefactual material and environmental samples. Cut features such as pits and postholes will be excavated by half-sectioning, although some features may require complete excavation. Linear features will be sectioned as appropriate with all observed termini being 100% excavated.

5.6 Recording

5.6.1.1 All archaeological features and deposits encountered will be issued separate context numbers and fully recorded using standardised record sheets, following standard procedures as outlined in MOLA (1994). Separate registers will be kept of all contexts, photographs, samples and small finds collected.

5.6.1.2 Overall trench plans will be drawn at a scale of 1:50. Sample sections of trench profiles will be drawn at a scale of 1:20. Plans and sections of all archaeological deposits will be drawn at a scale of 1:20 or 1:10. Trenches will be recorded in plan using digital survey equipment. All archaeological drawings will be directly related to the nearest OS datum point to a minimum of two decimal places.

5.6.1.3 High resolution photography, using a minimum resolution of 12 Mega-pixel for secure long-term storage and curation of digital files, will be undertaken throughout, including general trench photographs before and during excavation, and after backfilling. Detailed feature and deposit photographs will be taken using north arrow and ID board. Location photos will also be taken of each feature and deposit showing their position in the trench.

5.7 Finds, samples and human remains

5.7.1.1 All finds will be treated in a proper manner and to standards agreed in advance with the recipient museum. Finds will be recovered, cleaned, conserved,

marked, bagged and boxed in accordance with the guidelines set out in United Kingdom Institute for Conservation's *Conservation Guidelines No. 2* 1984.

5.7.1.2 The archaeological contractor should prepare a Selection Strategy in their Risk Assessment and Method Statement (RAMS), in line with CIfA guidelines and Selection Toolkit. Appropriate specialists for all anticipated classes of artefacts must be named in the RAMS including the conservator.

5.7.1.3 Finds coming under the definition of 'treasure' as defined by the Treasure Act 1996 will be reported to the Coroner and the Historic Environment Officer of North Lincolnshire Council. Following the protocol of Treasure Act Code of Practice, these finds will be moved to a safe place. Where removal cannot be effected on the same working day as the discovery, suitable security measures will be taken to protect the artefacts from theft or damage.

5.7.1.4 Where there is potential for laboratory analysis, environmental samples up to 40 litres in volume will be taken from archaeological deposits.

5.7.1.5 Should human remains be uncovered during the works, all work will cease, and H.M. Coroner and the local police will be contacted. Any human remains will be left *in situ*, covered and protected until the police are satisfied they are not of recent origin. If it is necessary to remove any human remains, a licence must be obtained from the Ministry of Justice in accordance with the Burial Act 1857. The archaeological contractor will be responsible for obtaining all necessary permits.

5.8 Archive deposition

5.8.1.1 The contractor will need to obtain a unique site code for archive deposition prior to commencement of the fieldwork from North Lincolnshire Museum Service (contact [redacted]@northlincs.gov.uk).

5.9 Development Area specification

5.9.1 Area 1 (25 trial trenches)

5.9.1.1 As noted above, GPR survey has provided a high degree of confidence that significant buried archaeology exists within the central part of Flixborough Staithe (site 7). Nearly all the structural remains revealed by this survey lie directly beneath the current riverfront road that connects Stather Road to First Avenue and are thus practically unsuitable for trial trench evaluation.

5.9.1.2 Two further sets of features identified in GPR survey (6003 and 6007, and 6001-6002, on the west and east sides of the current road respectively), do require evaluation to establish their archaeological potential. These will be evaluated with:

- Two 25m long and 1.80m wide trenches;
- One 20m long and 1.80m wide trench; and
- One 5m long and 1.80m wide trench.

5.9.1.3 The location of these trenches in relation to the GPR results is shown in Figure 5.

5.9.1.4 A further twenty-one trenches will be positioned to sample the rest of Area 1, located throughout the industrial estate between First Avenue and Stather Road and immediately to the south of Stather Road, as shown in Figure 4. This includes:

- Two 50m long and 1.80m wide trench
- Twelve 30m long and 1.80m wide trenches
- One 30m long and 1.80m wide trench
- One 25m long and 1.80m wide trench
- One 20m long and 1.80m wide trench
- Two 15m long and 1.80m wide trenches
- Two 5m long and 1.80m wide trenches

5.9.1.5 These trenches have two objectives:

- To evaluate the potential for the shallow lying medieval and post medieval archaeology to extend beyond the area covered in the GPR survey
- To provide further opportunity to evaluate the alluvial deposits including the upper peat layers.

5.9.1.6 The lower peat deposits of high palaeoenvironmental potential are found at depths unsuitable for trial trench evaluation. A programme of geoarchaeological evaluation of these deeper alluvial deposits is currently underway (AOC 2022), including a programme of radiocarbon dating to establish their age. A specific evaluation strategy, more suitable to obtaining bulk geoarchaeological samples from such deep deposits, will be designed in consultation with the Historic Environment Officer, as soon as these results are properly understood.

5.9.2 Area 2 (31 trial trenches)

5.9.2.1 To evaluate the archaeological and palaeoenvironmental potential of the alluvial deposits including the upper peat layers within Area 2, eight 100m trenches and twenty-three 50m trenches will be excavated to sample between 2-3% of the development areas shown in Figure 3. The location of these trenches are shown in Figure 6.

5.9.2.2 The trenches will consist of:

- Eight 100m long and 1.80m wide trenches positioned where three buildings are proposed in the northern part of Area 2, including a concrete block manufacturing facility, a plastic recycling facility and a visitor centre.
- Thirteen 50m long and 1.80m wide trenches positioned where a utility pipe is aligned north to south, from Stather Road in the north to the B1216 in

the south and connecting with the concrete manufacturing and plastic recycling plant and energy storage and refuelling stations.

- Eight 50m long and 1.80m wide trenches positioned where the north south aligned railhead is proposed in the west of Area 2.
- Two 50m long and 1.80m wide trenches positioned where an access road and utilities corridor are proposed in the south of Area 2, immediately to the north of Ferry Road West (B1261).

5.9.2.3 The Sustainable urban Drainage System (SuDS) proposed for Area 2 (Figure 3) may also require excavation to develop ponds and other wetland areas. Additional trial trench evaluation will be conducted, as appropriate, when the locations and depths of these possible features are confirmed.

5.9.3 Area 3 (85 trial trenches)

5.9.3.1 The archaeological evaluation of Area 3 consists of eighty-five trenches.

5.9.3.2 Twenty-nine evaluation trenches will be positioned to intercept possible archaeological features identified by geophysical survey, and one trench positioned to test for the remains of a historically known feature. These thirty trenches are located in five different areas within IA3, shown on Figures 7-23, and consist of:

- Five 50m long and 1.80m wide trenches will be positioned to intercept numerous possible pits (3100) in the area north of Ferry Road West (Figure 3), where the energy storage and refuelling facility is proposed. An additional 50m long and 1.80m wide trench will be positioned to the south and east of these five trenches to intercept an area of high magnetic response in the location where a WWII searchlight battery is known to have been sited (Figures 7-8).
- One 20m and 1.80m wide trench, three 10m long and 1.80m wide trenches, and three 5m long and 1.80m wide trenches will be located to intercept numerous possible pits (3008), along the DHPWN route, between the energy storage and refuelling facility and the Ferry Road West (B1216)/A1077 junction (Figure 9).
- Four 50m long and 1.80m wide trenches, one 60m long and 1.80m wide trench, and two 25m long and 1.80m wide trenches, and one 20m long and 1.80m wide trench will be positioned to intercept numerous possible pits (5002) and a linear anomaly (5001), located in two fields to the north of the A1077, immediately west of Skippingdale Roundabout (Figure 5). In addition to testing possible pit features that are part of the (5002) group, the 60m long trench, will also test for the presence of features associated with crop mark site 11, including a possible trackway feature visible on air photos and satellite images (Figures 11-12).
- Three 50m long and 1.80m wide trenches and five 25m long and 1.80m wide trenches will be positioned to intercept numerous possible pits (3000) along the north-south aligned part of IA3, immediately to the north west of the Frodingham Grange Roundabout (Figure 4).

- One 100m long and 1.80m wide and one 50m long and 1.80m wide trench will be positioned to intercept two groups of possible drainage features (3003) located to the south west of Frodingham Grange Roundabout.

5.9.3.3 In addition to these trenches, forty-eight additional trenches will be excavated to evaluate the archaeological potential in parts of Area 3 that have not been subjected to geophysical survey, employing a 3% sample. These are as follows:

- Thirteen trenches positioned to evaluate the western side of the area where the energy storage and refuelling facility is proposed (Figure 7).
- Six 25m long and 1.80m wide trenches and one 20m long and 1.80m wide trench, located in the DHPWN route immediately north and north east of the Ferry Road West (B1216)/A1077 junction (Figure 10).
- Sixteen 50m long and 1.80 m wide trenches, eleven 30m and 1.80m wide trenches, and one 25m and 1.80m wide trench, located on the DHPWN route, between the Ferry Road West (B1216)/A1077 junction in the north and the Birmingham Road, in the far south of Area 3 (Figure 14 & Figures 19-23).
- The northernmost 50m long trench along the southern stretch of the DHPWN will be positioned directly to the east of the crop mark site 13 in order to pick up any features that may be associated to the possible enclosure feature (Figure 10). In the area north of Brumby Lane and west of the M181, where previous geoarchaeological assessment in has located Sutton Sand, peat and palaeosol deposits, nine trenches have been positioned to best sample these different formations, following recommendations in Allen (2015e) (Figures 19-20).

5.9.4 Area 4 (34 trial trenches)

5.9.4.1 Eight trial trenches will be excavated to evaluate features identified by geophysical survey in the northern part of Area 4, where landscaping is proposed. These are as follows:

- One 25m long and 1.80m wide trial trench positioned to intercept the terminus of the recti-linear enclosure (4005) and two linear anomalies, (4007) and (4008) (Figure 24).
- One 20m long and 1.80m wide trial trench positioned to intercept the linear anomalies (4006) and (4007) (Figure 24).
- Two 15m long and 1.80m wide and one 5m long and 1.80m wide trial trenches positioned to intercept possible pit features that are part of the wider group (4013) of such features identified across Area 4 (Figure 24 & 25).
- One 20m long and 1.80m and one 10m long and 1.80m wide trial trenches positioned to intercept the linear anomaly (4009) and adjacent possible pit features that are part of the wider group (4013) of such features identified across Area 4 (Figure 24).
- One 10m and 1.80m wide trial trench positioned to intercept the long linear anomaly (4010) that may indicate a boundary feature (Figure 25).

5.9.4.2 Five trial trenches will be excavated to evaluate features identified by geophysical survey in the eastern part of Area 4, where landscaping is proposed. These are as follows:

- A 15m long and 1.80m wide trial trench and a 5m long and 1.80m wide trial trench positioned to evaluate a curvilinear anomaly (4011) and adjacent possible pit features (Figure 26).
- Three 30m long and 1.80m wide trial trenches positioned to evaluate numerous possible pit features that are part of the wider group (4013) of such features identified across Area 4 (Figure 26 & 27).

5.9.4.3 Five trial trenches will be excavated to evaluate features identified by geophysical survey and from historical archives in the central part of Area 4, immediately to the east of Flixborough Industrial Estate. These are as follows:

- Three 15m long and 1.80m wide trial trenches positioned to evaluate the linear feature (4012) and to intercept numerous possible pit feature (4013) (Figure 27 & 28).
- Two 50m long and 1.80m wide trial trenches positioned to evaluate the site of the former lime kiln (site 123) (Figure 28).

5.9.4.4 Three trial trenches will be excavated to evaluate features identified by geophysical survey in the area immediately to the east of the proposed Gas AGI and substation, where landscaping is proposed. These are as follows:

- One 30m long and 1.80m wide trench positioned to evaluate the long linear feature (4002) (Figure 30).
- A 20m long and 1.80m wide trench and a 10m long and 1.80m wide trench positioned to evaluate two smaller curvilinear features and pits that are part of the continuation of the (4004) group (Figure 30).

5.9.4.5 Thirteen trial trenches will be excavated to evaluate features identified by geophysical survey in the south western part of Area 4, where the Gas AGI and adjacent substation are proposed. These are as follows:

- Five 50m long and 1.80m wide trial trenches and three 20m long and 1.80m wide trial trenches positioned to intercept the enclosure features (4001, 4000 and 4003) identified in geophysical survey at site 133 (Figure 29 & 31). The trenches will be located to evaluate both the linear features themselves, their termini, possible pit features associated with them, and the potential survival of archaeological deposits within their interiors that may not appear in the geophysical survey plots.
- Two 50m long and 1.80m wide trial trenches, and three 25m wide and 1.80m long trenches will also be positioned to establish the extent, nature and age of the group of curvilinear features and possible pits (4004) (Figure 29 & 30).

5.9.5 Area 6 (7 trial trenches)

5.9.5.1 Seven 30m long and 1.80m wide trial trenches will be excavated to provide a 3% of the development area and to evaluate the archaeological and palaeoenvironmental potential of Area 6.

6. POST EXCAVATION ASSESSMENT

6.1.1.1 Following the completion of the trial trench evaluation, the site records, finds and samples will be assessed for their potential for further analysis. Conservation and specialist storage requirements will also be assessed at this stage. Finds that are susceptible to degradation should be selected for stabilisation after recording.

6.1.1.2 Processing of palaeoenvironmental and geoarchaeological samples, or a representative sub-sample must also be completed soon after fieldwork ends. Unprocessed sub-samples must be stored in appropriate environmental and storage conditions.

6.1.1.3 Dating samples must be submitted to an appropriate laboratory as soon as possible after fieldwork ends to inform subsequent stages of fieldwork.

7. PROJECT DELIVERABLES

7.1 Reporting

7.1.1.1 The archaeological contractor is required to produce a preliminary report within two weeks of fieldwork ending. The archaeological contractor is then required to produce a fully illustrated evaluation assessment report within an agreed timescale, including the following:

- A non-technical summary of the results of the work, introduction and aims and objectives.
- An introduction which will include North Lincolnshire Museum site code/s, or accession number from another registered museum accepting the archive.
- Planning application reference number.
- Dates when fieldwork took place, personnel involved and who commissioned it.
- National grid reference (centre of site/s).
- An account of the methods and results of the evaluation, describing both structural data and associated finds and/or environmental data recovered.
- Interpretation, including phasing of the site sequence and spot-dating of ceramics (descriptive material should be clearly separated from interpretative statements). This shall be supported by the use of photographs and drawings, to include an overall plan of the evaluation site at an appropriate scale; a plan or
- An overall plan of the evaluation site at an appropriate scale; a plan or plans at an appropriate standard scale (1:2500 minimum scale) locating all excavated trenches relative to current Ordnance Survey data and accurately geo-referenced to the National Grid; individual trench plans as excavated indicating the location of archaeological features, with at least one section detailing the stratigraphic sequence of deposits within each trench and including heights relative to Ordnance Datum.

- Specialist assessments of the artefacts recovered, and environmental samples taken, with a view to their potential for further study, and long-term conservation and storage needs. The results from investigations in Archaeological Sciences must be presented in the evaluation report and must include sufficient detail to permit assessment of potential for analysis. They should include tabulation of data in relation to site phasing and contexts, and must include non-technical summaries.
- The objective presentation of data must be clearly separated from interpretation. The relevant local reference collection codes for ceramic assemblages must be used. Recommendations for further investigations (both on samples already collected, and at future excavations) must be clearly separated from the results and interpretation, and will be incorporated into the Brief/Project Design for any future intervention or mitigation strategy.
- An assessment of the archaeological significance of the deposits identified, in relation to other sites in the region and the potential for the site to contribute to the regional research agenda,
- A conclusion with an assessment of the impact of the proposed development on the known and/or potential archaeological resource. If the precise impact cannot be assessed at this stage, this should be stated.
- Details of archive location and destination including timetable for deposition.
- Appendices and figures, as appropriate, including copies of the curatorial Brief (where issued), and Project Design.
- References and bibliography of all sources used/consulted.
- Copy of OASIS recording form.

7.1.1.2 Upon completion of the fieldwork, the archaeological contractor must agree a timeframe for the production and delivery of the evaluation assessment report.

7.1.1.3 The draft copies of the text and figures shall be provided to ERM in both Microsoft Word and PDF format for review, comment and subsequent revision by the archaeological contractor.

7.1.1.4 The final issue of report will comprise:

- A PDF copy of the report;
- A word copy of the report;
- Figures in the format in which they were produced;
- Data comprising: CAD and GIS data in ESRI format,
- Metadata comprising sufficient detail as to provide a summary, lineage and copyrights associated with any data provided.

7.2 Post-excavation analysis

7.2.1.1 Upon conclusion of the present fieldwork phase, recommendations will be made concerning a programme of post-excavation analysis of artefacts and ecofacts, and publication, and, if required, further fieldwork. All analysis will be conducted under best practice by specialists with appropriate experience. The archaeological contractor will provide a method statement for any post-excavation analysis with an up-to-date methodology.

7.3 Project Archive

7.3.1.1 All project archiving activity is the responsibility of the archaeological contractor, unless otherwise specified.

7.3.1.2 Following the guidelines of Historic England's procedural document, *Management of Research Projects in the Historical Environment* (MoRPHE) (HE 2015), a comprehensive archive of all results of the evaluation will be compiled.

7.3.1.3 The catalogued archive from these works will be prepared for deposition in a suitable museum within 6 months of the completion of all fieldwork. In this case, North Lincolnshire Museum is recommended. An appropriate financial contribution towards curation and storage of the archive will be required.

7.3.1.4 Digital copies of a selection of photographs and plans will be deposited separately for inclusion in the North Lincolnshire HER and/ or OASIS within 6 months of completion, unless otherwise instructed by the client.

8. HEALTH AND SAFETY

8.1 Risk Assessment

8.1.1.1 Health and Safety considerations will be of paramount importance in conducting all fieldwork. Safe working practises will override archaeological considerations at all times.

8.1.1.2 All work will be carried out in accordance with the Health and Safety at Work Act 1974 and the management of health and safety at work regulations (as amended) 2006; with all other relevant Health and Safety legislation, regulations and codes of practice in force at the time;

8.1.1.3 A project- and area-specific Risk Assessment will be undertaken and reported in the RAMS prepared by the contractor before the commencement of any fieldwork. The Risk Assessment will have been read and understood by all staff attending the Site before any groundwork starts. As part of the Risk Assessment and Health and Safety briefing process assessment of specific risks and hazards for each excavation area will be undertaken. The Risk Assessments for each area will be updated throughout the course of the work as appropriate.

8.2 Emergency Procedures

8.2.1.1 In the event of an accident, the survey team will follow the procedure established for the site in accordance standard Emergency Procedures set out within the Risk Assessment report contained in the RAMS, including area specific risk assessments with details of the nearest hospital.

8.3 Insurance

8.3.1.1 Both public liability and professional indemnity insurance are held by the Archaeological Contractors.

9. REFERENCES

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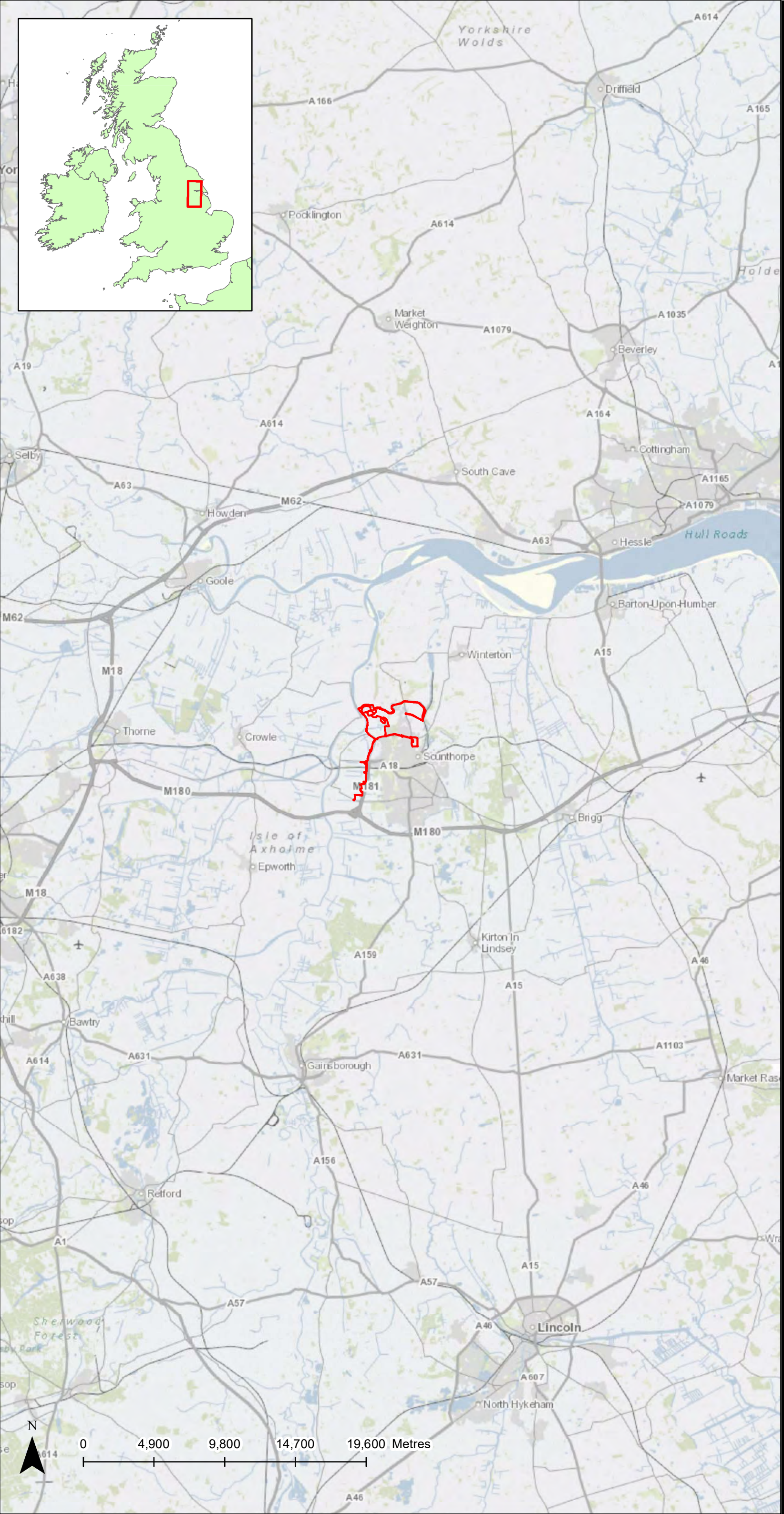


NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 1 Site Location

Client Information

Client	North Lincolnshire Green Energy Park Ltd
PINS Proj No	010116
Date	25/05/2022
Drawn by	MTC
Checked by	NW
Version	P0

Map Information

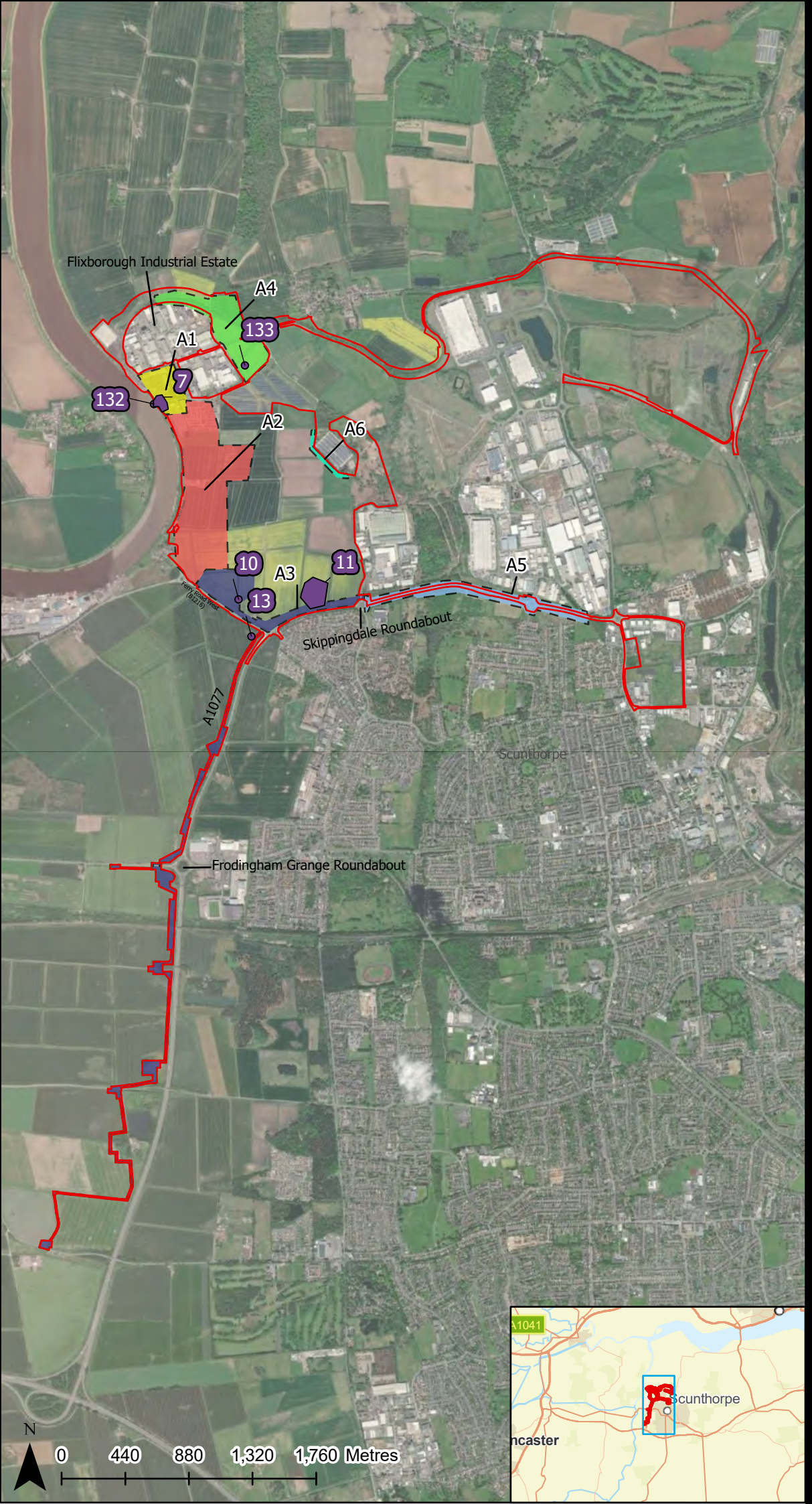
CRS EPSG	27700
CRS Name	British National Grid
Scale	250,007
ArcMap File	\\UKSSMBNAF- INTRODUCTION_ES_SiteLocation_A01

Legend

Order Limits

Layer Source Information

DO NOT SCALE THIS DRAWING



NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Map showing the NLGEP Project area, order limits, and the six Impact Areas

Figure 2

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	30/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:35,000

ArcMap File

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Legend

- Cultural Heritage
- Cultural Heritage
- Order Limits

Areas

- 1
- 2
- 3
- 4
- 5
- 6

Layer Source Information

World Street Map: Esri UK, Esri, HERE, Garmin, FAO, METI/NASA, USGS
World Imagery: Earthstar Geographics© Crown copyright and database rights 2021 OS Licence 100035409 Reproduced with the permission of the National Library of Scotland

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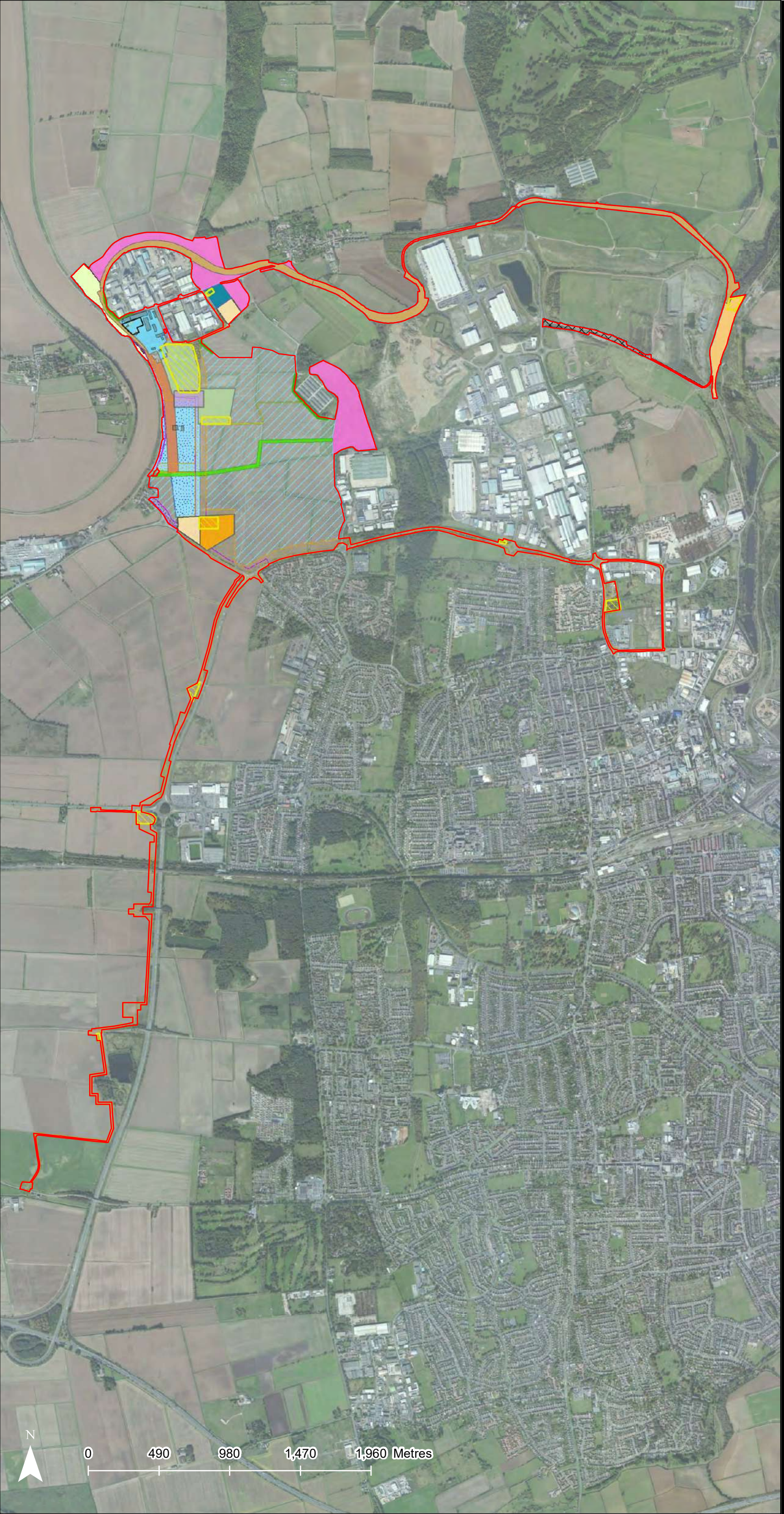

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title Figure 3
Project Elements

Client Information

Client	North Lincolnshire Green Energy Park Ltd
PINS Proj No	EN010116
Date	25/05/2022
Drawn by	MTC
Checked by	NW
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	25,001
ArcMap File	\\UKSSMBNAF-

INTRODUCTION_ES_ProjectElements_A01

Legend

- Order Limits
- Demolition
- Existing Port
- Areas for Potential Future Mitigation
- Surface Access
- Utilites
- Temporary Construction Haul Road
- Non-motorised Paths with Landscape Planting
- Construction Laydown (Indicative Size / Location)*
- Construction Laydown Limits of Deviation
- Flood Management
- Wetland / SuDs

Landuse

- Sub Station
- Carbon capture and associated curtilage landscape
- ERF and associated curtilage landscape
- Visitor Centre
- Concrete manufacturing and plastic recycling facility with associated curtilage landscape
- Gas AGI and associated curtilage landscape
- Energy storage and refueling station and associated curtilage landscape
- Flood Defence Bund

Railway Reinstated

- Dragonby Siding Expansion
- Railhead
- Railspur Upgrade

*Not all laydown areas are shown on the plan. Where laydown areas would be located within the footprint of the the building to be constructed, they have been omitted from the plan to improve clarity.

Layer Source Information

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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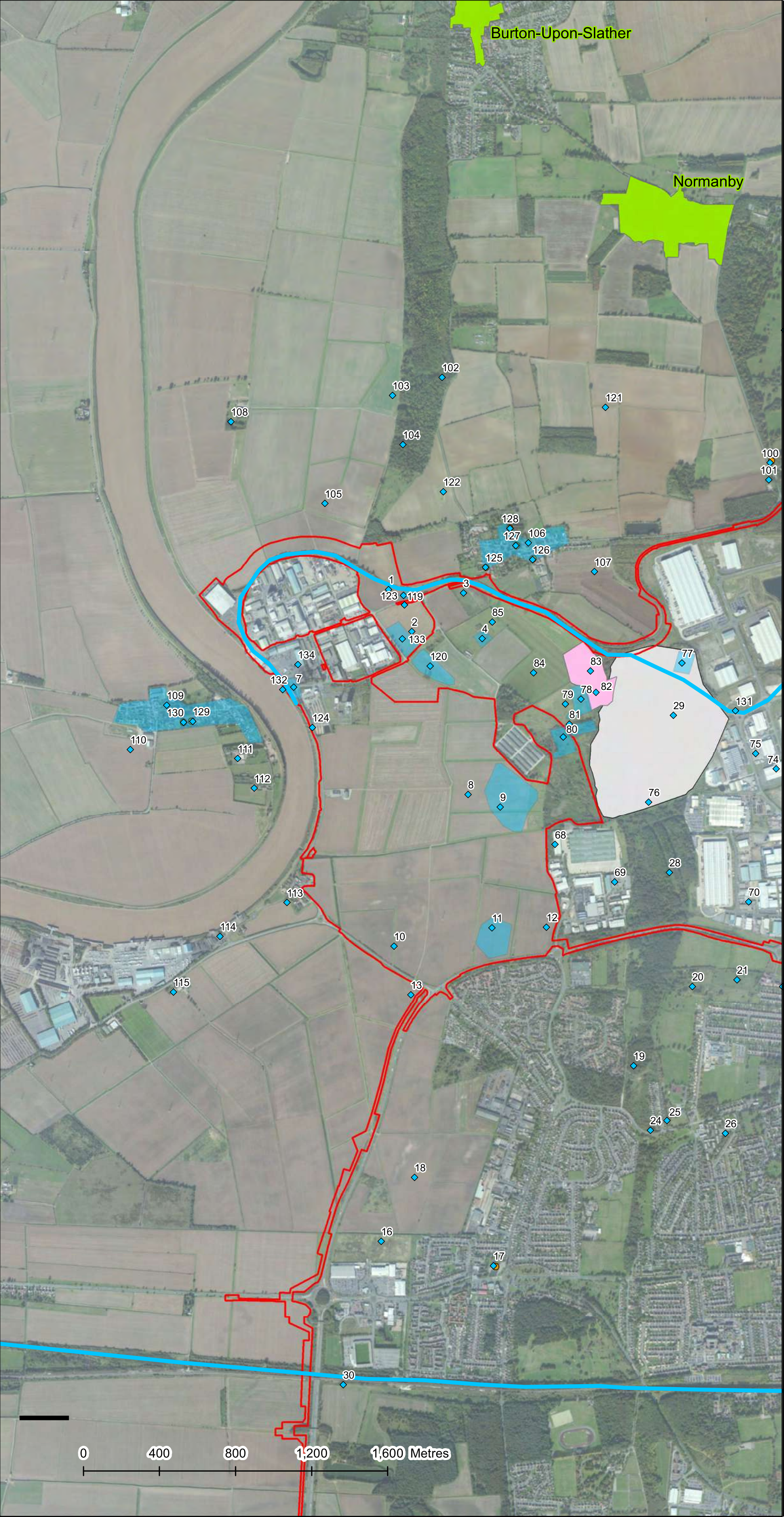

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title Figure 3b
Location Map Showing
Designated and Known Assets

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	15/03/2022
Drawn by	MTC
Checked by	CLQ
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	19,001
ArcMap File	HER_ES_LocationMapGazItems_A01

Legend

- Order Limits
- Gazetter Points
- Gazetteer Lines
- Gazetteer Polygons

Listed Buildings

- Grade I Listed Building
- Grade II Listed Building
- Grade II* Listed Building
- Scheduled Monuments
- Conservation Area
- Former Spoil Heap

Layer Source Information

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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North Lincolnshire Green Energy Park

Title Trench locations in Area 1

Figure 4

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	25/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:5,160

ArcMap File

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Legend

- Geophysical Survey Extent
- Trenches
- Archaeology Possible line
- Archaeology Possible polygon
- Buried structural remains – possible phase
- Buried structural remains – possible phase
- Buried structural remains – possible phase
- Buried structural remains – possible phase
- Modern Service Line
- Modern Service
- Order Limits

Layer Source Information

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NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title Trench locations in Area 1

Figure 5

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	25/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:5,160

ArcMap File

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Legend

- Geophysical Survey Extent
- Trenches
- Archaeology Possible line
- Archaeology Possible polygon
- Buried structural remains – possible phase
- Buried structural remains – possible phase
- Buried structural remains – possible phase
- Buried structural remains – possible phase
- Modern Service Line
- Modern Service
- Order Limits

Layer Source Information

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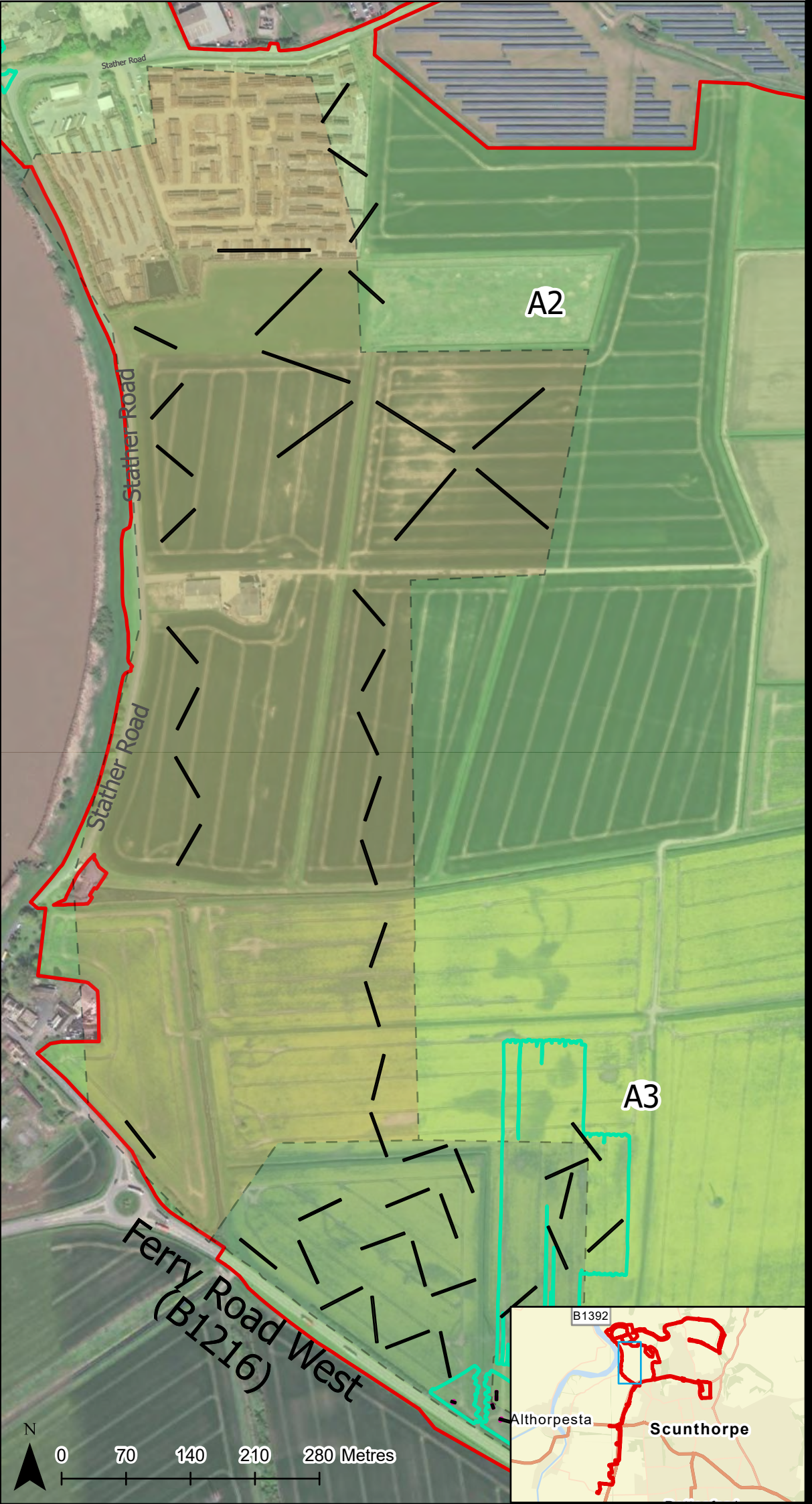

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title Trench locations in Area 2

Figure 6

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	26/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:5,500

ArcMap File

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Legend

- Trenches
- Geophysical Survey Extent
- Buried structural remains – possible phase
- Buried structural remains – possible phase

Area

- 1
- 2
- 3
- 4
- 5
- 6
- Order Limits

Layer Source Information

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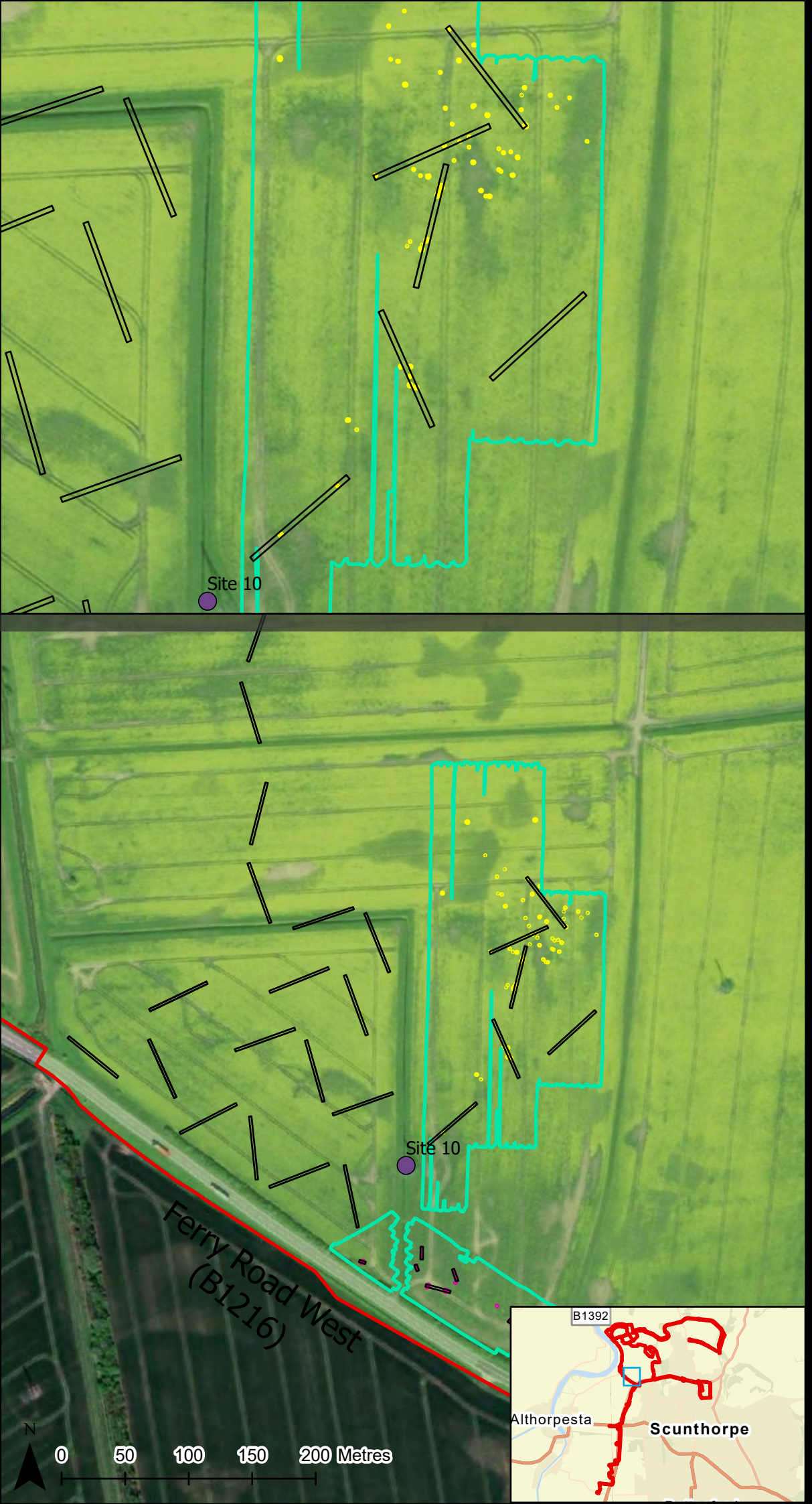

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title Trench locations in Area 3

Figure 7

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	30/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:3,986

ArcMap File

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Legend

- Trenches
- Geophysical Survey Extent
- Possible archaeological features
- Cultural Heritage
- Order Limits

Layer Source Information

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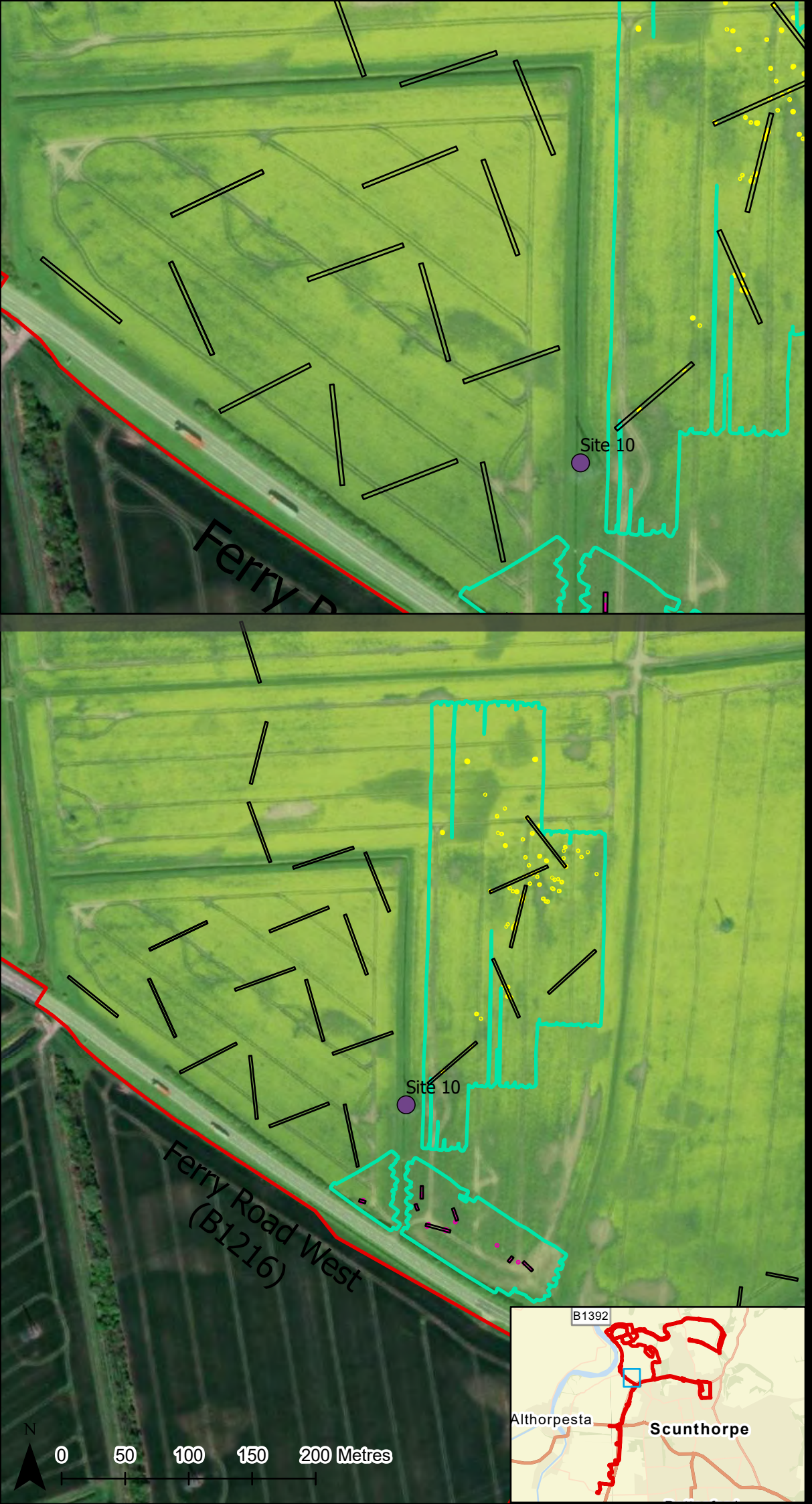

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title Trench locations in Area 3

Figure 8

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	30/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:3,986

ArcMap File

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Legend

- Trenches
- Geophysical Survey Extent
- Possible archaeological features
- Cultural Heritage
- Order Limits

Layer Source Information

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NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title Trench locations in Area 3

Figure 9

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	30/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:7,084

ArcMap File

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Legend

- Trenches
- Geophysical Survey Extent
- Possible archaeological features
- Possible archaeological features
- Cultural Heritage
- Cultural Heritage
- Order Limits

Layer Source Information

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NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title Trench locations in Area 3

Figure 10

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	30/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:14,082

ArcMap File

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Legend

- Trenches
- Geophysical Survey Extent
- Possible archaeological features
- Possible archaeological features
- Cultural Heritage
- Cultural Heritage
- Order Limits

Layer Source Information

World Street Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
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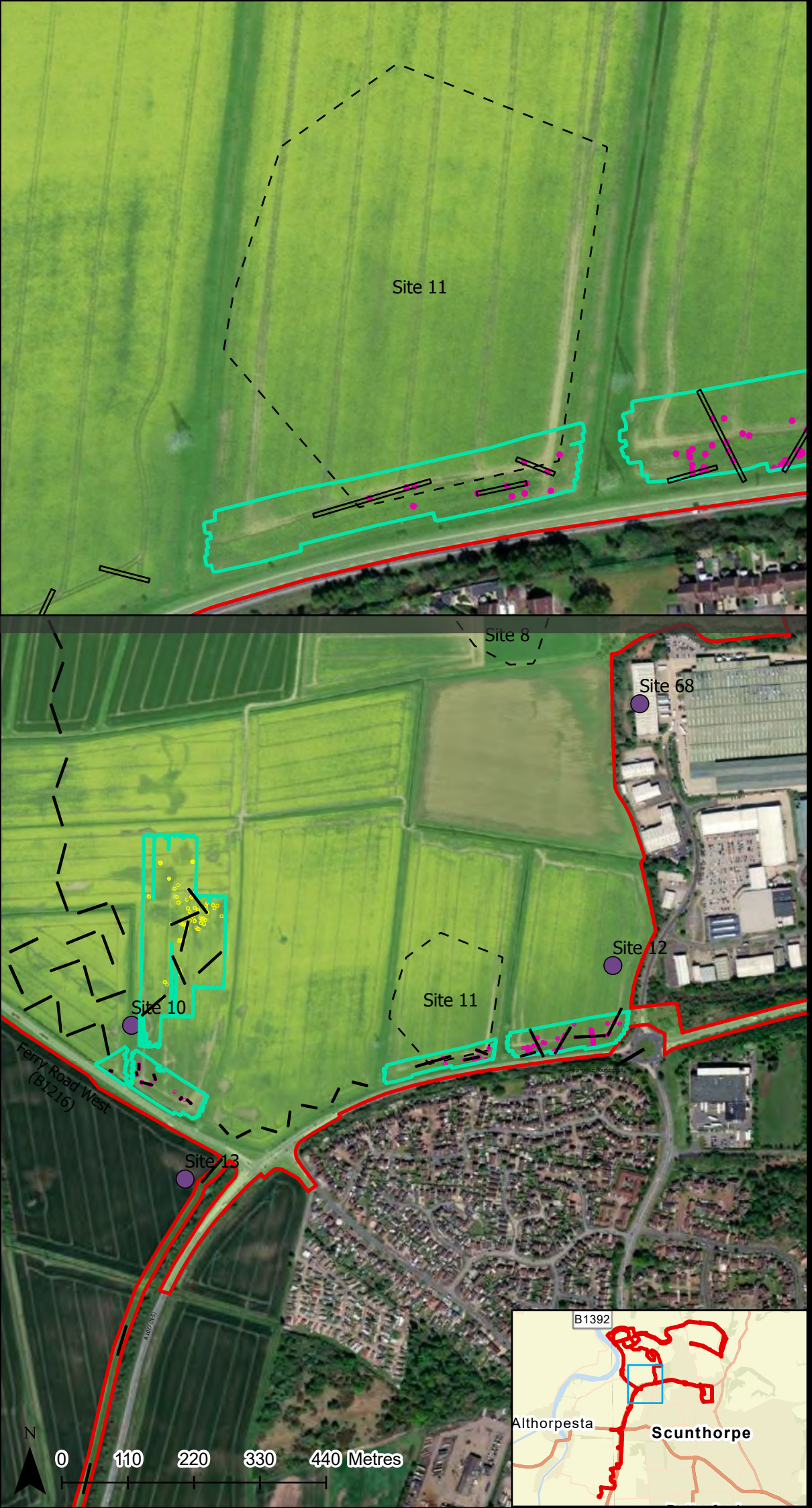

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title Trench locations in Area 3

Figure 11

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	30/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:8,447

ArcMap File

Q:\London\Confidential Projects\0483091 Solar 21.HB\2. Working\6. GIS\mw\Trenches_mw\Area3_figures_closeup.a

Legend

- Trenches
- Geophysical Survey Extent
- Possible archaeological features
- Possible archaeological features
- Cultural Heritage
- Cultural Heritage
- Order Limits

Layer Source Information

World Street Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
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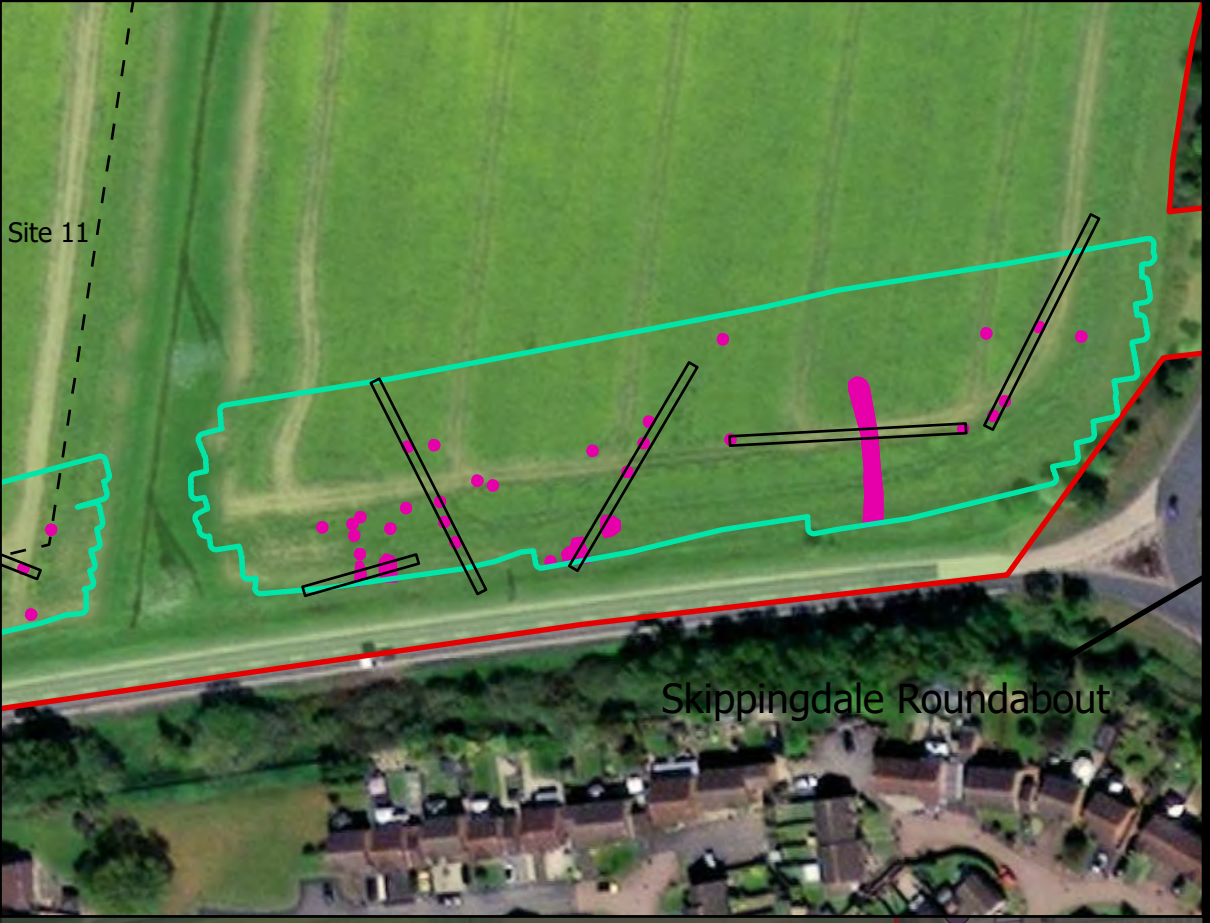

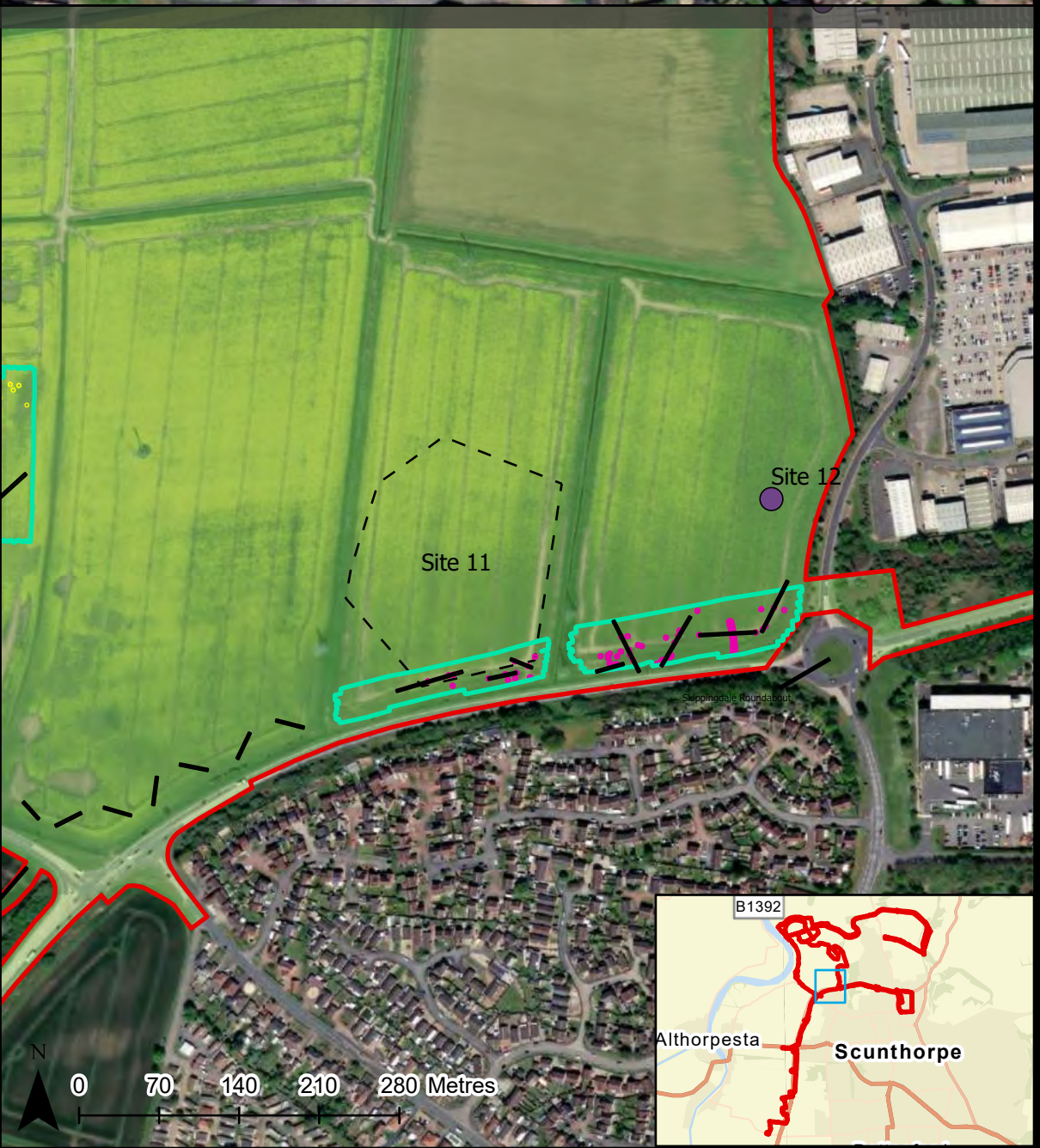

North Lincolnshire Green Energy Park

Title Trench locations in Area 3

Figure 12

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	30/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:5,685

ArcMap File

Q:\London\Confidential Projects\0483091 Solar 21.HB\2. Working\6. GIS\mw\Trenches_mw\Area3_figures_closeup.a

Legend

- Trenches
- Geophysical Survey Extent
- Possible archaeological features
- Possible archaeological features
- Cultural Heritage
- Cultural Heritage
- Order Limits

Layer Source Information

World Street Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
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North Lincolnshire Green Energy Park

Title Trench locations in Area 3

Figure 13

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	30/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:13,386

ArcMap File

Q:\London\Confidential Projects\0483091 Solar 21.HB\2. Working\6. GIS\mw\Trenches_mw\Area3_figures_closeup.a

Legend

- Trenches
- Geophysical Survey Extent
- Possible archaeological features
- Possible archaeological features
- Cultural Heritage
- Cultural Heritage
- Order Limits

Layer Source Information

World Street Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
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NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title Trench locations in Area 3

Figure 14

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	30/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:11,853

ArcMap File

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Legend

- Trenches
- Geophysical Survey Extent
- Possible archaeological features
- Possible archaeological features
- Drainage Line
- Cultural Heritage
- Cultural Heritage
- Order Limits

Layer Source Information

World Street Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
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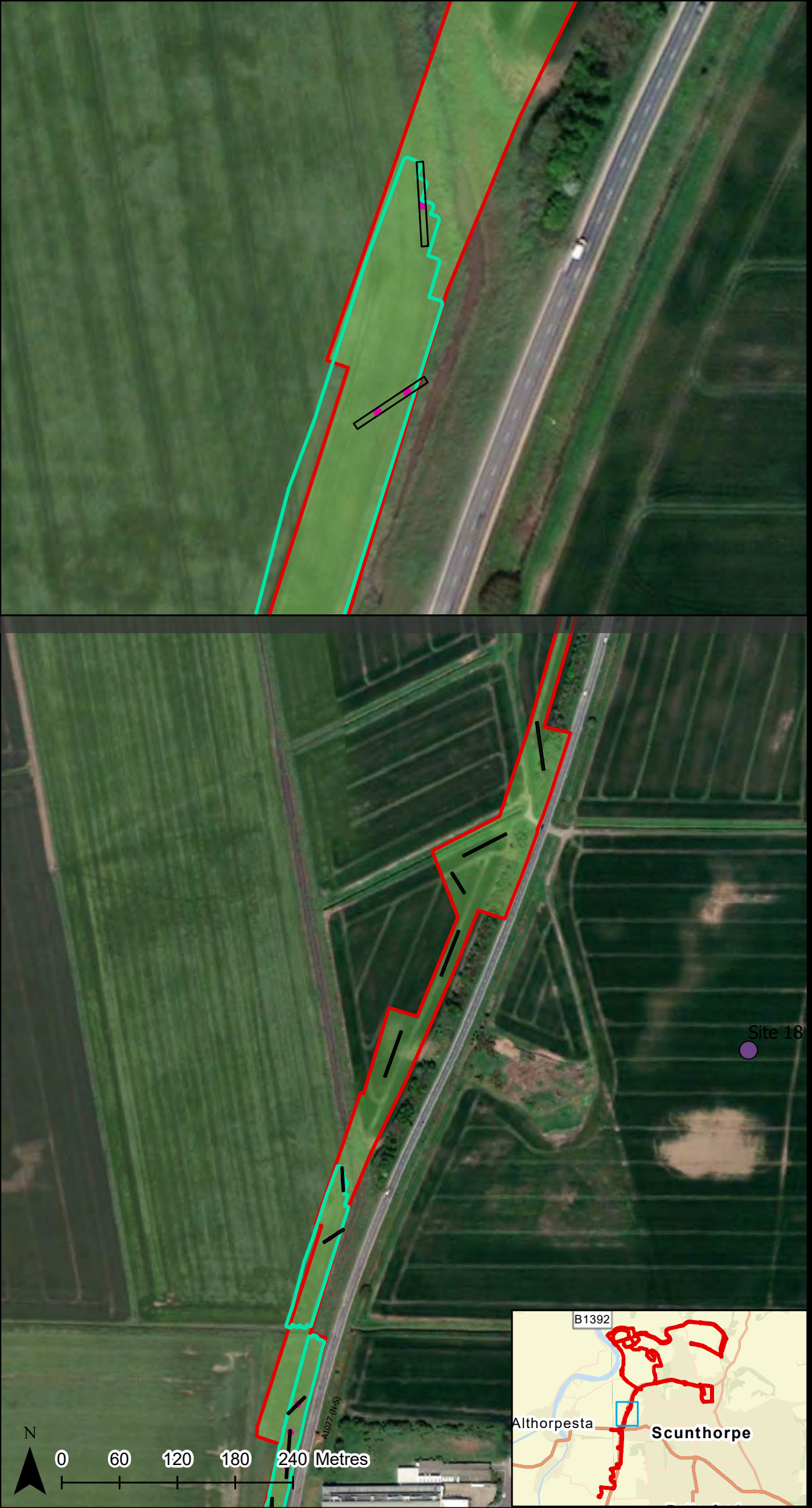

North Lincolnshire Green Energy Park

Title Trench locations in Area 3

Figure 15

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	30/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:5,266

ArcMap File

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Legend

- Trenches
- Geophysical Survey Extent
- Possible archaeological features
- Cultural Heritage
- Order Limits

Layer Source Information

World Street Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
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North Lincolnshire Green Energy Park

Title Trench locations in Area 3

Figure 16

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	30/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:3,045

ArcMap File

Q:\London\Confidential Projects\0483091 Solar 21.HB\2. Working\6. GIS\mw\Trenches_mw\Area3_figures_closeup.a

Legend

- Trenches
- Geophysical Survey Extent
- Possible archaeological features
- Drainage Line
- Order Limits

Layer Source Information

World Street Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
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NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title Trench locations in Area 3

Figure 17

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	30/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:3,045

ArcMap File

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Legend

- Trenches
- Geophysical Survey Extent
- Possible archaeological features
- Drainage Line
- Order Limits

Layer Source Information

World Street Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
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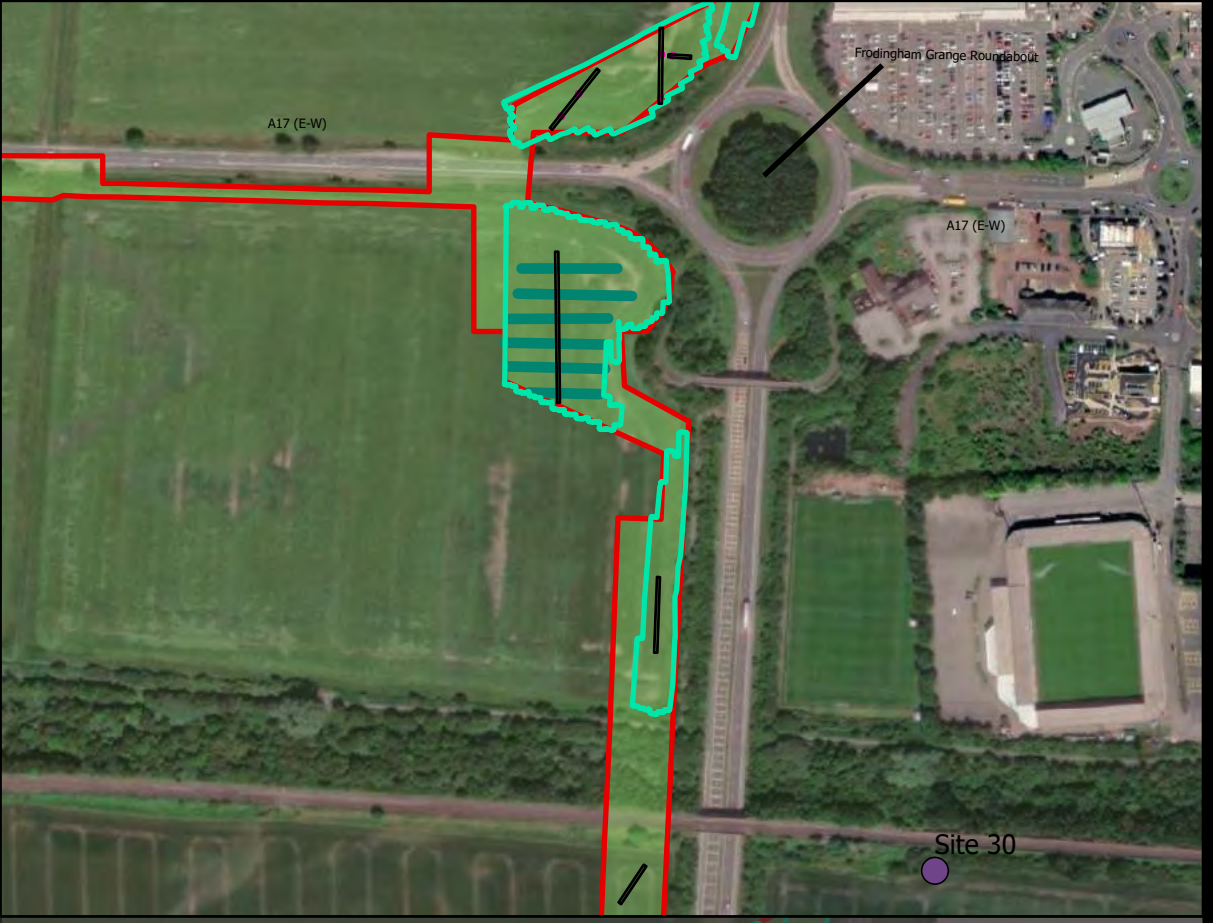

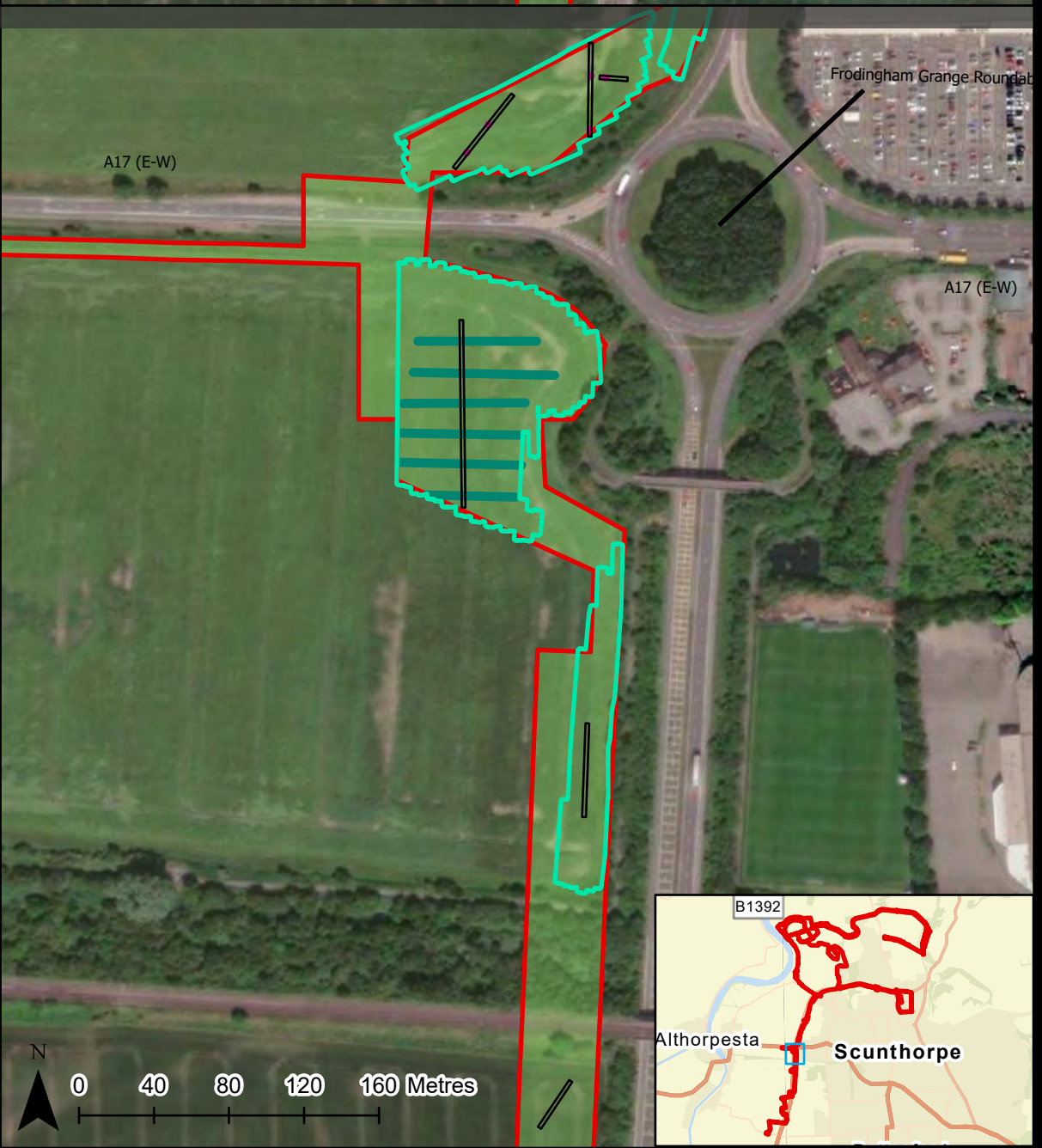

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title Trench locations in Area 3

Figure 18

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	30/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:3,467

ArcMap File

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Legend

- Trenches
- Geophysical Survey Extent
- Possible archaeological features
- Drainage Line
- Cultural Heritage
- Order Limits

Layer Source Information

World Street Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
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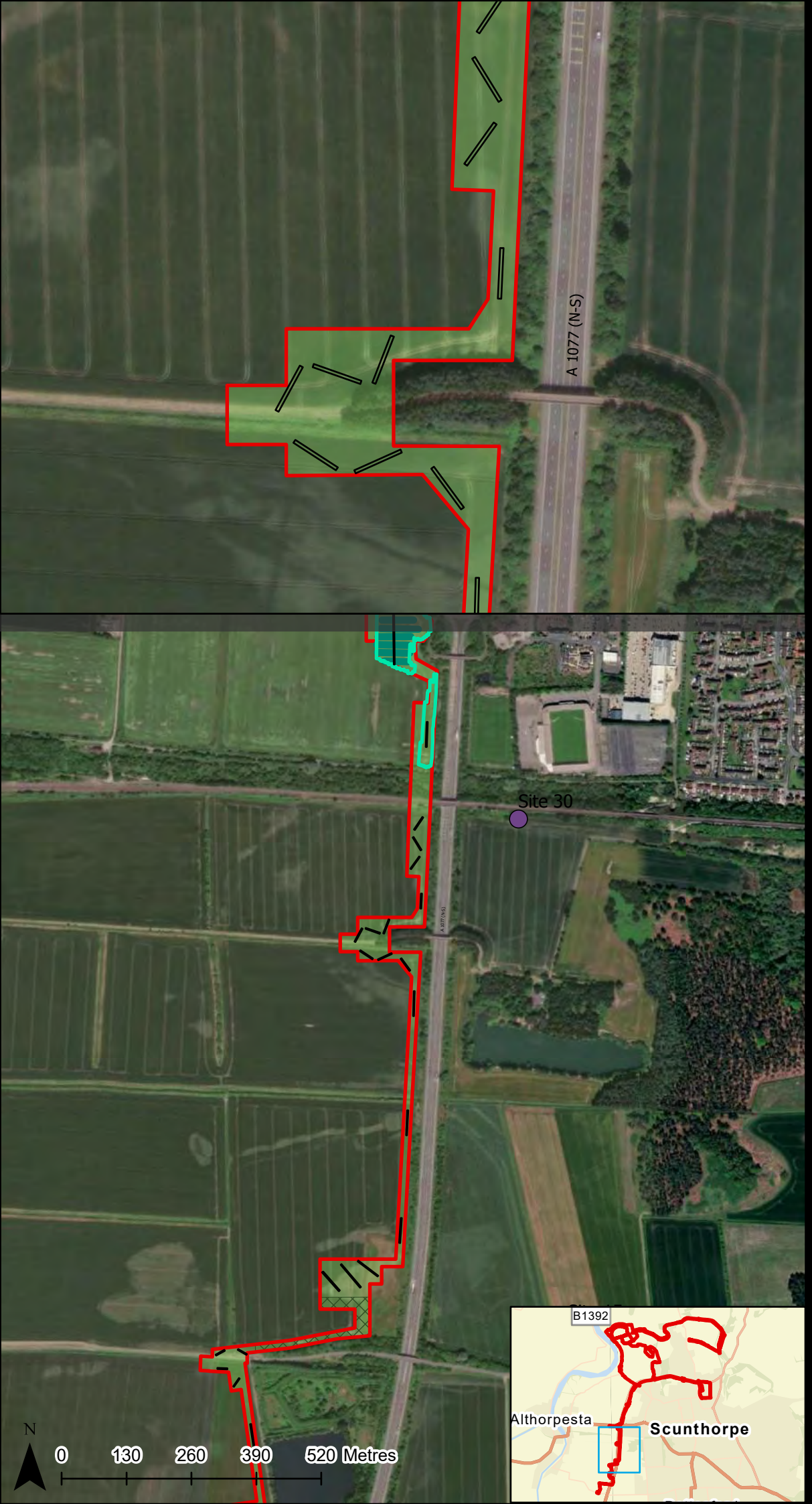

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title Trench locations in Area 3

Figure 19

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	30/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:10,140

ArcMap File

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Legend

- Trenches
- Geophysical Survey Extent
- Drainage Line
- Cultural Heritage
- Order Limits
- Previous Archaeological Investigation

Layer Source Information

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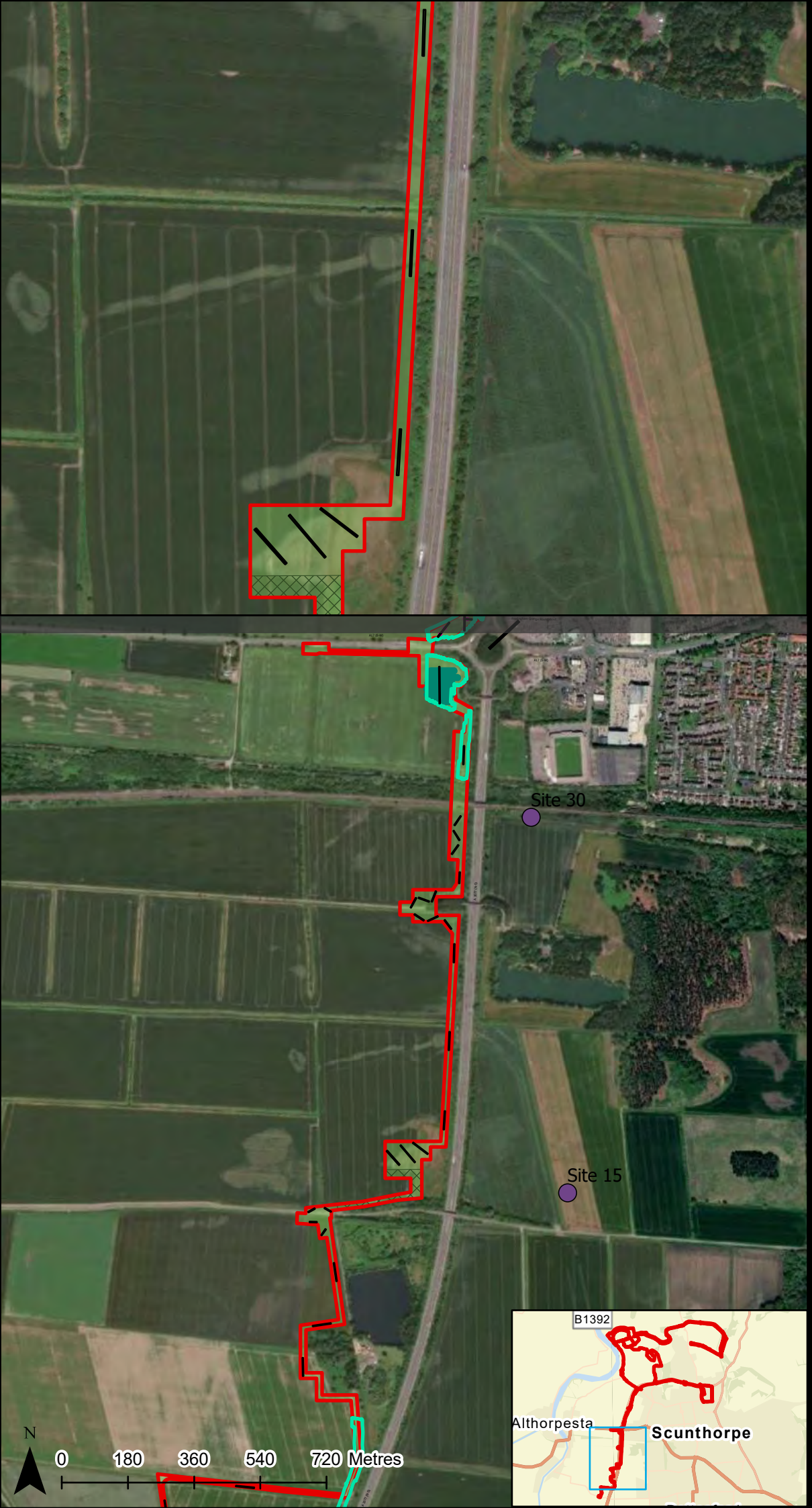

North Lincolnshire Green Energy Park

Title Trench locations in Area 3

Figure 20

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	30/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:13,805

ArcMap File

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Legend

- Trenches
- Geophysical Survey Extent
- Possible archaeological features
- Drainage Line
- Cultural Heritage
- Order Limits
- Previous Archaeological Investigation

Layer Source Information

World Street Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
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NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title Trench locations in Area 3

Figure 21

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	30/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:15,112

ArcMap File

Q:\London\Confidential Projects\0483091 Solar 21.HB\2. Working\6. GIS\mw\Trenches_mw\Area3_figures_closeup.a

Legend

- Trenches
- Geophysical Survey Extent
- Cultural Heritage
- Order Limits
- Previous Archaeological Investigation

Layer Source Information

World Street Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
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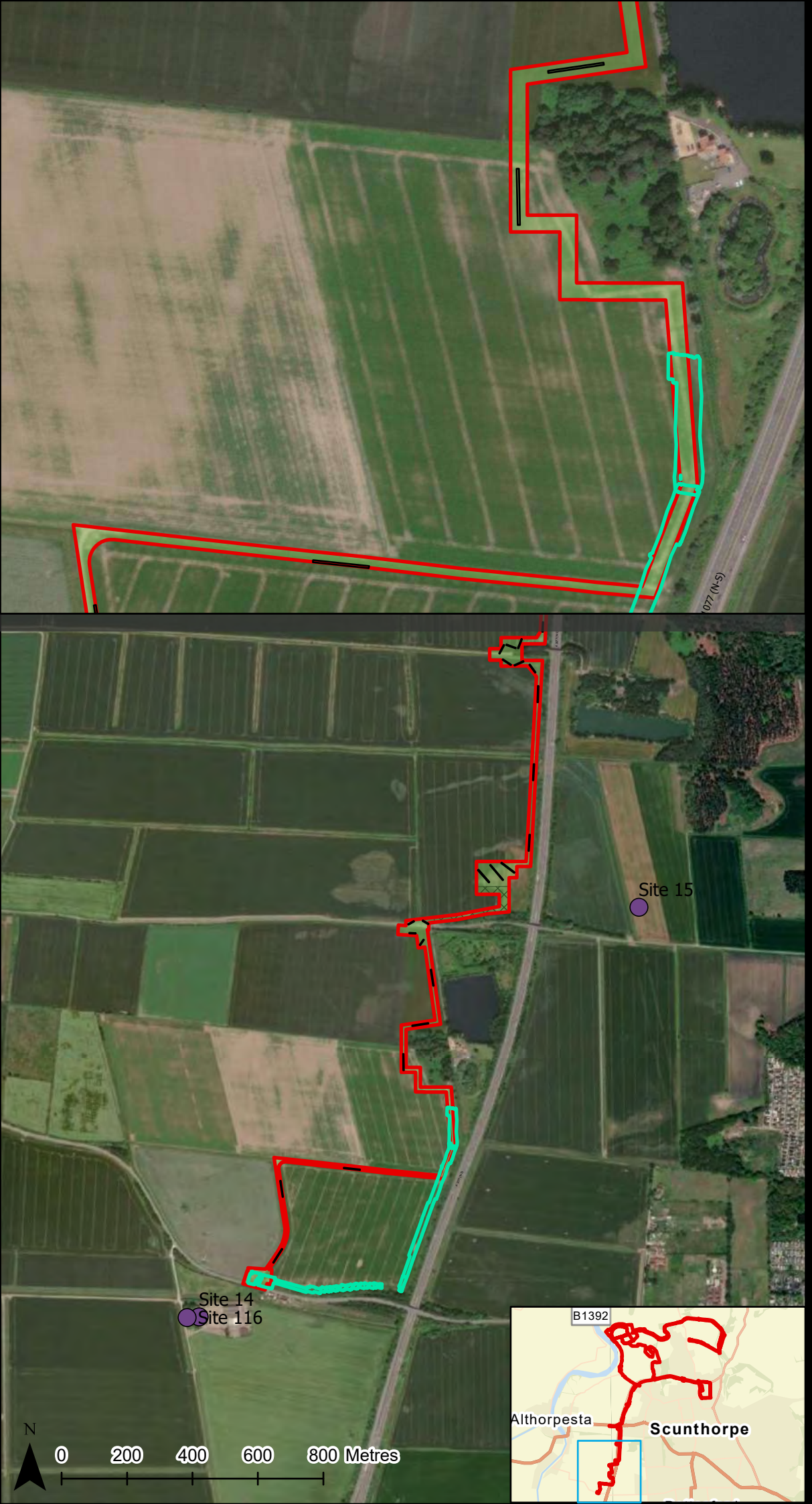

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title Trench locations in Area 3

Figure 22

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	30/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:15,477

ArcMap File

Q:\London\Confidential Projects\0483091 Solar 21.HB\2. Working\6. GIS\mw\Trenches_mw\Area3_figures_closeup.a

Legend

- Trenches
- Geophysical Survey Extent
- Cultural Heritage
- Order Limits
- Previous Archaeological Investigation

Layer Source Information

World Street Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
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North Lincolnshire Green Energy Park

Title Trench locations in Area 3

Figure 23

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	30/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:9,368

ArcMap File

Q:\London\Confidential Projects\0483091 Solar 21.HB\2. Working\6. GIS\mw\Trenches_mw\Area3_figures_closeup.a

Legend

- Trenches
- Geophysical Survey Extent
- Cultural Heritage
- Order Limits
- Previous Archaeological Investigation

Layer Source Information

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North Lincolnshire Green Energy Park

Title Trench locations in Area 4

Figure 24

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	26/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:4,116

ArcMap File

Q:\London\Confidential Projects\0483091 Solar 21.HB\2. Working\6. GIS\mw\Trenches_mw\Area4_figures_closeup1.

Legend

- Geophysical Survey Extent
- Trenches
- Possible archaeological features
- Drainage_line
- Modern Service
- Order Limits

Layer Source Information

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North Lincolnshire Green Energy Park

Title Trench locations in Area 4

Figure 25

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	26/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:3,290

ArcMap File

Q:\London\Confidential Projects\0483091 Solar 21.HB\2. Working\6. GIS\mw\Trenches_mw\Area4_figures_closeup2_

Legend

- Geophysical Survey Extent
- Trenches
- Archaeology Possible line
- Possible archaeological features
- Drainage_line
- Modern Service
- Trend_line
- Order Limits

Layer Source Information

World Street Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
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NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title Trench locations in Area 4

Figure 26

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	26/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:3,367

ArcMap File

Q:\London\Confidential Projects\0483091 Solar 21.HB\2. Working\6. GIS\mw\Trenches_mw\Area4_figures_closeup2_

Legend

- Geophysical Survey Extent
- Trenches
- Archaeology Possible line
- Possible archaeological features
- Drainage_line
- Modern Service
- Trend_line
- Order Limits

Layer Source Information

World Street Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
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NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title Trench locations in Area 4

Figure 27

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	26/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:3,189

ArcMap File

Q:\London\Confidential Projects\0483091 Solar 21.HB\2. Working\6. GIS\mw\Trenches_mw\Area4_figures_closeup2_

Legend

- Geophysical Survey Extent
- Trenches
- Archaeology Possible line
- Possible archaeological features
- Possible archaeolgoical features
- Drainage_line
- Modern Service
- Trend_line
- Order Limits

Layer Source Information

World Street Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
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NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title Trench locations in Area 4

Figure 28

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	26/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:4,335

ArcMap File

Q:\London\Confidential Projects\0483091 Solar 21.HB\2. Working\6. GIS\mw\Trenches_mw\Area4_figures_closeup2_

Legend

- Geophysical Survey Extent
- Trenches
- Archaeology Possible line
- Possible archaeological features
- Possible archaeolgoical features
- Drainage_line
- Modern Service
- Trend_line
- Order Limits

Layer Source Information

World Street Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
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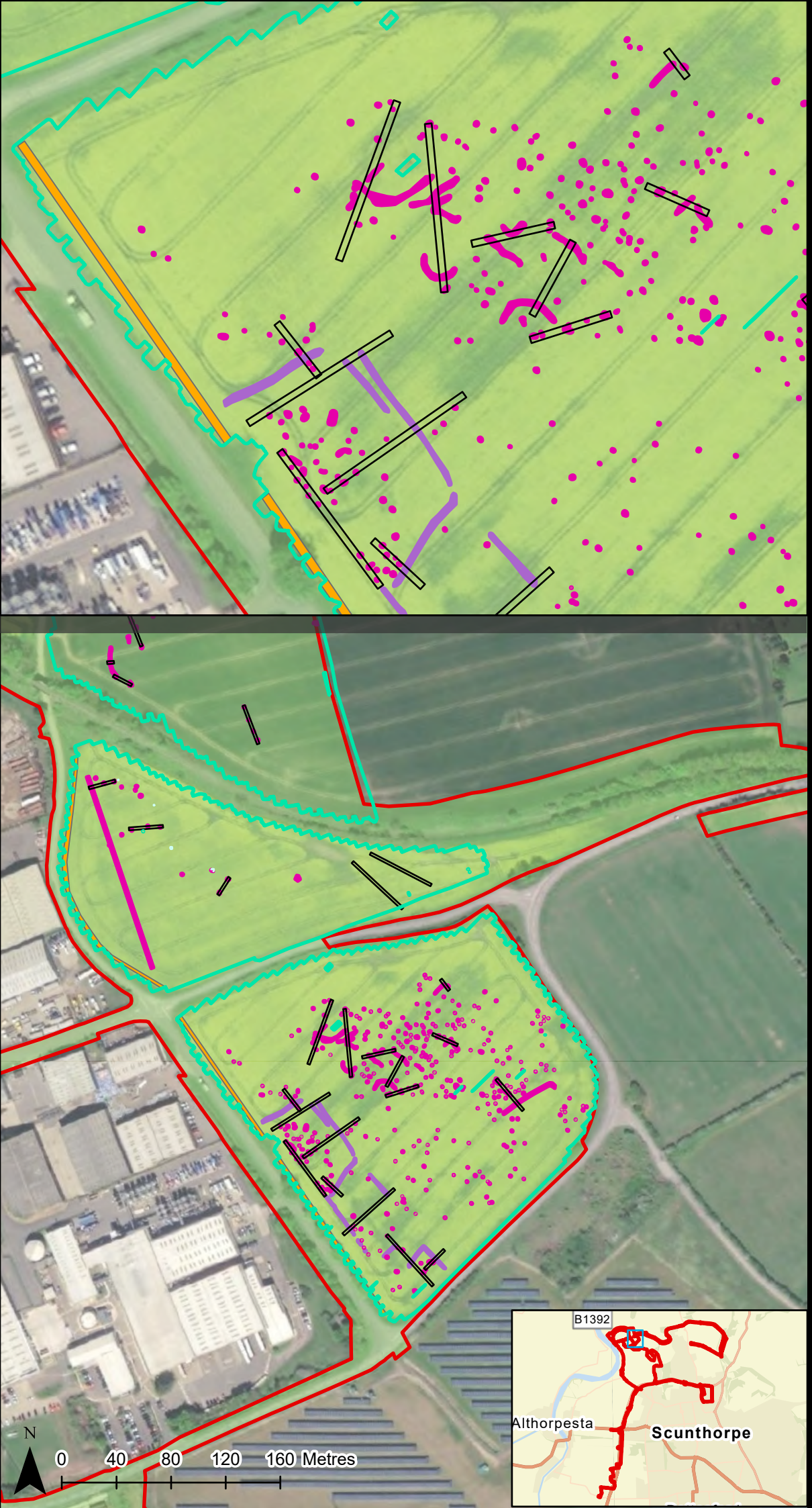

North Lincolnshire Green Energy Park

Title Trench locations in Area 4

Figure 29

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	26/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:3,716

ArcMap File

Q:\London\Confidential Projects\0483091 Solar 21.HB\2. Working\6. GIS\mw\Trenches_mw\Area4_figures_closeup2_

Legend

- Geophysical Survey Extent
- Trenches
- Archaeology Possible line
- Possible archaeological features
- Possible archaeolgoical features
- Modern Service
- Order Limits

Layer Source Information

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North Lincolnshire Green Energy Park

Title Trench locations in Area 4

Figure 30

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	26/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:3,716

ArcMap File

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Legend

- Geophysical Survey Extent
- Trenches
- Archaeology Possible line
- Possible archaeological features
- Possible archaeolgoical features
- Modern Service
- Order Limits

Layer Source Information

World Street Map: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS
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NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title Trench locations in Area 4

Figure 31

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	26/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:3,380

ArcMap File

Q:\London\Confidential Projects\0483091 Solar 21.HB\2. Working\6. GIS\mw\Trenches_mw\Area4_figures_closeup2_

Legend

- Geophysical Survey Extent
- Trenches
- Archaeology Possible line
- Possible archaeological features
- Possible archaeolgoical features
- Modern Service
- Order Limits

Layer Source Information

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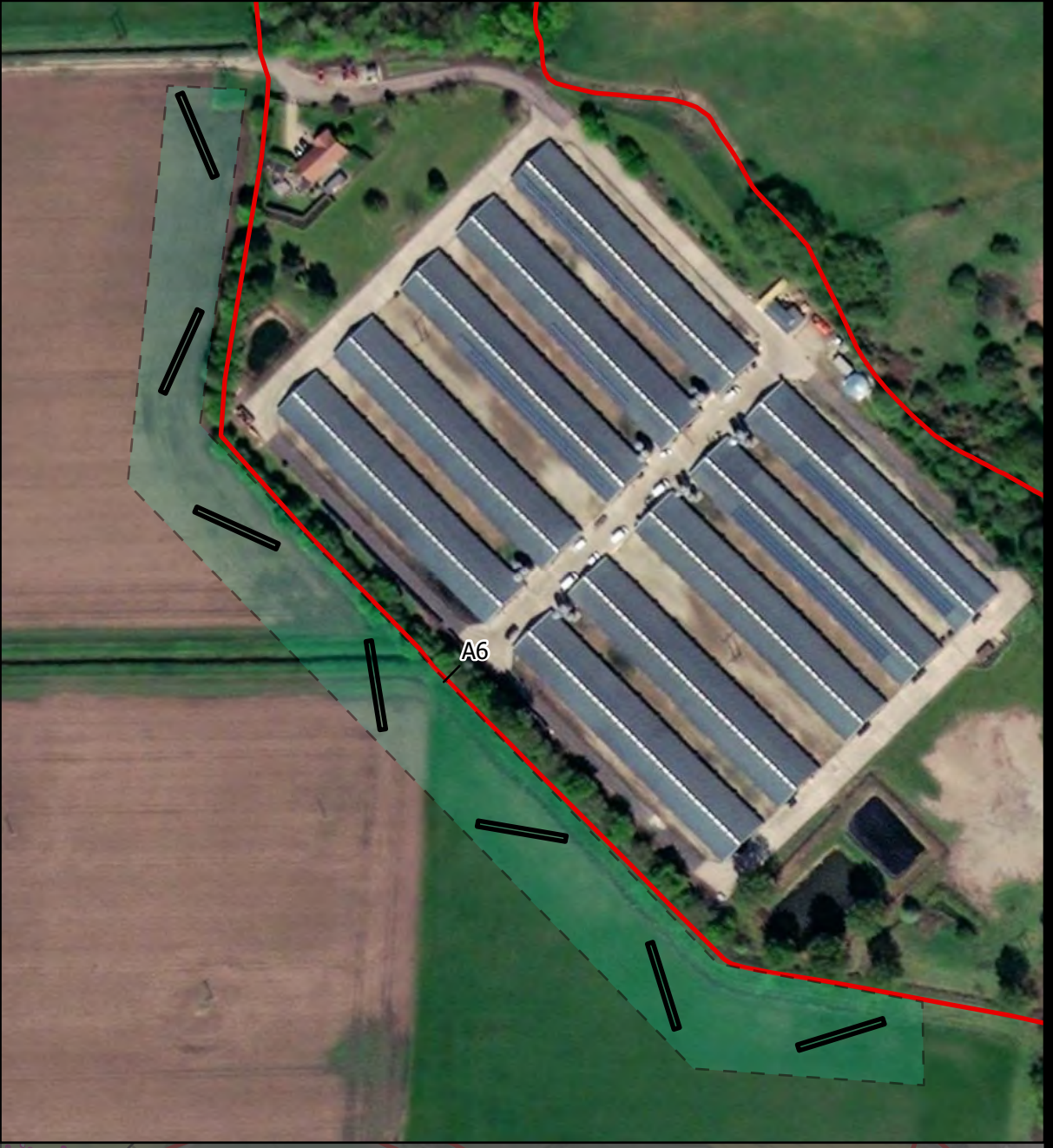

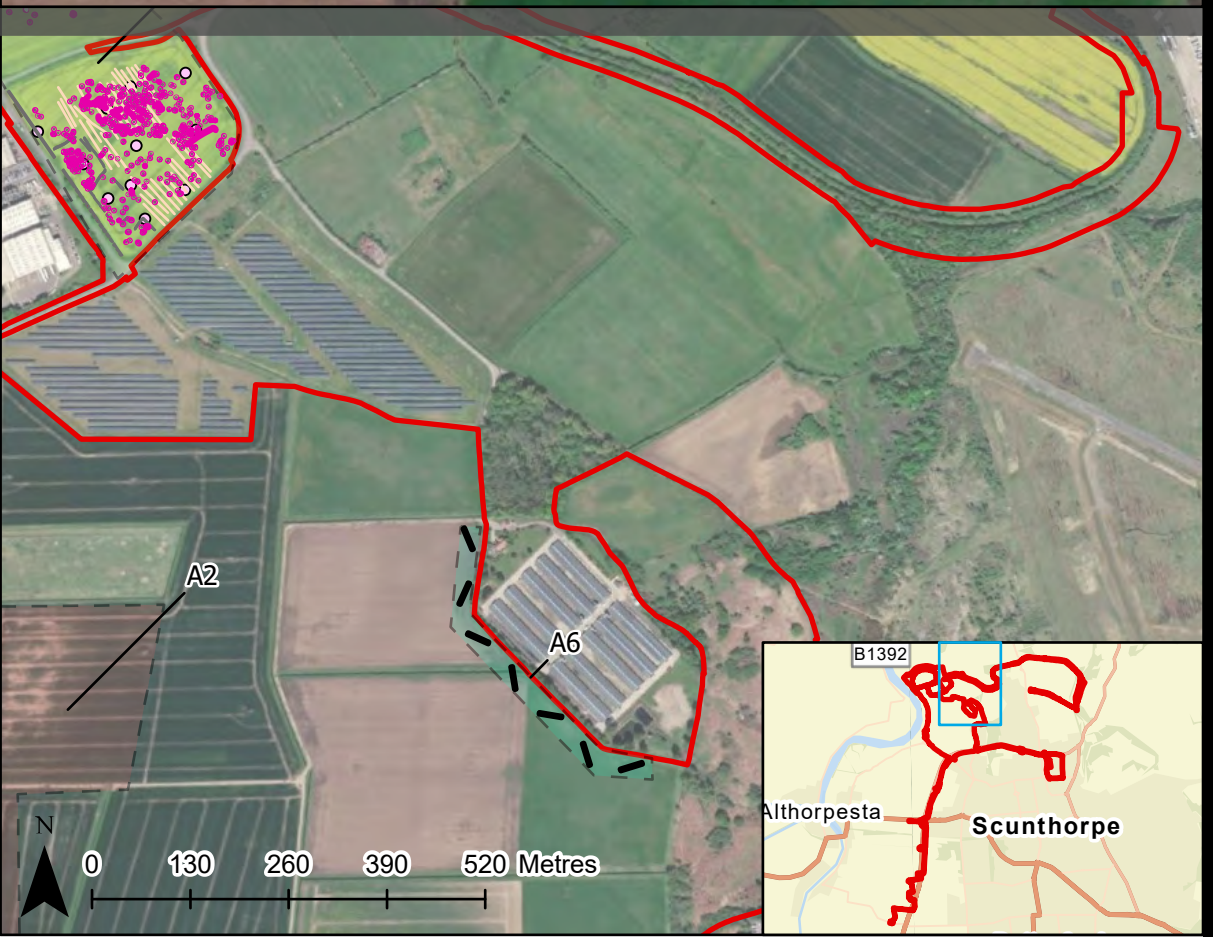

North Lincolnshire Green Energy Park

Title	Area 6, located north of Skippingdale Retail Park, showing the location of seven trial trenches
Figure 32	

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	26/05/2022
Drawn by	MW
Checked by	CA
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	1:10,000

ArcMap File

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Legend

- Possible archaeological features
- Possible archaeological features
- Modern Service
- Trend_line

Areas

- 2
- 4
- 6
- Order Limits

Layer Source Information

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APPENDIX G EVALUATION PROGRAMME

Evaluation component	WSI Ref	Archaeological contractor	March 22	April 22	May 22	June 22	July 22	Aug 22	Sept 22	Oct 22	Nov 22
Geoarchaeological site visit	Appendix E (this document)	AOC									
Geoarchaeological hand augering	Appendix E (this document)	AOC									
Geoarchaeological boreholes	Appendix E (this document)	AOC									
ERT survey	Appendix E (this document)	Wessex Archaeology									
Radiocarbon dating of geoarchaeological samples	Appendix E (this document)	AOC									
Geoarchaeological report	Appendix E (this document)	AOC									
Trial trench evaluation		Wessex Archaeology									
Trial trench evaluation assessment		Wessex Archaeology									
Trial trench evaluation report		Wessex Archaeology									

APPENDIX H PREDICTED CONSTRUCTION IMPACT

Asset number	Asset name	Designation and grade	Value	Description of impact	Magnitude of impact	Significance of effect	Mitigation	Residual effects
7	Flixborough Staithe	N/A	Moderate	Likely to be substantial impacts on the remains of the medieval and post-medieval settlement associated with the river port	Medium	Moderate	Record by controlled archaeological excavation down to proposed foundation levels.	Moderate
9	Cropmarks, Atkinsons Warren	N/A	Moderate	Potential removal or partial removal of buried remains	Low	Minor	If deemed appropriate following results of ongoing evaluations, recommended mitigation would take the form of controlled excavation or a watching brief.	Minor
10	Neap House WWII searchlight battery	N/A	Low	Potential removal or partial removal of buried remains	High	Moderate	If deemed appropriate following results of ongoing evaluations, recommended mitigation would take the form of controlled excavation or a watching brief.	Moderate
11	Linear cropmarks and possible enclosure	N/A	Moderate	Partial disturbance of buried remains of settlement	Low	Minor	If deemed appropriate following results of ongoing evaluations, recommended mitigation would take the form of controlled excavation or a watching brief.	Minor
12	Enclosure, W of Holyrood Drive	N/A	Moderate	Partial disturbance of buried remains of settlement	Low	Minor	If deemed appropriate following results of ongoing evaluations, recommended mitigation would take the form of controlled excavation or a watching brief.	Minor
78	Flixborough Saxon nunnery & site of All Saints burial ground.	Scheduled Monument	High	The addition of the ERF and its 120m high stack does mark a substantial additional industrialisation	Low	Moderate	No suitable mitigation	Moderate

Asset number	Asset name	Designation and grade	Value	Description of impact	Magnitude of impact	Significance of effect	Mitigation	Residual effects
				of what remains a largely rural landscape today.				
119	Lime kilns (site of), east of Flixborough	N/A	Low	Potential removal or partial removal of buried remains	Low	Minor	If deemed appropriate following results of ongoing evaluations, recommended mitigation would take the form of controlled excavation or a watching brief.	Minor
123	Site of limekilns	N/A	Low	Potential removal or partial removal of buried remains	Low	Minor	If deemed appropriate following results of ongoing evaluations, recommended mitigation would take the form of controlled excavation or a watching brief.	Minor
124	Brick Kiln, Flixborough Staither	N/A	Low	Potential removal or partial removal of buried remains	Medium	Minor	Watching brief.	Minor
132	Flixborough Ferry jetty	N/A	Low	Indirect effects on setting	Low	Minor	Record at low water to form a permanent record of their form and current condition.	Minor
133	Land east of Flixborough Industrial Estate	N/A	Moderate	Substantial disturbance of likely multi-period archaeological remains	High	Moderate	Record by controlled archaeological excavation down to proposed foundation levels.	Moderate
134	Deep sequence of peat deposits at depths of between 4.70-6.70m to 11.70-12.30m below ground level	N/A	Moderate	Likely to be substantial impacts on buried alluvial organic deposits	Medium	Moderate	Record by strip map and sample investigation or stepped trial pits to facilitate geoarchaeological and palaeoenvironmental sampling and dating.	Moderate