

# The Sizewell C Project

6.6 Volume 5 Two Village Bypass

Chapter 9 Terrestrial Historic Environment
Appendix 9C - Geophysical Survey Report

Revision: 2.0

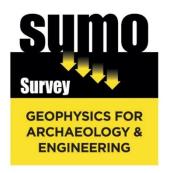
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# June 2021

Planning Act 2008 Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009





# **GEOPHYSICAL SURVEY REPORT**

# Two Village Bypass, Sizewell, Suffolk

Client

**Cotswold Archaeology** 

For

**EDF Energy** 

Survey Report

14282B V3

Date

March 2020



## Survey Report 14282B V2: Two Village Bypass, Sizewell, Suffolk

**Survey dates** 12 - 13 February 2019 4 - 7 March 2019 7 - 8 May 2019 9 - 12 December 2019 16 -19 March 2020 Field co-ordinators **Field Team Report Date** 24 March 2020 **CAD Illustrations Report Authors Project Managers** Report approved

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#### 2. **SURVEY TECHNIQUE**

1

Detailed magnetic survey (magnetometry) was chosen as the most efficient and effective method of locating the type of archaeological anomalies which might be expected at this site.

Bartington Grad 601-2 Traverse Interval 1.0m Sample Interval 0.25m

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#### 3 SUMMARY OF RESULTS

3.1 A magnetic survey, in advance of a proposed bypass to the south of Farnham, Suffolk, covered over 56ha and was carried out in several phases. The survey has recorded anomalies of possible archaeological interest which includes field systems, possible enclosures and a number of ditch and pit like responses; some of these may be associated with recorded features within the HER. Several uncertain responses have also been detected, some of which are likely to be due to modern processes; however, the regular anomaly in Area 9 could be of archaeological origin. Anomalies due to modern agricultural practices are visible and the locations of several service pipes have been marked. Natural responses associated with varying local geology is also visible in the data.

#### INTRODUCTION 4

4.1 SUMO Geophysics Ltd were commissioned to undertake a geophysical survey of an area outlined for road improvements. This survey forms part of an archaeological investigation being undertaken by Cotswold Archaeology on behalf of EDF Energy.

#### 4.2 Site details

This report comprises the results from 14502A and 14502B Two Village Bypass, Sizewell, Suffolk and an additional 30ha of survey that has been carried out subsequently (SOR14292, SOR14502 and SOR15113).

NGR / Postcode Easterly extent: TM370 604 / IP17 1JX

Westerly extent: TM353 595 / IP17 1LF

Location The site is located 3.5km south of Saxmundham and 6km north-east of

> Wickham Market. The proposed road corridor starts at Friday Street. extends south-westwards, south of Farnham, and terminates at Stratford

St Andrew.

**HER** Suffolk

**HER Code** FNM030, SSA 027 OASIS Ref. sumogeop1-342879

District East Suffolk

**Parishes** Farnham

Stratford St. Andrew

Topography Flat

**Current Land Use** Farmland

Geology Bedrock: Crag group - sand.

Chillesford church sand member - sand. (BGS 2020)

Crag Formation - sand

Superficial: Lowestoft formation - sand and gravel.

> Lowestoft formation - diamicton Alluvium - clay, silt, sand and gravel

Soils Soilscape 8: Slightly acid loamy and clayey soils with impeded drainage.

(CU 2020) Soilscape 10: Freely draining slightly acid sandy soils.

Soilscape 27: Fen peat soils

Archaeology (Wood [E&IS]

2018)

Within the study area surrounding landscape lies:

Widespread scatter of worked and burnt flint over an MSF13451

area c 200 x 100 m.

MSF13452 Widespread scatter of worked and burnt flint over an

area c 200 x 80 m.

MSF11207 Roman artefact scatter of pottery and metalwork.

2 © SUMO Geophysics Ltd

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MSF13435	Medieval scatter.
MSF13453	Widespread scatter of worked and heavily burnt flints
	over an area c 180 x 120m.
MSF13455	Widespread lithic scatter over c 260 x 160m.
MSF25883	Crop marks showing a possible old field system.
MSF33814	Prehistoric and Saxon/medieval field systems at Land off Hill Farm.
MSF11779	Blade end of socketed axe.
MSF12793	Two gold angels of Henry VIII found 8m apart. (PostMed).
MSF19452	Ancient Woodlands.
MSF15049	Small area with cropmarks, including probable field boundaries, on different alignments, and a possible causewayed ring ditch.
391335	3 Neolithic sherds found.
391336	AS Whetstone found.
ESF23208	Two phases of field systems dating from the Bronze
ESF25706	Age and Iron Age; including boundary ditches and possible causewayed ring ditch.
NA	and the second s

Survey Methods Magnetometer survey (fluxgate gradiometer)

Study Area 56 ha

#### 4.3 **Aims and Objectives**

To locate and characterise any anomalies of possible archaeological interest within the study area.

#### 5 **RESULTS**

The survey has been divided into 23 survey areas (Areas 1-23) and specific anomalies have been given numerical labels [1] [2] which appear in the text below, as well as on the Interpretation Figure(s).

#### 5.1 Possible Archaeology

- A number of discrete anomalies and linear trends [1] have been recorded in Area 2 which 5.1.1 correspond with observations made in the DBA (MSF 25883); anomalies in the east of Area 2 appear to form part of a field system. It is difficult to give a precise interpretation for anomalies found in the west of Area 2 as background noise (likely to be modern or natural in origin) has partially masked the data.
- 5.1.2 A potential, partial enclosure [2] has been detected in the west of Area 3 and may be associated with some of the possible archaeological responses recorded in Area 2 (see 5.1.1). An area of increased magnetic response has also been detected within the confines of the two ditches which could be indicative of localised activity, i.e. settlement activity. Hence, these responses have been assigned to the category of Possible Archaeology.
- 5.1.3 Several strong and well-defined anomalies [3] have been recorded in Areas 17 and 18 which are ditch and pit like in from. These responses are in close proximity to archaeological features that have been excavated during trial trenches, which included ditches dating to the Bronze and Iron Ages (ESF23208 & ESF25706). It is possible that the responses detected in the survey are associated as they appear morphologically similar. Therefore, the anomalies have been categorised as Possible Archaeology.

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#### 5.2 Uncertain

5.2.1 Several linear, discrete anomalies and trends across the survey areas have been classified as *Uncertain*. Linear and curvilinear responses could be archaeological, but they are more likely to be due to agricultural effects or a consequence of the natural soils / geology. Isolated responses can be particularly difficult to interpret; although some may appear pit-like in form, they could be natural pockets of magnetic soil or even deeply buried ferrous objects, as these can also result in a similar signature.

5.2.2 A number of discrete and linear anomalies [4] have been recorded in Area 9. These responses are located within a band of natural alluvium (see 5.5.3) and share a similar magnetic signature; however, the anomalies appear to form a rectilinear enclosure and are regular in form. This has led to the responses being categorised as *Uncertain*.

# 5.3 Former Field Boundary / Trackway

- 5.3.1 Anomalies in Area 23 correspond to the line of a trackway used for car boot sales which take place on the site.
- 5.3.2 A number of linear responses visible in the magnetic data in Areas 9, 10, 13 and 22 correlate to the locations of former field boundaries shown on historic mapping. Two linear anomalies have been recorded in Area 12, though these are not recorded on historic mapping as field boundaries. There magnetic signature is not too dissimilar to the other recorded field boundaries; hence, they have been categorised as conjectural field boundaries.

### 5.4 Agricultural – Ploughing / Land Drains

- 5.4.1 Numerous magnetically weak closely spaced parallel linear responses are due to relatively recent ploughing. Headlands or tractor lines adjacent to field edges are visible throughout the dataset.
- 5.4.2 Several linear responses recorded in Areas 16 and 17 are due to land drains.

### 5.5 Natural / Geological / Pedological

4

- 5.5.1 A zone of variable and ill-defined anomalies in the south-west of Area 20 has been assigned to the category *Natural* as it is characteristic of responses caused by increased levels of geological or pedological background variation. There are several ponds in the vicinity, but none are shown on historic OS mapping in this location; old sand pits are depicted c.100m east of Area 2 on the 1883 edition OS map and these could be an alternative explanation.
- 5.5.2 Anomalies consistent with natural soil variations are present in Areas 20 and 21; most comprise zones of stronger or weaker mottling and weak amorphous sinuous trends.
- 5.5.3 A large band of alluvium has been recorded in the west of the road corridor. The anomalies area sinuous in form but are magnetically strong and coincide with alluvium noted by the British Geological Survey (see Figure 08). These responses may have obscured any weaker archaeological anomalies, if present.

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#### 5.6 Service Pipes

5.6.1 Three strong dipolar linear anomalies have been recorded in Areas 2, 9, 10, 11, 13 and 22 and mark the location of service pipes.

#### 5.7 Ferrous / Magnetic Disturbance

- 5.7.1 Magnetically strong isolated anomalies in Areas 19 and 20 are due to electricity poles.
- 5.7.2 Magnetic disturbance recorded in Area 23 is thought to be directly related with consolidation material used for the Friday Street car boot sale.
- 5.7.3 Ferrous responses close to boundaries are due to adjacent fences and gates. Smaller scale ferrous anomalies ("iron spikes") are present throughout the data and are characteristic of small pieces of ferrous debris (or brick / tile) in the topsoil; they are commonly assigned a modern origin. Only the most prominent of these are highlighted on the interpretation diagram.

#### 6 DATA APPRAISAL & CONFIDENCE ASSESSMENT

6.1 Historic England guidelines (EH 2008) Table 4 states that the typical magnetic response on the local soils / geology is variable. The results from this survey indicate the presence of possible ditches and pits; as a consequence, the survey is deemed to have worked well. However, any weaker archaeological anomalies may have been masked by the magnetically strong natural deposits.

#### 7 CONCLUSION

7.1 The magnetometer survey has detected a number of anomalies that have been classified as being of possible archaeological origin. Several anomalies and trends in Area 2 appear to form a series of field systems and a possible partial enclosure has been recorded in Area 3. A series of responses in Area 17 could be associated with Bronze Age and Iron Age ditches that were recorded during excavation due south-west of the area. Uncertain responses have been detected throughout the dataset, which include a large rectangular feature in Area 9; however, the majority of these responses are probably due to modern or agricultural processes. A couple of former field boundaries have been recorded; modern ploughing and land drains are also visible in the data. Large bands of magnetically strong but sinuous anomalies have been assigned to the category of natural and reflect alluvial deposits. Service pipes have been located along with areas of modern magnetic disturbance.

8 **REFERENCES BGS 2020** British Geological Survey, Geology of Britain viewer [accessed 24/03/2020] website: (http://www.bgs.ac.uk/opengeoscience/home.html?Accordion1=1#maps) CIfA 2014 Standard and Guidance for Archaeological Geophysical Survey. Amended 2016. CIfA Guidance note. Chartered Institute for Archaeologists, Reading http://www.archaeologists.net/sites/default/files/CIfAS%26Geophysics 2.pdf CU 2020 The Soils Guide. Available: www.landis.org.uk. Cranfield University, UK. [accessed 24/03/2020] website: http://mapapps2.bgs.ac.uk/ukso/home.html **EAC 2016** EAC Guidelines for the Use of Geophysics in Archaeology, European Archaeological Council, Guidelines 2. EH 2008 Geophysical Survey in Archaeological Field Evaluation. English Heritage, Swindon https://content.historicengland.org.uk/images-books/publications/geophysicalsurvey-in-archaeological-field-evaluation/geophysics-guidelines.pdf/ Wood [E&IS] Two Village Bypass - Archaeological Desk Based Assessment. Wood Environment

& Infrastructure Solutions UK Limited. 2018. Ref: 40345-007i2.

2018

6

#### Standards & Guidance

This report and all fieldwork have been conducted in accordance with the latest guidance documents issued by Historic England (EH 2008) (then English Heritage), the Chartered Institute for Archaeologists (CIfA 2014) and the European Archaeological Council (EAC 2016).

#### **Grid Positioning**

For hand held gradiometers the location of the survey grids has been plotted together with the referencing information. Grids were set out using a Trimble R8 Real Time Kinematic (RTK) VRS Now GNSS GPS system.

An RTK GPS (Real-time Kinematic Global Positioning System) can locate a point on the ground to a far greater accuracy than a standard GPS unit. A standard GPS suffers from errors created by satellite orbit errors, clock errors and atmospheric interference, resulting in an accuracy of 5m-10m. An RTK system uses a single base station receiver and a number of mobile units. The base station rebroadcasts the phase of the carrier it measured, and the mobile units compare their own phase measurements with those they received from the base station. This results in an accuracy of around 0.01m.

Technique	Instrument	Traverse Interval	Sample Interval
Magnetometer	Bartington Grad 601-2	1m	0.25m

### Instrumentation: Bartington *Grad* 601-2

Bartington instruments operate in a gradiometer configuration which comprises fluxgate sensors mounted vertically, set 1.0m apart. The fluxgate gradiometer suppresses any diurnal or regional effects. The instruments are carried, or cart mounted, with the bottom sensor approximately 0.1-0.3m from the ground surface. At each survey station, the difference in the magnetic field between the two fluxgates is measured in nanoTesla (nT). The sensitivity of the instrument can be adjusted; for most archaeological surveys the most sensitive range (0.1nT) is used. Generally, features up to 1m deep may be detected by this method, though strongly magnetic objects may be visible at greater depths. The Bartington instrument can collect two lines of data per traverse with gradiometer units mounted laterally with a separation of 1.0m. The readings are logged consecutively into the data logger which in turn is daily down-loaded into a portable computer whilst on site. At the end of each site survey, data is transferred to the office for processing and presentation.

#### **Data Processing**

Zero Mean Traverse This process sets the background mean of each traverse within each grid to zero. The operation removes striping effects and edge discontinuities over the whole of the data set.

Step Correction (De-stagger)

When gradiometer data are collected in 'zig-zag' fashion, stepping errors can sometimes arise. These occur because of a slight difference in the speed of walking on the forward and reverse traverses. The result is a staggered effect in the data, which is particularly noticeable on linear anomalies. This process corrects these errors.

### Display

Greyscale/ Colourscale Plot This format divides a given range of readings into a set number of classes. Each class is represented by a specific shade of grey, the intensity increasing with value. All values above the given range are allocated the same shade (maximum intensity); similarly, all values below the given range are represented by the minimum intensity shade. Similar plots can be produced in colour, either using a wide range of colours or by selecting two or three colours to represent positive and negative values. The assigned range (plotting levels) can be adjusted to emphasise different anomalies in the data-set.

### Presentation of results and interpretation

The presentation of the results includes a 'minimally processed data' and a 'processed data' greyscale plot. Magnetic anomalies are identified, interpreted and plotted onto the 'Interpretation' drawings.

When interpreting the results, several factors are taken into consideration, including the nature of archaeological features being investigated and the local conditions at the site (geology, pedology, topography etc.). Anomalies are categorised by their potential origin. Where responses can be related to other existing evidence, the anomalies will be given specific categories, such as: Abbey Wall or Roman Road. Where the interpretation is based largely on the geophysical data, levels of confidence are implied, for example: Probable, or Possible Archaeology. The former is used for a confident interpretation, based on anomaly definition and/or other corroborative data such as cropmarks. Poor anomaly definition, a lack of clear patterns to the responses and an absence of other supporting data reduces confidence, hence the classification Possible.

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### **Interpretation Categories**

In certain circumstances (usually when there is corroborative evidence from desk-based or excavation data) very specific interpretations can be assigned to magnetic anomalies (for example, Roman Road, Wall, etc.) and where appropriate, such interpretations will be applied. The list below outlines the generic categories commonly used in the interpretation of the results.

Archaeology / Probable Archaeology

This term is used when the form, nature and pattern of the responses are clearly or very probably archaeological and /or if corroborative evidence is available. These anomalies, whilst considered anthropogenic, could be of any age.

Possible Archaeology

These anomalies exhibit either weak signal strength and / or poor definition, or form incomplete archaeological patterns, thereby reducing the level of confidence in the interpretation. Although the archaeological interpretation is favoured, they may be the result of variable soil depth, plough damage or even aliasing as a result of data collection orientation.

Industrial / Burnt-Fired Strong magnetic anomalies that, due to their shape and form or the context in which they are found, suggest the presence of kilns, ovens, corn dryers, metalworking areas or hearths. It should be noted that in many instances modern ferrous material can produce similar magnetic anomalies.

Former Field & possible)

Anomalies that correspond to former boundaries indicated on historic mapping, or Boundary (probable which are clearly a continuation of existing land divisions. Possible denotes less confidence where the anomaly may not be shown on historic mapping but nevertheless the anomaly displays all the characteristics of a field boundary.

Ridge & Furrow

Parallel linear anomalies whose broad spacing suggests ridge and furrow cultivation. In some cases, the response may be the result of more recent agricultural activity.

**Agriculture** (ploughing) Parallel linear anomalies or trends with a narrower spacing, sometimes aligned with existing boundaries, indicating more recent cultivation regimes.

Land Drain

Weakly magnetic linear anomalies, guite often appearing in series forming parallel and herringbone patterns. Smaller drains may lead and empty into larger diameter pipes, which in turn usually lead to local streams and ponds. These are indicative of clay fired land drains.

Natural

These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions.

Magnetic Disturbance Broad zones of strong dipolar anomalies, commonly found in places where modern ferrous or fired materials (e.g. brick rubble) are present.

Service

Magnetically strong anomalies, usually forming linear features are indicative of ferrous pipes/cables. Sometimes other materials (e.g. pvc) or the fill of the trench can cause weaker magnetic responses which can be identified from their uniform linearity.

**Ferrous** 

This type of response is associated with ferrous material and may result from small items in the topsoil, larger buried objects such as pipes, or above ground features such as fence lines or pylons. Ferrous responses are usually regarded as modern. Individual burnt stones, fired bricks or igneous rocks can produce responses similar to ferrous material.

Uncertain Origin

Anomalies which stand out from the background magnetic variation, yet whose form and lack of patterning gives little clue as to their origin. Often the characteristics and distribution of the responses straddle the categories of *Possible* Archaeology / Natural or (in the case of linear responses) Possible Archaeology /

Agriculture; occasionally they are simply of an unusual form.

Where appropriate some anomalies will be further classified according to their form (positive or negative) and relative strength and coherence (trend: weak and poorly defined).

#### Appendix B - Technical Information: Magnetic Theory

Detailed magnetic survey can be used to effectively define areas of past human activity by mapping spatial variation and contrast in the magnetic properties of soil, subsoil and bedrock. Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.1 nanoTeslas (nT) in an overall field strength of 48,000 (nT), can be accurately detected.

Weakly magnetic iron minerals are always present within the soil and areas of enhancement relate to increases in *magnetic susceptibility* and permanently magnetised *thermoremanent* material.

Magnetic susceptibility relates to the induced magnetism of a material when in the presence of a magnetic field. This magnetism can be considered as effectively permanent as it exists within the Earth's magnetic field. Magnetic susceptibility can become enhanced due to burning and complex biological or fermentation processes.

Thermoremanence is a permanent magnetism acquired by iron minerals that, after heating to a specific temperature known as the Curie Point, are effectively demagnetised followed by re-magnetisation by the Earth's magnetic field on cooling. Thermoremanent archaeological features can include hearths and kilns; material such as brick and tile may be magnetised through the same process.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil creates a relative contrast against the much lower levels of magnetism within the subsoil into which the feature is cut. Systematic mapping of magnetic anomalies will produce linear and discrete areas of enhancement allowing assessment and characterisation of subsurface features. Material such as subsoil and non-magnetic bedrock used to create former earthworks and walls may be mapped as areas of lower enhancement compared to surrounding soils.

Magnetic survey is carried out using a fluxgate gradiometer which is a passive instrument consisting of two sensors mounted vertically 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field whilst the lower sensor measures the same field but is also more affected by any localised buried feature. The difference between the two sensors will relate to the strength of a magnetic field created by this feature, if no field is present the difference will be close to zero as the magnetic field measured by both sensors will be the same.

Factors affecting the magnetic survey may include soil type, local geology, previous human activity and disturbance from modern services.

# **OASIS DATA COLLECTION FORM: England**

List of Projects □ | Manage Projects | Search Projects | New project | Change your details | HER coverage | Change country | Log out

#### **Printable version**

### OASIS ID: sumogeop1-342879

### **Project details**

Project name Two Village By-Pass, Farnham

Short description of the project Geophysical (magnetometer) survey.

Project dates Start: 12-02-2019 End: 13-02-2109

Previous/future work Not known / Not known

Any associated project

reference codes

14502A - Contracting Unit No.

Type of project Field evaluation

Site status None

Current Land use Cultivated Land 3 - Operations to a depth more than 0.25m

Monument type NONE None

Monument type NONE None

Significant Finds NONE None

Significant Finds NONE None

Methods & techniques "'Geophysical Survey'"

Development type Road scheme (new and widening)

Prompt Environmental (unspecified schedule)

Position in the planning process Not known / Not recorded

Solid geology (other) Chillesford Church Sand Member - sand.

Drift geology (other) Lowestoft Formation - Diamicton

Techniques Magnetometry

#### **Project location**

Country England

Site location SUFFOLK SUFFOLK COASTAL STRATFORD ST ANDREW Two Village

By Pass,farnham

Site location SUFFOLK SUFFOLK COASTAL FARNHAM Two Village By Pass,farnham Site location SUFFOLK SUFFOLK COASTAL BENHALL Two Village By Pass,farnham

Study area 24 Hectares

Site coordinates TM 367 597 52.18408484357 1.462988045408 52 11 02 N 001 27 46 E

Point

#### **Project creators**

Name of Organisation Sumo Geophysics

https://oasis.ac.uk/form/print.cfm

1/2

Project brief originator Consultant

Project design originator Sumo Geophysics
Project director/manager Sumo Geophysics
Project supervisor Sumo Geophysics

Type of sponsor/funding body Not known

#### **Project archives**

Physical Archive Exists? No

Digital Archive recipient Suffolk HER
Digital Contents "Survey"

Digital Media available "Geophysics"

Paper Archive recipient Suffolk HER

Paper Contents "Survey"

Paper Media available "Report", "Survey "

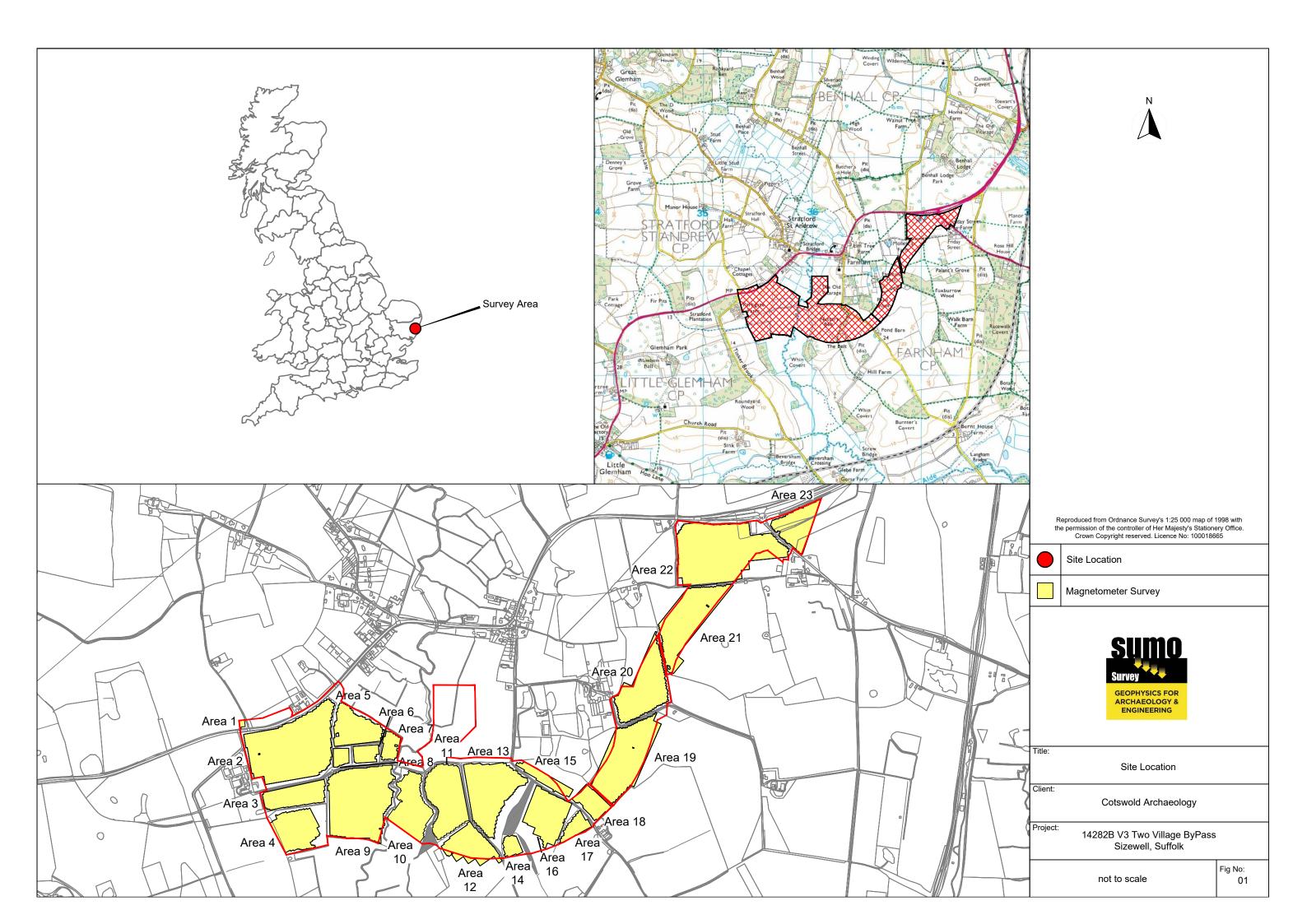
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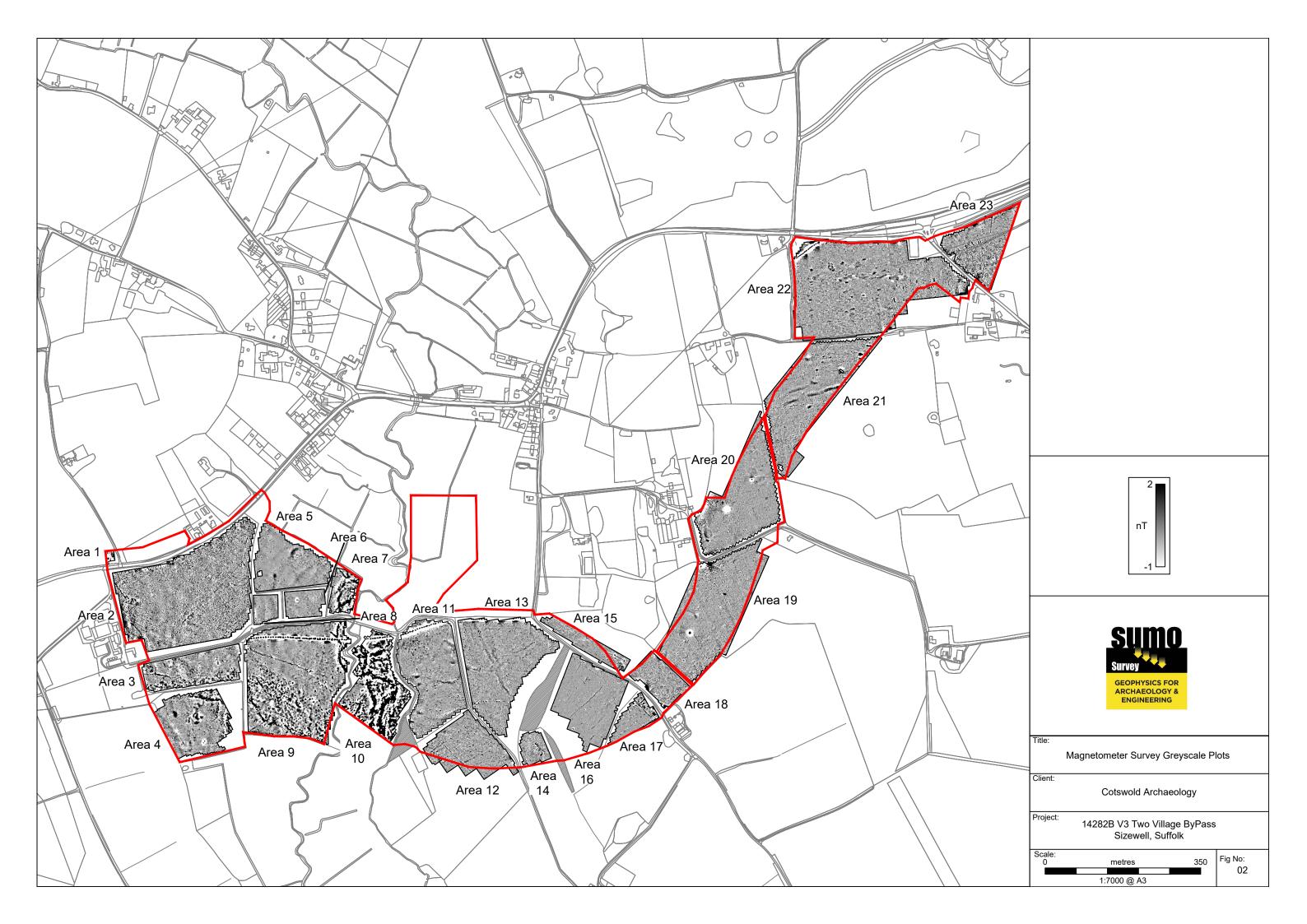
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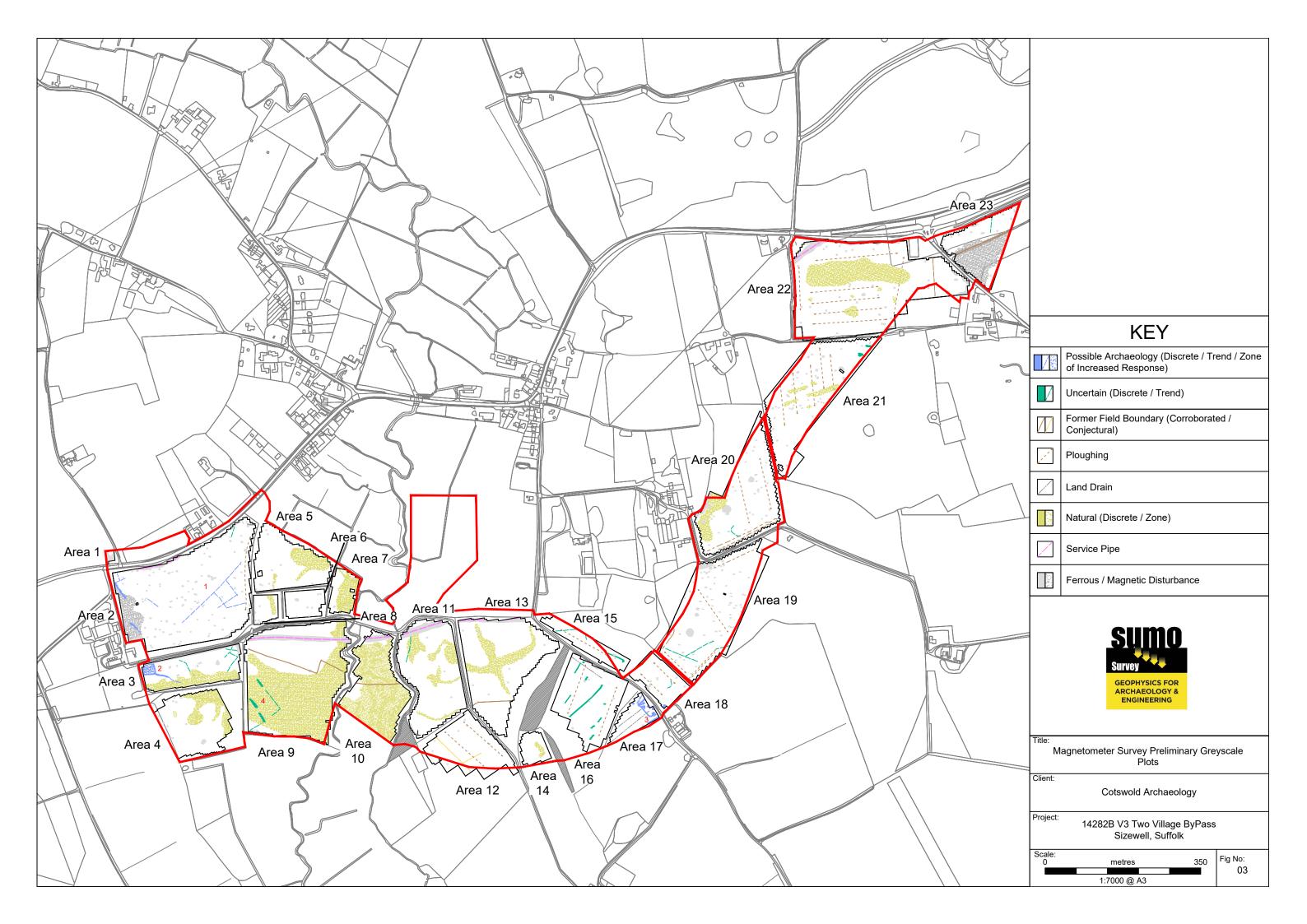
# **OASIS:**

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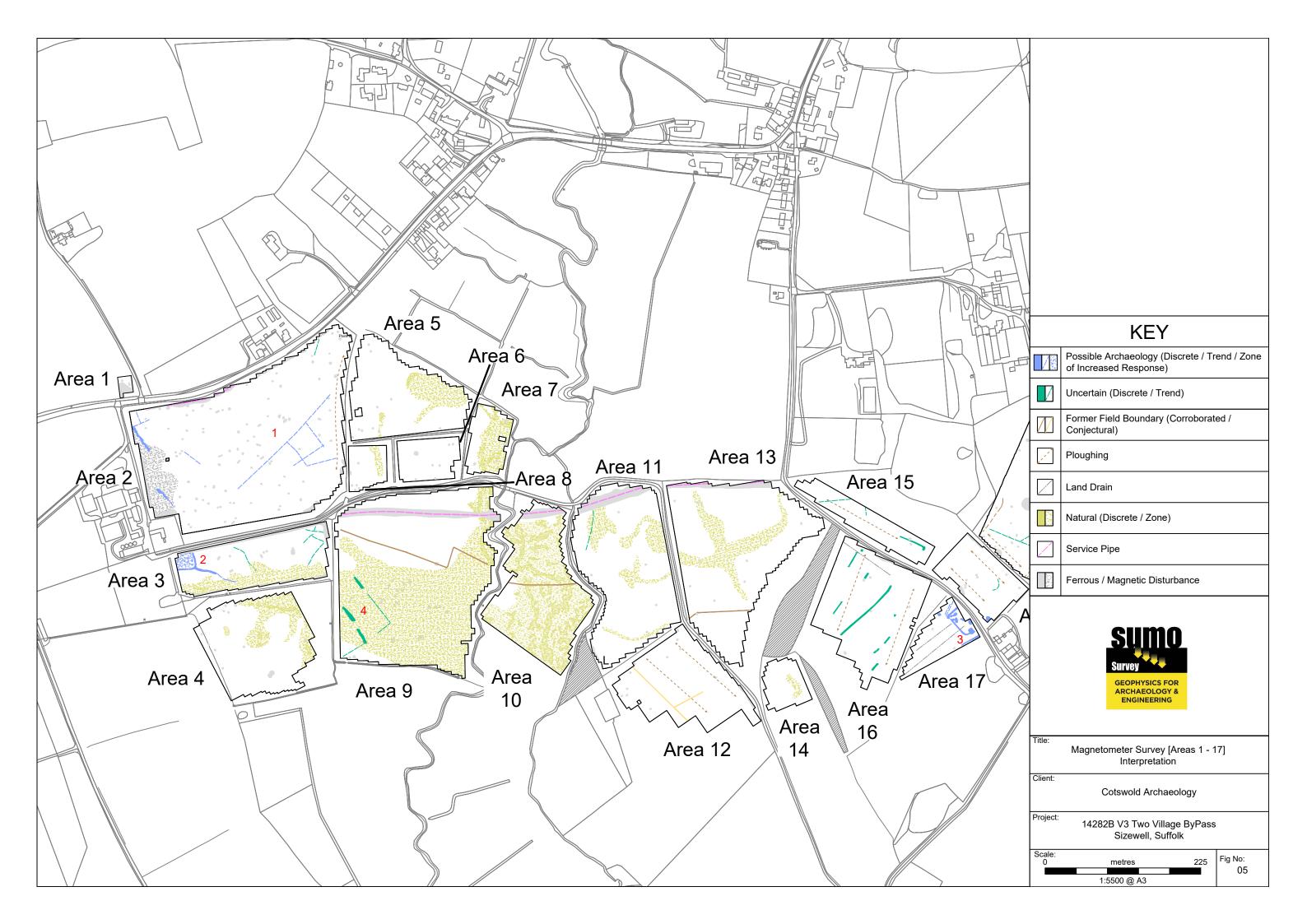
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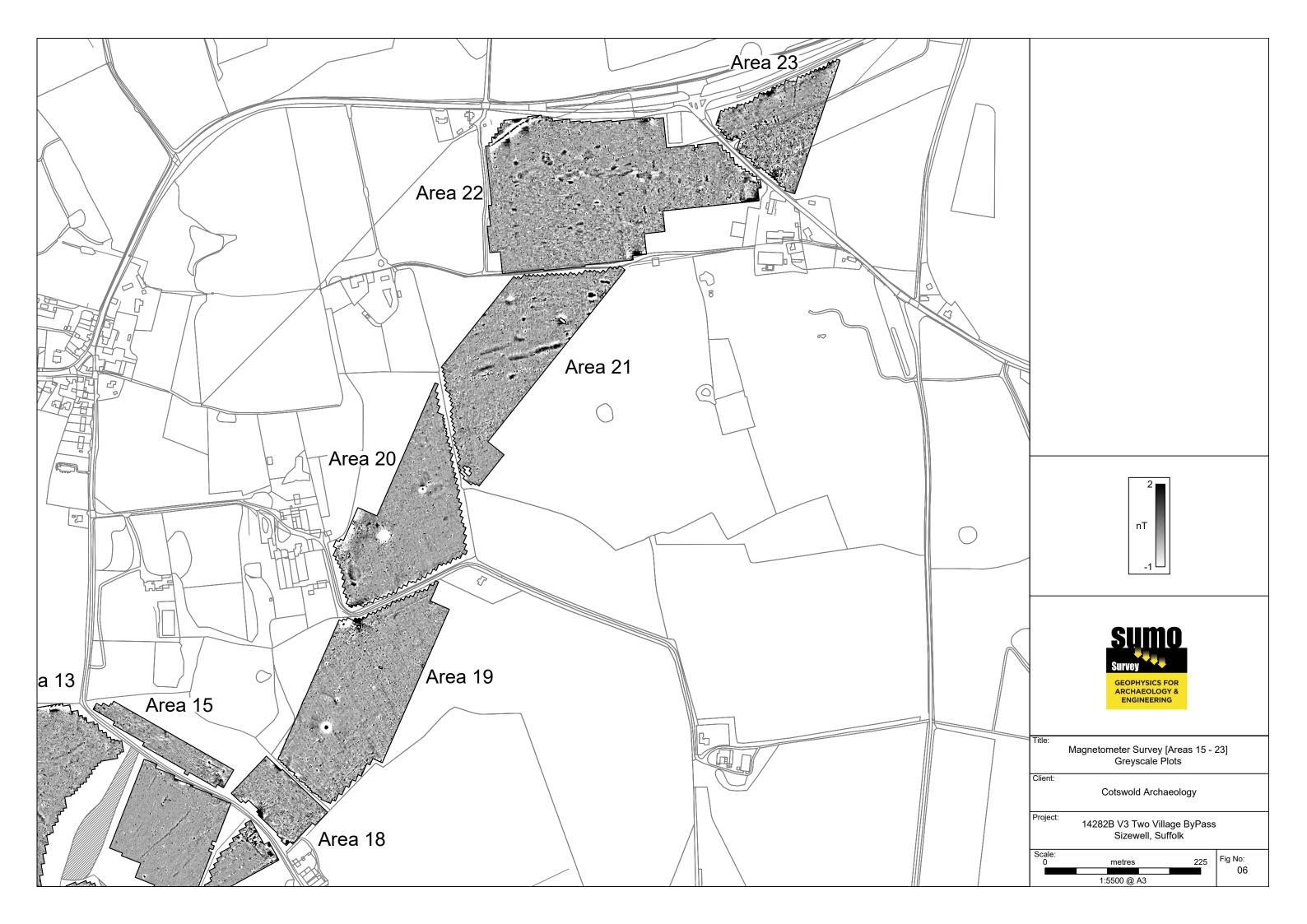


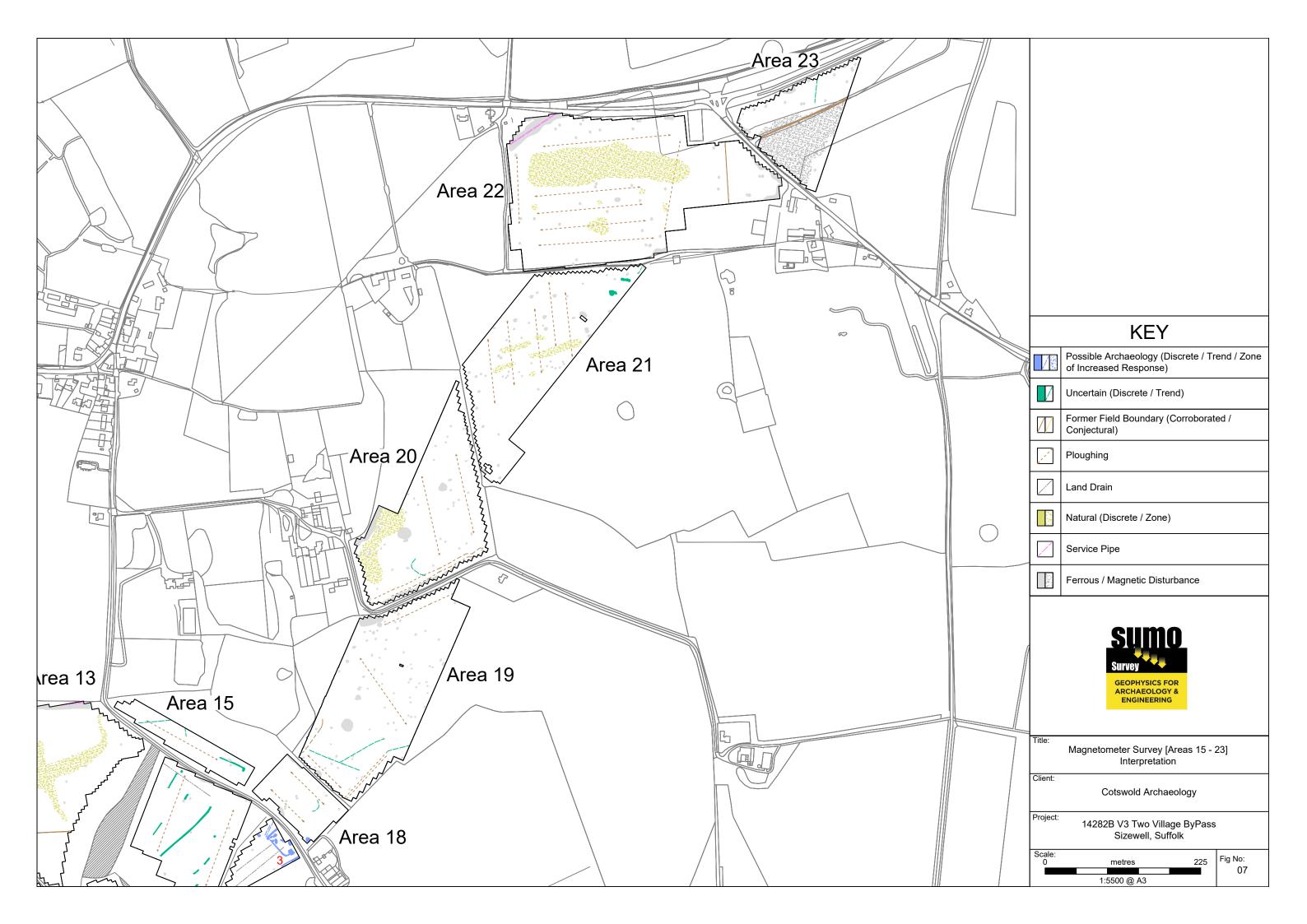


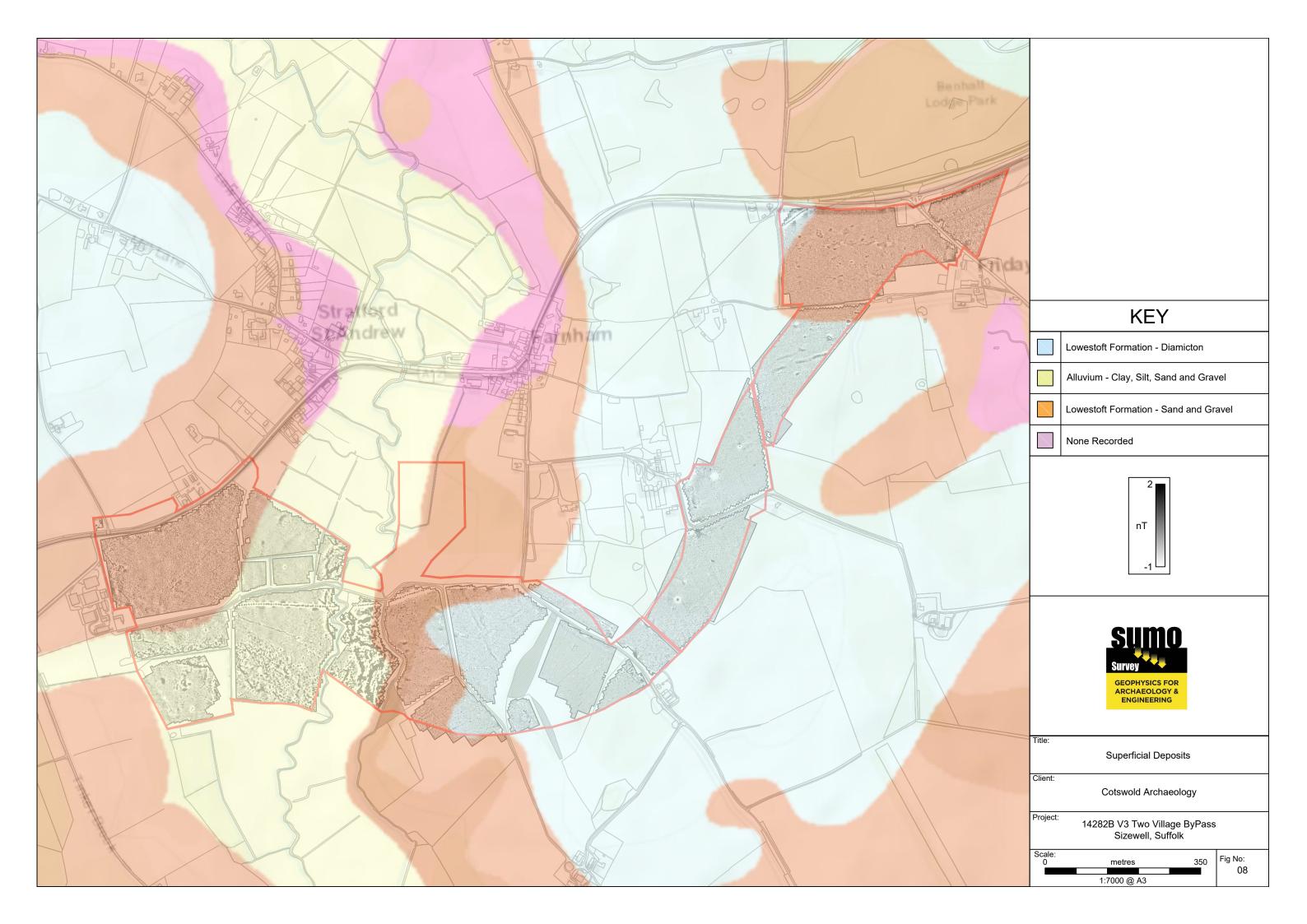


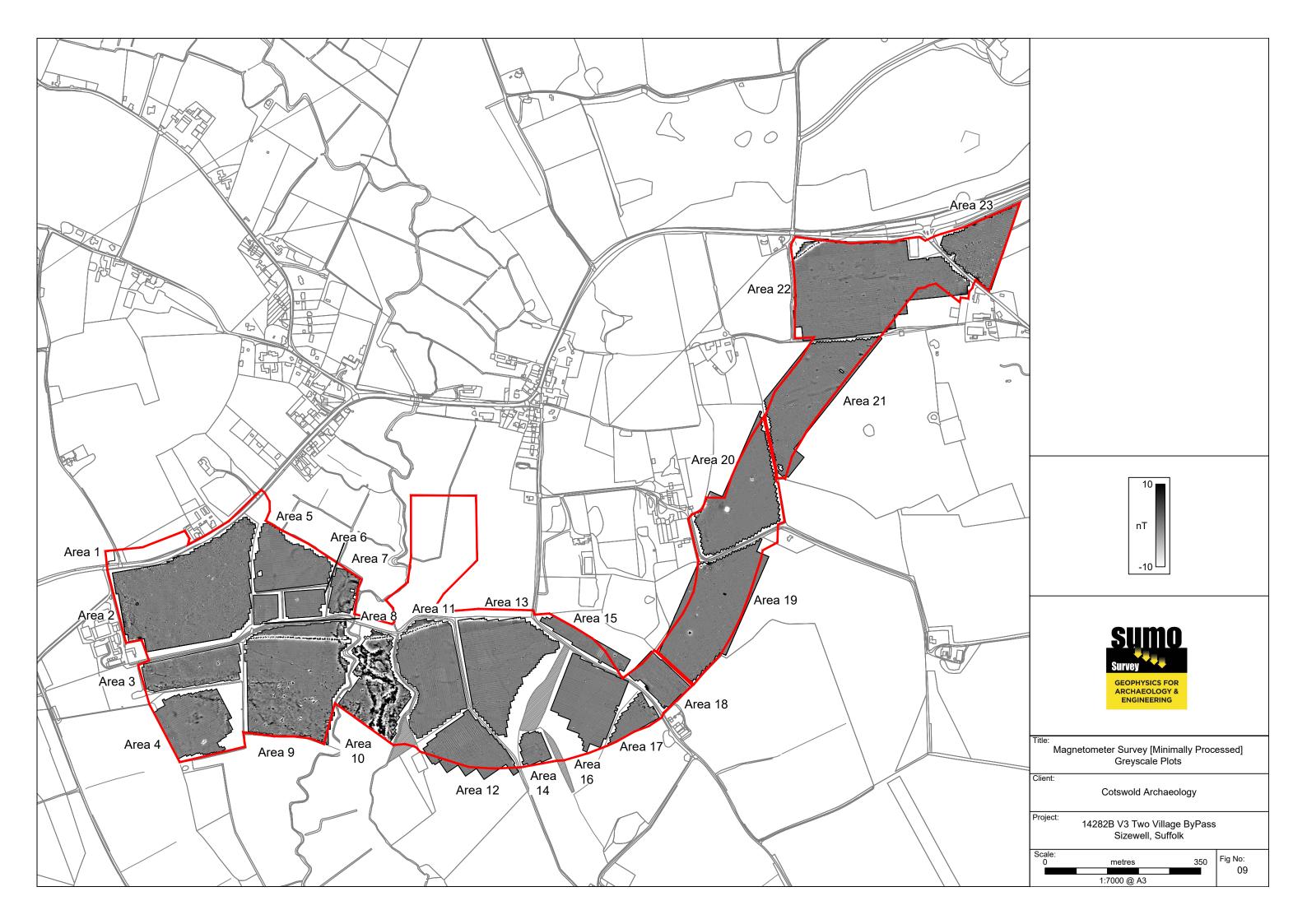


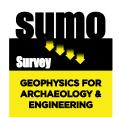












- Laser Scanning
- Archaeological Geophysical Measured Building Topographic

  - TopographicUtility Mapping

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