LAND AT
COLDSTREAM FARM, WATERPERRY LANE
WORMINGHALL,
BUCKINGHAMSHIRE

GEOPHYSICAL SURVEY
(WOCF16)

Work undertaken for
OPTIMIS CONSULTING

May 2016

Report produced by
Sean Parker (BSc Hons)

OASIS Ref: archaeol1-251571
National Grid Reference: SP 63802 08220

APS Report No: **33/16**

ARCHAEOLOGICAL
PROJECT
SERVICES

Quality Control
Coldstream Farm,
Worminghall,
Buckinghamshire,

WOCF16

Project Coordinator	Paul Cope-Faulkner
Site Staff	Sean Parker
Survey processing and report	Sean Parker

Checked by Project Manager	Approved by Team Leader
Gary Taylor	Denise Drury
Date: 20/5/16	Date: 20/5/16

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1. SUMMARY

A detailed magnetic gradiometer survey was undertaken for Optimis Consulting in connection with proposed development on land at Coldstream Farm, Waterperry Lane, Worminghall, Buckinghamshire. The survey area totalled c. 1ha.

The majority of features seen in the survey are likely to be modern in origin or variations in the natural geology. Large parts of the site are obscured by strong magnetically enhanced responses caused by modern features.

Two weak positive linear features of uncertain origin were detected. One of the liner features in the southern part of the site, continues towards one of the more magnetically enhanced areas and may extend across the area.

2. INTRODUCTION

2.1 Definition of an Evaluation

Geophysical survey is a non-intrusive method of archaeological evaluation. Evaluation is defined as *'a limited programme of non-intrusive and/or intrusive fieldwork which determines the presence or absence of archaeological features, structures, deposits, artefacts or ecofacts within a specified area or site. If such archaeological remains are present Field Evaluation defines their character and extent, quality and preservation, and it enables an assessment of their worth in a local, regional, national or international context as appropriate'* (CIfA 2014a).

2.2 Project Background

Archaeological Project Services (APS) was commissioned by Optimis Consulting to undertake a detailed magnetometer survey, totalling approximately 1ha, on land at Coldstream Farm, Worminghall, Buckinghamshire. This was in advance of proposed development of the area. The work was undertaken in accordance with a specification prepared by APS and approved by the archaeological advisor for Buckinghamshire. The survey was carried out on 12th May 2016.

2.3 Topography and Geology

Worminghall is situated approximately 12.4km east of Oxford and 18.8km west of Aylesbury in the county of Buckinghamshire (Fig 1). The proposed development site is located to the south-west of Worminghall, on the south side of Waterperry Lane, at National Grid Reference SP 63802 08220 (Fig 2).

Worminghall lies on a gentle east and southeast facing slope at heights of *c*. 64m OD. Soils at the site are Evesham 1 Association, typically calcareous pelosols (Hodge *et al*. 1984, 186). The soils are developed upon a solid geology of Jurassic limestones and mudstones of the Oakley Member (BGS 1994).

2.4 Archaeological Setting

The site does not appear to have changed significantly from historic mapping since 1876,

3. GEOPHYSICAL SURVEY

3.1 Methods

A magnetic gradiometry survey was carried out with a Bartington Grad 601-2 fluxgate magnetometer. The fields were divided into grids and each grid was walked systematically in a zigzag pattern, taking readings every 0.25m in traverses 1m apart.

The layout of the survey area is shown in Figure 3. The survey was carried out using 30m^2 grids. The north-east boundary consisted of large trees and a hedgerow. The area available for survey was limited by a road which cut across the western part of the site and beyond this were trees and bushes. In the south of the site are stables and the southern boundary consists of large bushes, in the south-east corner of the site there was an electricity box, other constraints included several geological test pits that were open and had monitoring equipment nearby. The site was under pasture and, other than noted above, no problems were encountered during the survey.

The survey was undertaken in accordance with English Heritage (2008) and CIfA (2014b) guidelines and codes of conduct. Detailed methodology can be found in Appendix 1.

3.2 Results

The presentation of the data for the site involves a greyscale print-out of the minimally processed data (Fig 4; clipped for display but otherwise unprocessed) and the processed data (Fig 5). Magnetic anomalies have been identified and plotted on to an interpretative drawing (Fig 6). In the following text, the letters in brackets refer to annotations on Figure 6.

Weak Positive linear anomalies
Only two weak positive linear anomalies (**A**) are present in this area (highlighted with a red dashed line). These responses are very faint and are uncertain in origin. The one to the north of the site is very diffuse and is probably caused by natural accumulation of magnetic material. The one to the south is much clearer but due to its position (close to the edge of the survey and in an area of magnetic disturbance) it is uncertain in origin.

Isolated positive anomalies
There are two examples of isolated positive anomalies (**B**) that have been identified in this site (highlighted with red circles). These can represent human-made features, but here they are considered to be more likely caused by variations in the natural geology.

Isolated bipolar anomalies
Two examples of isolated bipolar anomalies have been identified (highlighted with blue circles). These are typically caused by modern metallic debris in the topsoil or may be related to the geology present on site and as such are not considered to have archaeological significance.

Area of Disturbance
There is an area of disturbance in the eastern part of the site. This could be caused by both the modern electricity box.

4. DISCUSSION

The majority of features seen in the survey are likely to be modern in origin or variations in the natural geology. Large parts of the site are obscured by strong magnetically enhanced responses caused by modern features.

Only two weak positive linear features of uncertain origin were detected. One of the liners in the south of the site appears to continue into the more magnetically enhanced areas and may extend across the area.

5. ACKNOWLEDGEMENTS

Archaeological Project Services wishes to acknowledge Optimis Consulting who commissioned the project. Gary Taylor and Denise Drury edited the report.

6. PERSONNEL

Project coordinator: Paul Cope-Faulkner
Geophysical Survey: Sean Parker
Survey processing and reporting: Sean Parker

7. BIBLIOGRAPHY

BGS, 1994 *Thame: Solid and drift edition, 1:50 000 map sheet **237***

CIfA, 2014a *Standard and Guidance for Field Evaluation.*

CIfA, 2014b *Standard and Guidance for Geophysical Survey.*

English Heritage, 2008 *Geophysical Survey in Archaeological Field Evaluation.*

Hodge, CAH, Burton, RGO, Corbett, WM, Evans, R and Seale, RS, 1984 *Soils and their use in Eastern England, Soil Survey of England and Wales **13***

8. ABBREVIATIONS

APS Archaeological Project Services

BGS British Geological Survey

CIfA Chartered Institute for Archaeologists

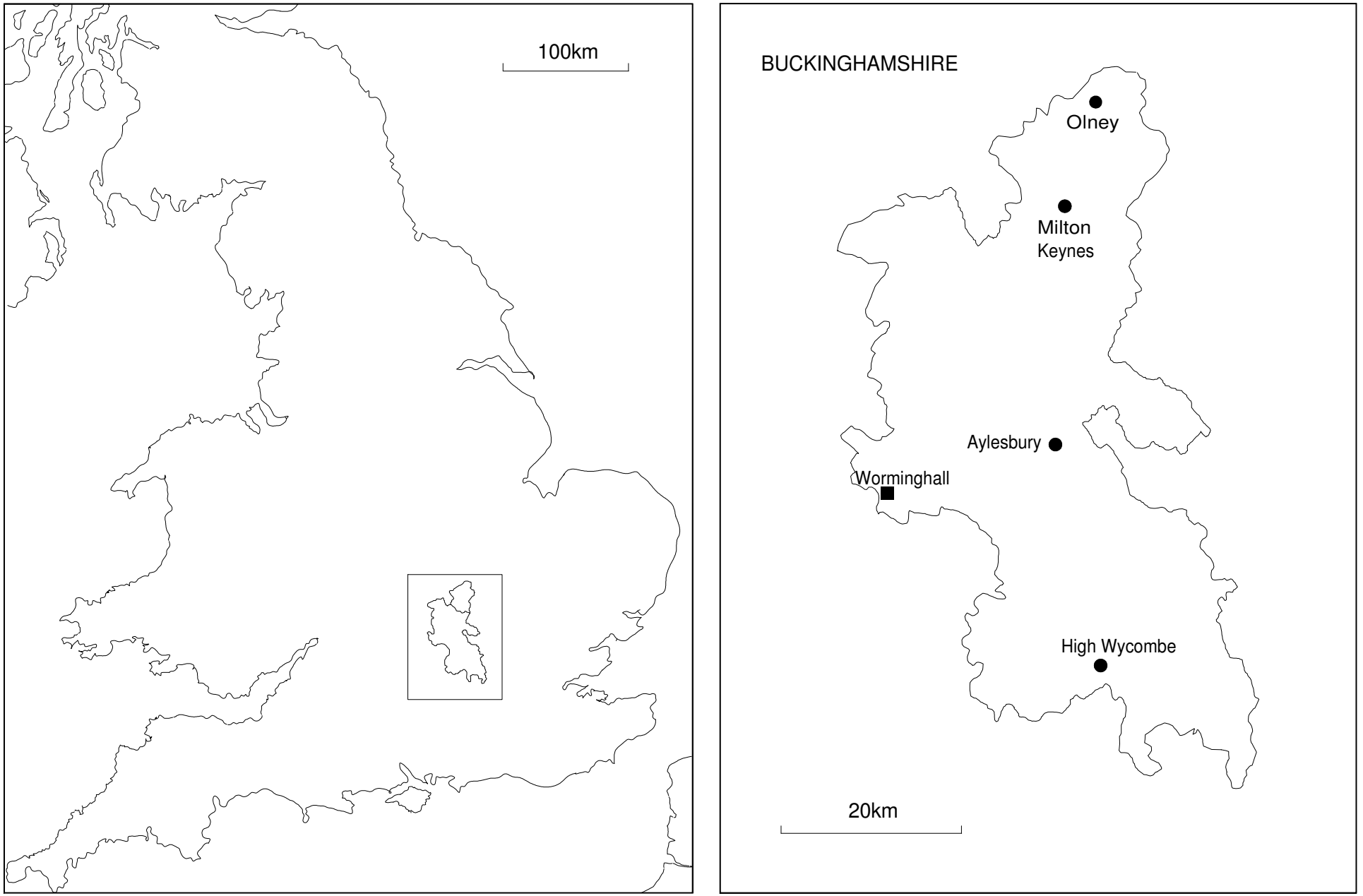

Figure 1 General location plan

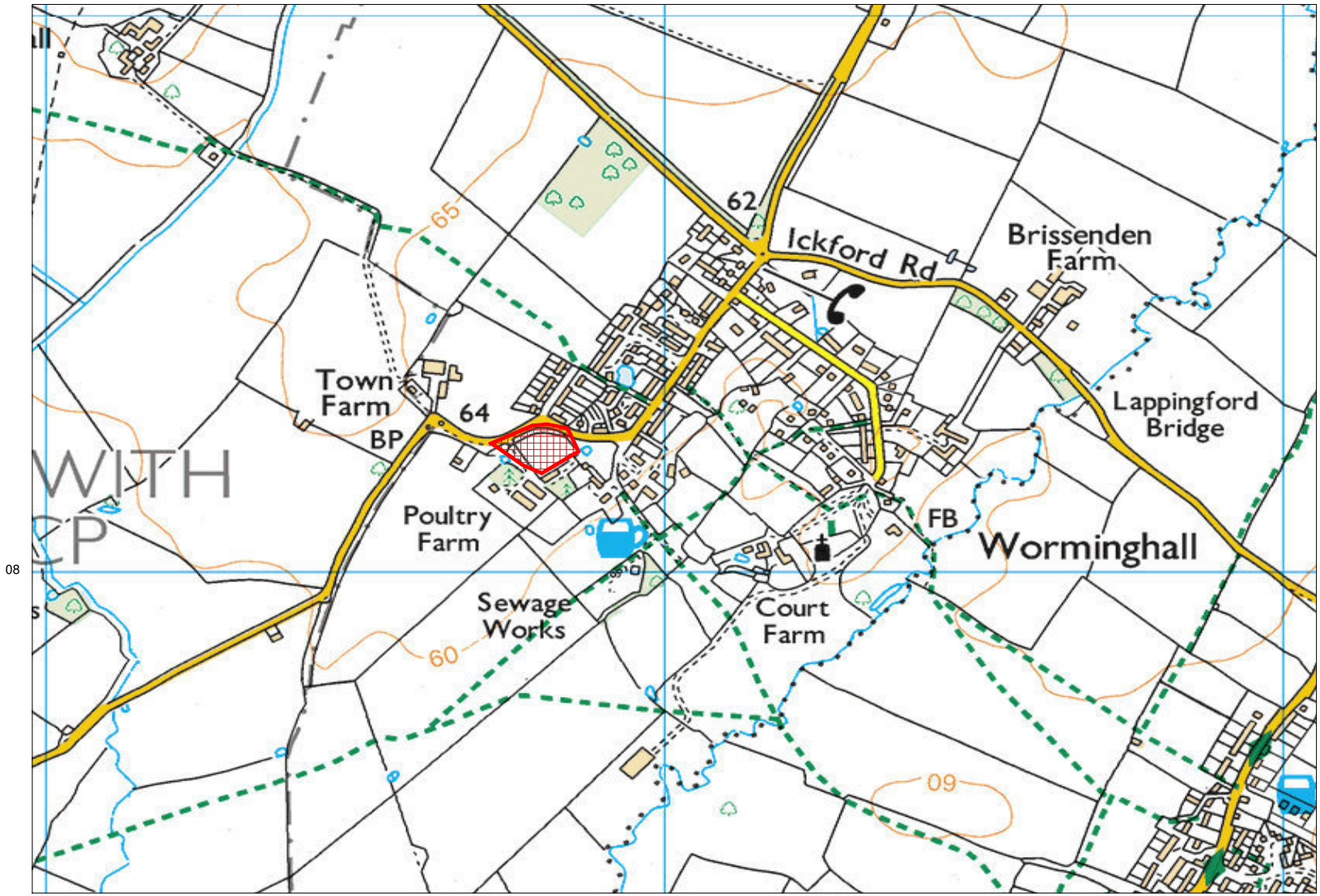

Figure 2: Site Location

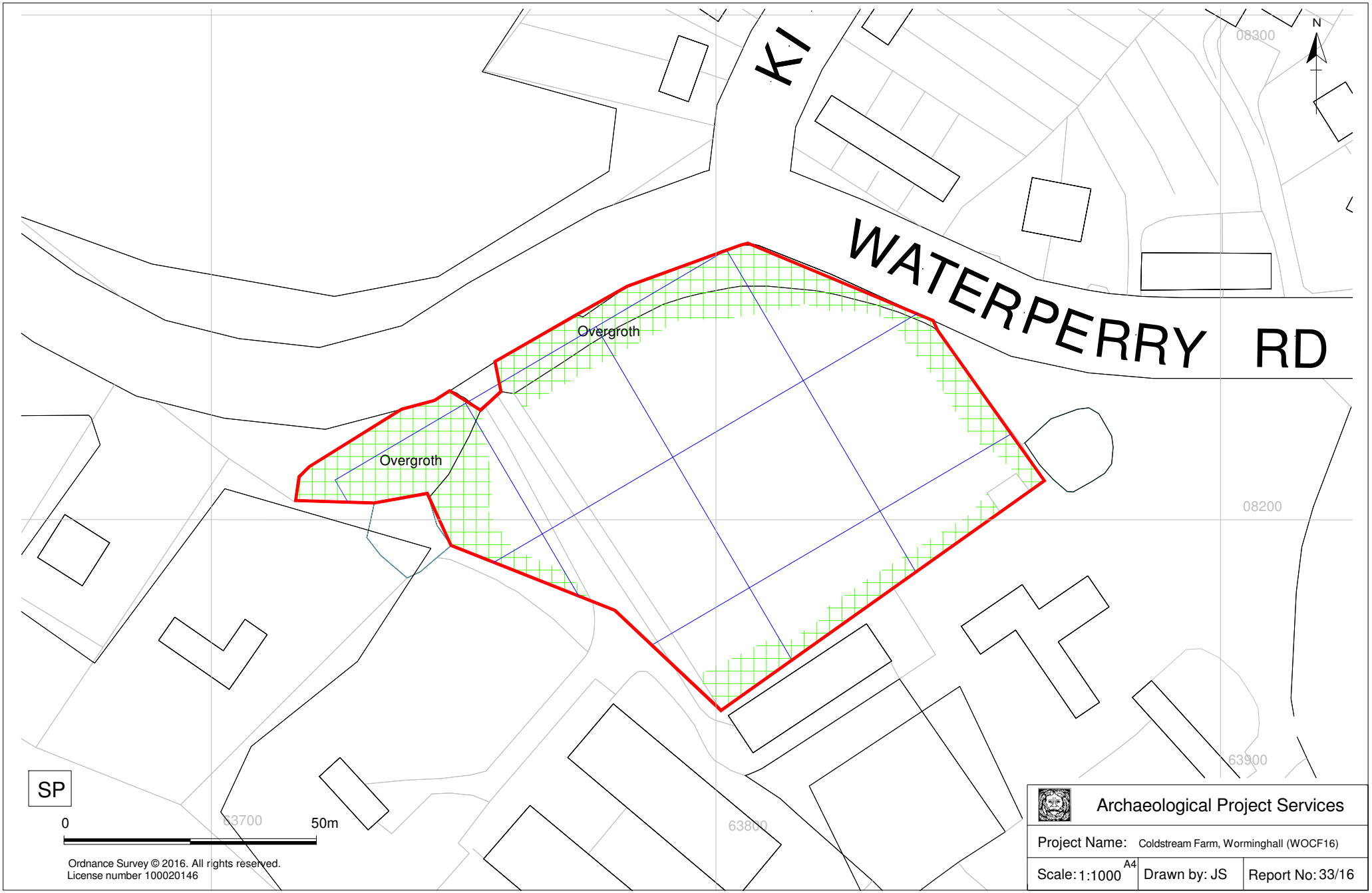

Figure 3: Site Layout

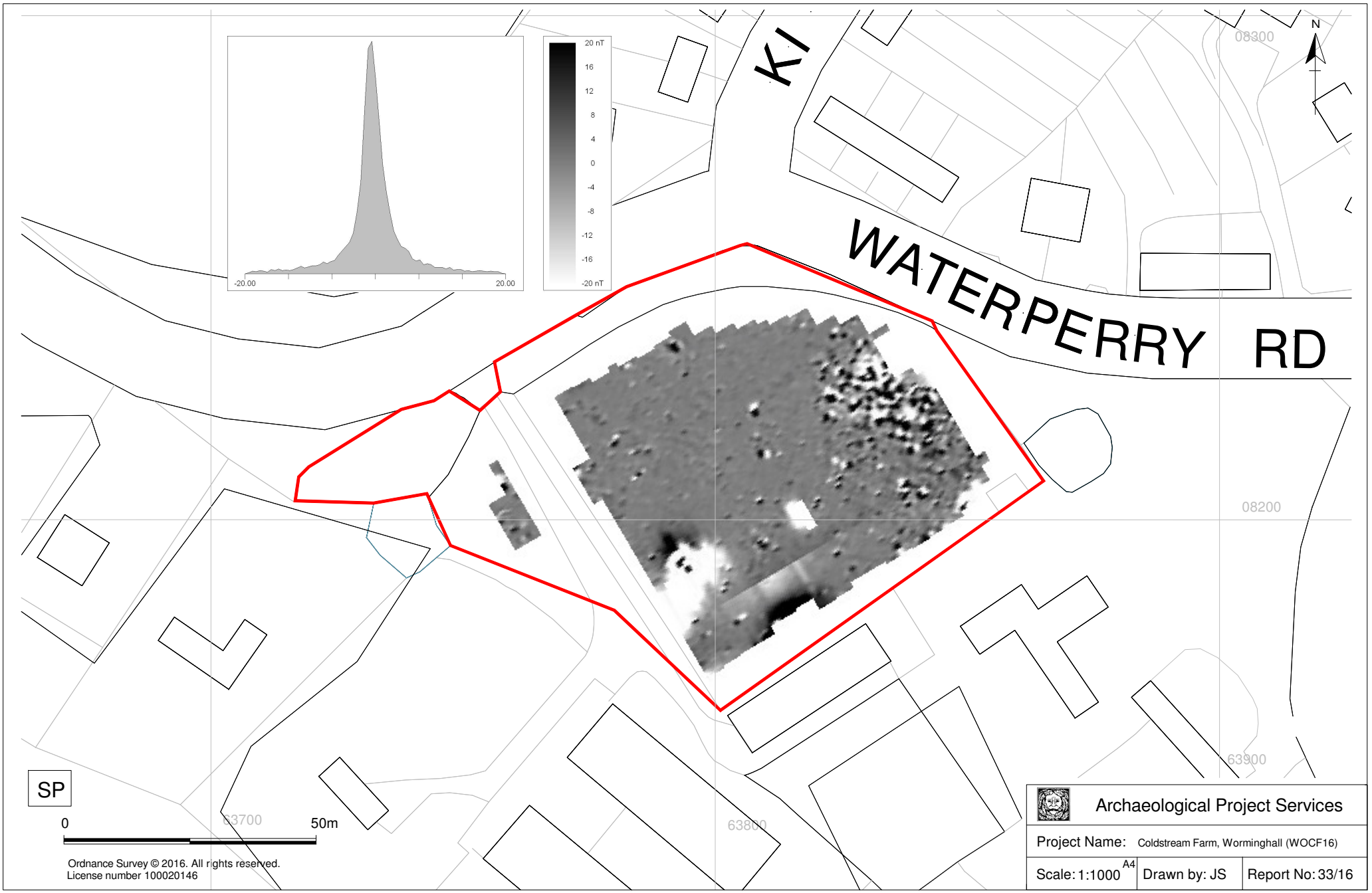

Figure 4: Minimally Processed Data

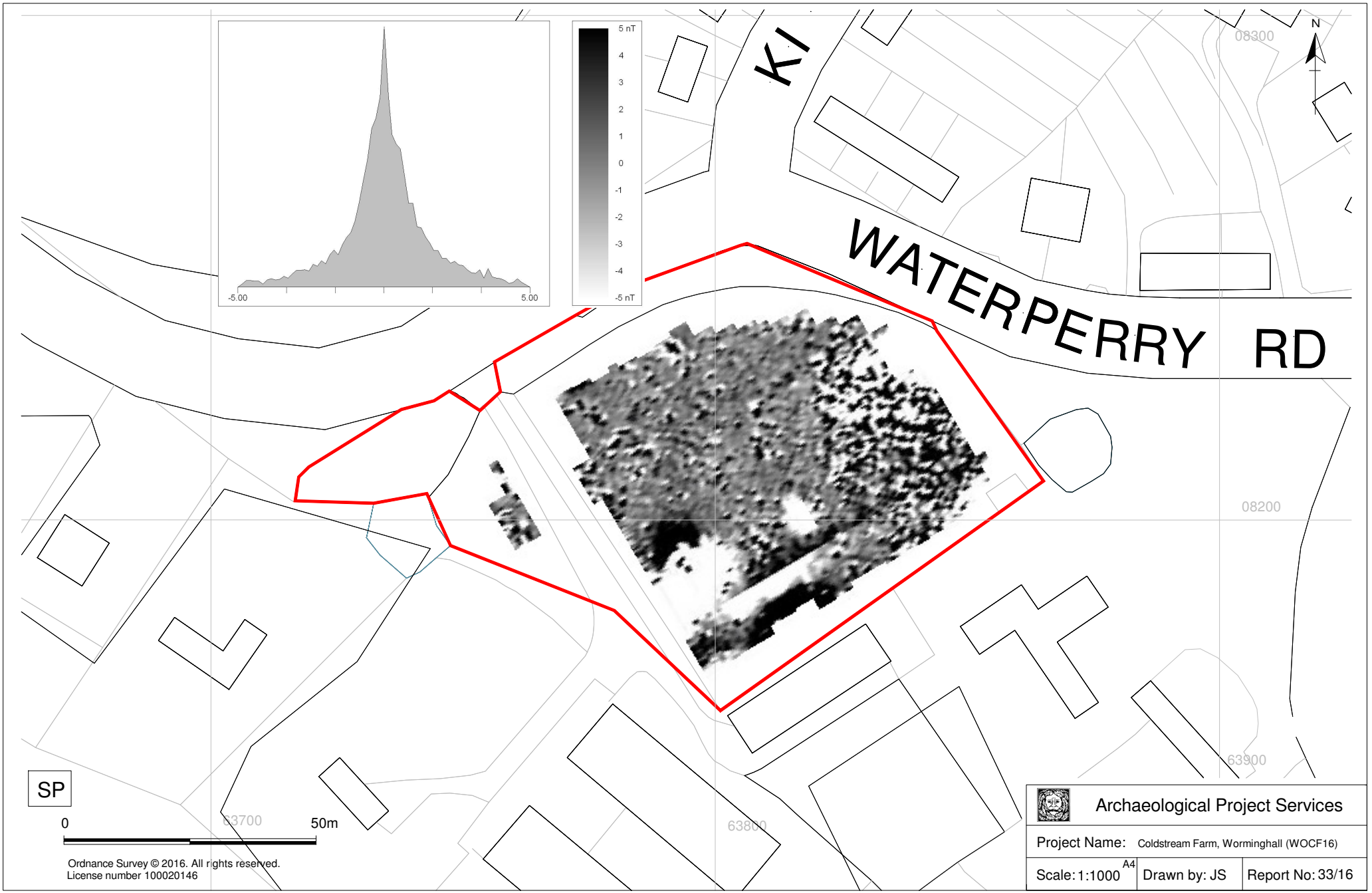

Figure 5: Processed Data

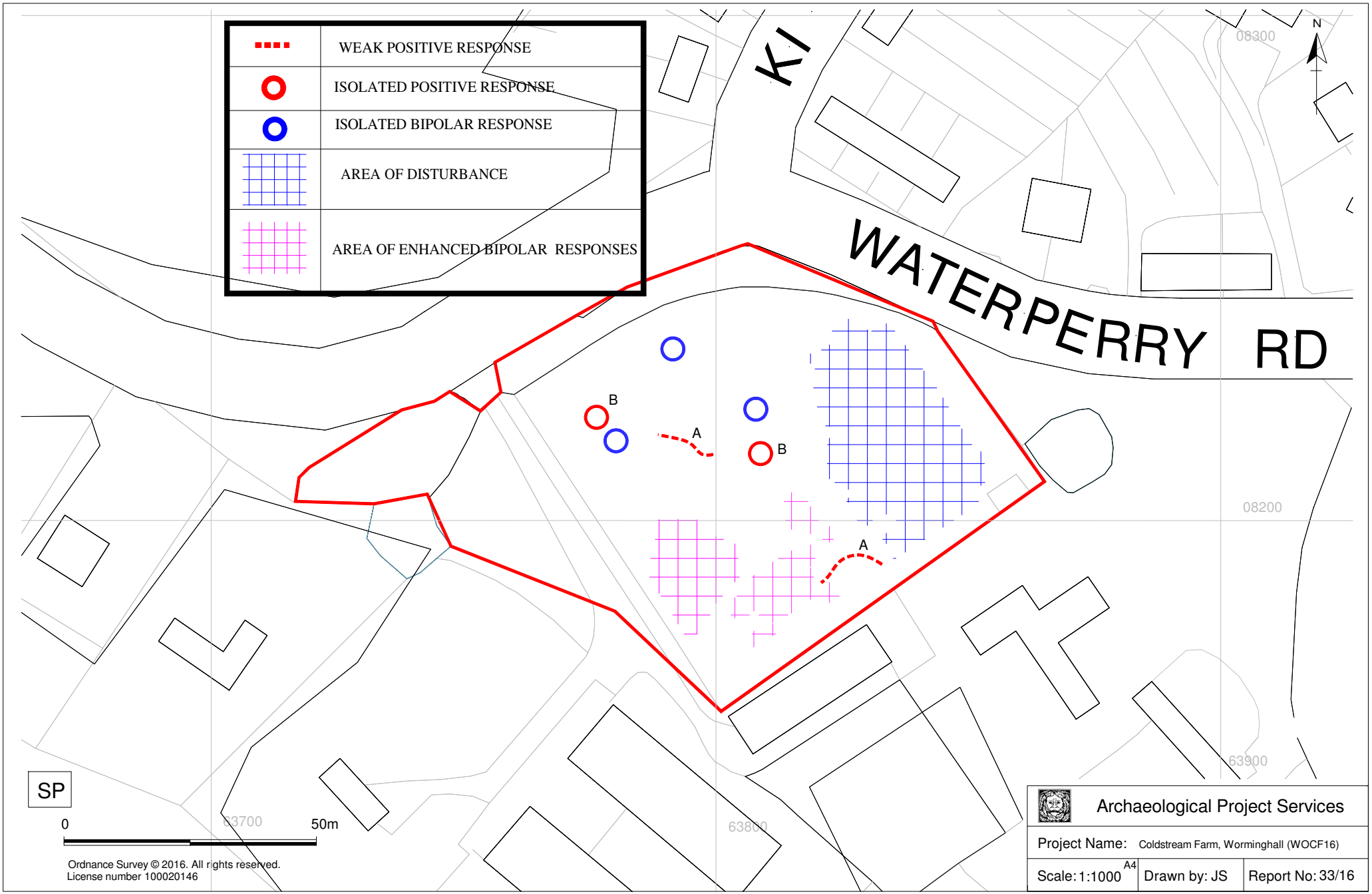

Figure 6: Interpretation

Appendix 1
TECHNICHAL INFORMATION

Principles of magnetometry
The basis for magnetic prospecting is the presence of weakly magnetised iron oxides in the soil. Depending on the state of iron oxides, the material will exhibit either a weak or a strong magnetisation (Gaffney and Gater 2003).

Human activities tend to enrich sediments with magnetic particles. Strong heat, such as that generated by fires, cause surrounding iron particles in the soil to become aligned with the earth's magnetic field and take on a magnetic charge. Where these particles accumulate, such as in cut features like ditches and pits, a weak positive magnetic anomaly is apparent. In cases where very strong heat has been applied, such as furnace and kiln bases, a bipolar magnetic anomaly will be apparent, with one area having a strong positive signature and one area having a strongly negative signature. Where banks have been built up from natural geological material which excludes magnetically enriched sediments, or walls have been made of stone, this may result in a negative anomaly. Modern metallic items and fired bricks cause sharp bipolar spikes. Modern services have a tendency to alternate between positive and negative readings along their length.

It should be noted that not all features will be responsive and absence of anomalies does not necessarily indicate absence of archaeological features (Clark 1996).

Bartington Grad 601-2
A gradiometer uses two sensors separated by a fixed distance in order to measure the difference in strength between the earth's magnetic field and the soil. The Bartington Grad 601 uses two fluxgate sensors separated vertically by 1m to take these readings, which reduces variations associated with the Earth's magnetic field and deep geology. Changes as small as 0.2 nanoTesla (nT) in an overall field strength of c. 49,000nT can be accurately detected using this instrumentation, although in practice instrument interference and soil noise can limit sensitivity. The instrument has typical penetration of 0.5m-1m, although stronger anomalies can be detected at greater depths. The 601-2 model uses two pairs of sensors to take parallel readings 1m apart.

Methodology
The survey area is divided into grid squares of $30m^2$ or $40m^2$, depending on the terrain. The grids are set out using a survey grade GPS, accurate to 0.03m. The grids are systematically walked in a zig-zag pattern with the gradiometer taking readings every 0.25m along a traverse, and each traverse being separated by 1m. This equates to 3600 sampling points in a full 30m x 30m grid or 6400 in a 40m x 40m grid. Readings are automatically recorded on a datalogger which is downloaded at the end of each day. The gradiometer is 'zeroed' at the start of each day and at intervals throughout to ensure consistent results are achieved throughout the survey.

Data Processing
The data is downloaded and processed using TerraSurveyor software (version 3.0.25.1). The raw data is then adjusted to emphasise possible features. At each stage the data is examined as a greyscale image and as a trace plot.

Minimally Processed data
The data is clipped so that the mid-range of readings is most visible. This involves excluding all readings outside of the -20nT to 20nT range.

Processed Data
The following processes are applied to produce the processed greyscale image:

- Destripe: Each traverse is flattened with regard to surrounding traverses by setting the median value of the traverse to 0nT. This produces cleaner images, but may cause bleeding where particularly strong signals are present at one end of a traverse.
- Data Clip: The data is clipped to provide the most suitable contrast for seeing archaeological features. This excludes readings outside of the -3nT to 3nT range.

The following processes may also be applied to improve the clarity of the processed greyscale images:

- Destagger: Minor inconsistences in the way an operator walked grids can be corrected by shifting a traverse up to 0.5m to match edges with adjacent traverses.

Data is exported as a JPG image and georeferenced for use in scale plans of the site. Anomalies are then checked against historical maps, and where available, lidar contour data.

References

Clark, A., 1996 *Seeing Beneath the Soil*, London, 2nd edn.

Gaffney C. and Gater, J., 2006 *Revealing the Buried Past: Geophysics for Archaeologists,* The History Press

Appendix 2
THE ARCHIVE

The archive consists of:

1 Daily record sheets
1 Report text and illustrations
1 Digital data

File names	WOCF16.xyz
Explanation of codes used in file names	.xyz files allow whole composite to be generated and stored easily.
Description of file formats	All files are in xyz format where Z= nT reading
List of codes used in files	
Hardware, software and operating systems	TerraSurveyor 3.0.25.1 running under Windows 10
Date of last modification	12/05/16
Indications of known areas of weakness in data	
Survey Technique	Zigzag
Origin	Starts at 0
Grid size	30m x 30m
Interval	X=0.25, Y=1m
Dummy Value	32702
XYZ Separation	Comma

All primary records are currently kept at:

Archaeological Project Services, The Old School, Cameron Street, Heckington, Sleaford, Lincolnshire NG34 9RW

Final destination of the archive is:

Buckingham County Museum
Buckinghamshire County Council
Museum Resource Centre
Tring Road
Buckinghamshire
HP22 5PJ

Accession number: Pending

OASIS code: archaeol1-251571

Site Code: WOCF16

OASIS DATA COLLECTION FORM: England

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OASIS ID: archaeol1-251571

Project details

Project name	Geophysical survey at Coldstream Farm, Waterperry Lane, Worminghall, Buckinghamshire
Short description of the project	Geophysical survey of small area in Worminghall Buckinghamshire, The majority of features seen in the survey are likely to be modern in origin or variations in the natural geology. only two features of uncertain origin were detected
Project dates	Start: 11-05-2016
Previous/future work	No / Yes
Any associated project reference codes	WOCF16 - Sitecode
Type of project	Field evaluation
Site status	None
Current Land use	Other 13 - Waste ground
Monument type	NONE None
Significant Finds	NONE None
Methods & techniques	"Geophysical Survey"
Development type	Rural residential
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Pre-application
Solid geology (other)	Limestone and Mudstone
Drift geology (other)	None
Techniques	Magnetometry

Project location

Country	England
Site location	BUCKINGHAMSHIRE AYLESBURY VALE WORMINGHALL Coldstream Farm
Study area	1 Hectares
Site coordinates	SP 638 082 51.768383965243 -1.075321396501 51 46 06 N 001 04 31 W Point

Project creators

Name of Organisation	Archaeological Project Services
Project brief originator	Consultant
Project design originator	Archaeological Project Services
Project director/manager	Paul Cope-Faulkner
Project supervisor	Sean Parker
Type of sponsor/funding body	Developer

Project archives

Physical Archive Exists?	No
Digital Archive recipient	Buckinghamshire County Museum
Digital Media available	"Geophysics"
Paper Archive recipient	Archaeological Project Services
Paper Media available	"Drawing","Report"

Entered by	Sean Parker (info@apsarchaeology.co.uk)
Entered on	25 May 2016

OASIS:

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