THAMES VALLEY

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SERVICES

Boxfield to Box Pipeline, Wiltshire

Geophysical Survey (Magnetic)

by Kyle Beaverstock

Site Code: BLB22/128

(ST 8349 6875)

Boxfield to Box Pipeline, Wiltshire

Geophysical Survey (Magnetic) Report

For ADAS

by Kyle Beaverstock

Thames Valley Archaeological Services Ltd

Site Code BLB 22/128

July 2022

Summary

Site name: Boxfield to Box Pipeline, Wiltshire

Grid reference: ST 8349 6875

Site activity: Magnetometer survey

Date and duration of project: 29th – 30th June 2022

Project coordinator: David Sanches

Site supervisor: Kyle Beaverstock

Site code: BLB22/128

Area of site: c. 7ha

Summary of results: A number of magnetic anomalies were detected by the geophysical survey, many of which were linear in nature and could represent agricultural land division.

Location of archive: The archive is presently held at Thames Valley Archaeological Services, Reading in accordance with TVAS digital archiving policies.

Report edited/checked by: Steve Ford✓ 18.07.22

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Boxfield to Box Pipeline, Wiltshire
A Geophysical Survey (Magnetic)

by Kyle Beaverstock

Report 22/128

Introduction

This report documents the results of a geophysical survey (magnetic) carried out at Quarry Hill, Box Hill, Wiltshire (ST 8349 6875) (Fig. 1). The work was commissioned by Diarmuid O'Seaneachain of RSK ADAS Ltd, 11D Park House, Milton Park, Abingdon, OX14 4RS on behalf of Wessex Water in compliance with the Water Act 1991 (as amended). The fieldwork was undertaken by Kyle Beaverstock between 29th and 30th June 2022 and the site code is BLB22/128.

The archive is presently held at Thames Valley Archaeological Services, Reading in accordance with TVAS digital archiving policies.

Location, topography and geology

The site is located 500m south of Box Hill and 900m north-east Box (fig 1). The survey area is sinuous and covers several fields. The northern fields are currently utilised for pastoral farming while the field to the south of these are under crop and further south are lying fallow. Of the northern area surveyed, there is a gentle slope from 138m above Ordinance Datum (aOD) in the north down to 128m aOD in the south and the underlying geology is stated as Bath Oolite Member in the north above Twinhoe member further south, which is above Combe Down Oolite Member in the south (BGS 2011)

Methodology

Sample interval

Data collection required a temporary grid to be established across the survey area using wooden pegs at 20m intervals with further subdivision where necessary. Readings were taken at 0.25m intervals along traverses 1m apart. This provides 1600 sampling points across a full 20m × 20m grid (EAC 2015), providing an appropriate methodology balancing cost and time with resolution. Most of the site was unobstructed, however some areas surrounding the field boundaries had significant vegetation and the field to the south could not be surveyed as it was currently under crop. Conditions were dry and bright.

The Grad 601-2 has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects have been buried in the site. Under normal operating conditions it can be expected to identify buried features >0.5m in diameter. Features which can be detected include disturbed soil, such as the fill of a ditch, structures that have been heated to high temperatures (magnetic thermoremnance) and objects made from ferro-magnetic materials. The strength of the magnetic field is measured in nano Tesla (nT), equivalent to 10^{-9} Tesla, the SI unit of magnetic flux density.

Equipment

The purpose of the survey was to identify geophysical anomalies that may be archaeological in origin in order to inform a targeted archaeological investigation of the site prior to development. The survey and report generally follow the recommendations and standards set out by both European Archaeological Council (EAC 2015) and the Chartered Institute *for* Archaeologists (2002, 2014).

Magnetometry was chosen as a survey method as it offers the most rapid ground coverage and responds to a wide range of anomalies caused by past human activity. These properties make it ideal for the fast yet detailed surveying of an area.

The detailed magnetometry survey was carried out using a dual sensor Bartington Instruments Grad 601-2 fluxgate gradiometer. The instrument consists of two fluxgates mounted 1m vertically apart with a second set positioned at 1m horizontal distance. This enables readings to be taken of both the general background magnetic field and any localised anomalies with the difference being plotted as either positive or negative buried features. All sensors are calibrated to cancel out the local magnetic field and react only to anomalies above or below this base line. On this basis, strong magnetic anomalies such as burnt features (kilns and hearths) will give a high response as will buried ferrous objects. More subtle anomalies such as pits and ditches, can be seen from their infilling soils containing higher proportions of humic material, rich in ferrous oxides, compared to the undisturbed subsoil. This will stand out in relation to the background magnetic readings and appear in plan following the course of a linear feature or within a discrete area.

A Trimble Geo7x handheld GPS system with sub-decimetre real-time accuracy was used to tie the site grid into the Ordnance Survey national grid. This unit offers both real-time correction and post-survey processing; enabling a high level of accuracy to be obtained both in the field and in the final post-processed data.

Data gathered in the field was processed using the TerraSurveyor software package. This allows the survey data to be collated and manipulated to enhance the visibility of anomalies, particularly those likely to be of

archaeological origin. The table below lists the processes applied to this survey, full survey and data information is recorded in Appendix 1.

Process	Effect
Clip from -4.00 to 3.00 nT	Enhance the contrast of the image to improve the appearance of possible archaeological anomalies.
Interpolate: *y* doubled	Increases the resolution of the readings in the *y* axis, enhancing the shape of anomalies.
De-stripe: median, all sensors	Removes the striping effect caused by differences in sensor calibration, enhancing the visibility of potential archaeological anomalies.
De-spike: threshold 1, window size 3×3	Compresses outlying magnetic points caused by interference of metal objects within the survey area.
Search & Replace: from: ±30 nT to: ±1000 nT with: dummy	Removes extreme values resulting from magnetic interference caused by near-by ferromagnetic objects.
Range match (area: top 90, left 0, bottom 149, right 359) to top edge	Equalises the range of values between areas surveyed by different operatives, correcting for differences in setup.
De-stagger: all grids, both by -1 intervals	Cancels out effects of site's topography on irregularities in the traverse speed.

The raw data plot is presented as a greyscale plot shown in relation to the site (Fig. 3) with the processed data then presented as a second figure (Fig. 4), followed by a third plan to present the abstraction and interpretation of the magnetic anomalies (Fig. 5). Anomalies are shown as colour-coded lines, points and polygons. The grid layout and georeferencing information (Fig. 2) is prepared in EasyCAD v.7.58.00, producing a .FC7 file format, and printed as a .PDF for inclusion in the final report.

The greyscale plot of the processed data is exported from TerraSurveyor in a georeferenced portable network graphics (.PNG) format, a raster image format chosen for its lossless data compression and support for transparent pixels, enabling it to easily be overlaid onto an existing site plan. The data plot is combined with grid and site plans in QGIS 2.16.2 and exported again in .PNG format in order to present them in figure templates in Adobe InDesign CS5.5, creating .INDD file formats. Once the figures are finalised they are exported in .PDF format for inclusion within the finished report.

Results

In the north is a positive linear with an associated negative response **[1]**, orientated east to west and running for c. 185m, this is represented by strong positive linear surrounded by a strong negative response. The strong responses suggest that this linear is likely caused by ferromagnetic material from a service. To the south of this is a short positive linear **[2]**, this is orientated south-west to north east and measures 45m in length. To the east of this on a similar alignment is positive linear **[4]**. This linear returns a strong response in the north for 192m and

reappears a weak positive linear in the south measuring 113m. These linears **[2 and 4]** likely represent the remains of land division and their orientation suggests that they may be related to or shortly preceded the current field system. There are also a number of weak background variations **[3]**, these appear as irregular positive anomalies with a relatively low response. The irregular form and sinuous pattern of these suggest that they are geological in nature such as changes in the underlying geology which is likely on this site.

Running across the field is positive linear **[5]** with an associated negative linear on the southern side, this is caused by a single anomaly orientated east to west. The relatively weak magnetic response suggests that this is likely a former field boundary with bank. To the south of this is a slightly curved positive linear **[6]**, this linear is roughly orientated south-west to north-east and measures c. 60m long. To the north of linear **[5]** is weak positive linear **[7]**, this linear is orientated east to west and runs for c.40m and in the north running along a north-east to south-west orientation is positive linear **[8]**. These linears most likely represent various forms of agricultural field boundaries with their differing orientations suggesting several phases.

Conclusion

The geophysical survey identified a modest number of magnetic anomalies across the whole of the survey area, while some of these may have archaeological potential the majority are likely related to agricultural activity or land division and some are likely to be geological in origin.

References

BGS, 2011, *British Geological Survey*, 1:50,000, Sheet 265, Bedrock and Superficial Edition, Keyworth

CI*f*A, 2014, 'Standard and Guidance for archaeological geophysical survey', Reading

EAC, 2015, *EAC Guidelines for the use of Geophysics in Archaeology: Questions to Ask and Points to Consider*, EAC Guidelines 2, Namur

IFA, 2002, 'The Use of Geophysical Techniques in Archaeological Evaluation', IFA Paper No. 6, Reading

NPPF, 2021, *National Planning Policy Framework*, Ministry of Housing, Communities and Local Govt, London

Appendix 1. **Survey and data information**

Programme:
Name: TerraSurveyor
Version: 3.0.25.0

Raw data
Filename: Comp 1 RAW.xcp
Instrument Type: Grad 601 (Magnetometer)
Units: nT
Survey corner coordinates (X/Y):
Northwest corner: 383630.571, 169020.014 m
Southeast corner: 383670.571, 168840.014 m
Direction of 1st Traverse: 103 deg
Collection Method: ZigZag
Sensors: 2 @ 1 m spacing.
Dummy Value: 2047.5

Dimensions
Survey Size (meters): 40 m x 180 m
X&Y Interval: 0.25 m

Stats
Max: 96.73
Min: -100.00
Std Dev: 13.57
Mean: -0.53
Median: 0.69
Composite Area: 0.72 ha
Surveyed Area: 0.5984 ha

Source Grids: 18
1 Col:0 Row:0 grids\10.xgd
2 Col:0 Row:1 grids\11.xgd
3 Col:0 Row:2 grids\12.xgd
4 Col:0 Row:3 grids\13.xgd
5 Col:0 Row:4 grids\14.xgd
6 Col:0 Row:5 grids\15.xgd
7 Col:0 Row:6 grids\16.xgd
8 Col:0 Row:7 grids\17.xgd
9 Col:0 Row:8 grids\18.xgd
10 Col:1 Row:0 grids\01.xgd
11 Col:1 Row:1 grids\02.xgd
12 Col:1 Row:2 grids\03.xgd
13 Col:1 Row:3 grids\04.xgd
14 Col:1 Row:4 grids\05.xgd
15 Col:1 Row:5 grids\06.xgd
16 Col:1 Row:6 grids\07.xgd
17 Col:1 Row:7 grids\08.xgd
18 Col:1 Row:8 grids\09.xgd

Filename: Comp 2 RAW.xcp
Description:
Instrument Type: Grad 601 (Magnetometer)
Units: nT
Survey corner coordinates (X/Y):
Northwest corner: 383626.237, 169025.782 m
Southeast corner: 383666.237, 168845.782 m
Direction of 1st Traverse: 160 deg
Collection Method: ZigZag
Sensors: 2 @ 1 m spacing.
Dummy Value: 2047.5

Dimensions
Survey Size (meters): 40 m x 180 m
X&Y Interval: 0.25 m

Stats
Max: 96.75
Min: -100.00
Std Dev: 22.05
Mean: -2.59
Median: 0.23
Composite Area: 0.72 ha
Surveyed Area: 0.57075 ha
Collection Method: ZigZag
Sensors: 2 @ 1 m spacing.
Dummy Value: 2047.5

Source Grids: 17
1 Col:0 Row:0 grids\20-a.xgd
2 Col:0 Row:2 grids\29.xgd
3 Col:0 Row:3 grids\30.xgd
4 Col:0 Row:4 grids\31.xgd
5 Col:0 Row:5 grids\32.xgd
6 Col:0 Row:6 grids\33.xgd
7 Col:0 Row:7 grids\34.xgd
8 Col:0 Row:8 grids\35.xgd
9 Col:1 Row:0 grids\19.xgd
10 Col:1 Row:1 grids\21.xgd
11 Col:1 Row:2 grids\22.xgd
12 Col:1 Row:3 grids\23.xgd
13 Col:1 Row:4 grids\24.xgd
14 Col:1 Row:5 grids\25.xgd
15 Col:1 Row:6 grids\26.xgd
16 Col:1 Row:7 grids\27.xgd
17 Col:1 Row:8 grids\28.xgd

Filename: Comp 2 RAW.xcp
Description:
Instrument Type: Grad 601 (Magnetometer)
Units: nT
Survey corner coordinates (X/Y):
Northwest corner: 383626.237, 169025.782 m
Southeast corner: 383666.237, 168845.782 m
Direction of 1st Traverse: 160 deg
Collection Method: ZigZag
Sensors: 2 @ 1 m spacing.
Dummy Value: 2047.5

Dimensions
Survey Size (meters): 40 m x 180 m
X&Y Interval: 0.25 m

Stats
Max: 96.75
Min: -100.00
Std Dev: 22.05
Mean: -2.59
Median: 0.23
Composite Area: 0.72 ha
Surveyed Area: 0.57075 ha

Source Grids: 17
1 Col:0 Row:0 grids\20-a.xgd
2 Col:0 Row:2 grids\29.xgd
3 Col:0 Row:3 grids\30.xgd
4 Col:0 Row:4 grids\31.xgd
5 Col:0 Row:5 grids\32.xgd
6 Col:0 Row:6 grids\33.xgd
7 Col:0 Row:7 grids\34.xgd
8 Col:0 Row:8 grids\35.xgd
9 Col:1 Row:0 grids\19.xgd
10 Col:1 Row:1 grids\21.xgd
11 Col:1 Row:2 grids\22.xgd
12 Col:1 Row:3 grids\23.xgd
13 Col:1 Row:4 grids\24.xgd
14 Col:1 Row:5 grids\25.xgd
15 Col:1 Row:6 grids\26.xgd
16 Col:1 Row:7 grids\27.xgd
17 Col:1 Row:8 grids\28.xgd

Filename: Comp 3 RAW.xcp
Description:
Instrument Type: Grad 601 (Magnetometer)
Units: nT
Survey corner coordinates (X/Y):
Northwest corner: 383474.645, 168962.346 m
Southeast corner: 383514.645, 168862.346 m
Direction of 1st Traverse: 121 deg
23 Col:1 Row:9 grids\66.xgd
24 Col:1 Row:10 grids\67.xgd
25 Col:1 Row:11 grids\68.xgd
26 Col:1 Row:12 grids\69.xgd

Dimensions
Survey Size (meters): 40 m x 100 m
X&Y Interval: 0.25 m

Stats
Max: 12.71
Min: -14.00
Std Dev: 2.98
Mean: -0.25
Median: 0.23
Composite Area: 0.4 ha
Surveyed Area: 0.2398 ha

Source Grids: 9
1 Col:0 Row:1 grids\38.xgd
2 Col:0 Row:2 grids\40.xgd
3 Col:0 Row:3 grids\42.xgd
4 Col:0 Row:4 grids\43.xgd
5 Col:1 Row:0 grids\36.xgd
6 Col:1 Row:1 grids\37.xgd
7 Col:1 Row:2 grids\39.xgd
8 Col:1 Row:3 grids\41.xgd
9 Col:1 Row:4 grids\44-a.xgd

Filename: Comp 4 RAW.xcp
Description:
Instrument Type: Grad 601 (Magnetometer)
Units: nT
Survey corner coordinates (X/Y):
Northwest corner: 383588.123, 168850.848 m
Southeast corner: 383628.123, 168590.848 m
Direction of 1st Traverse: 105 deg
Collection Method: ZigZag
Sensors: 2 @ 1 m spacing.
Dummy Value: 2047.5

Dimensions
Survey Size (meters): 40 m x 260 m
X&Y Interval: 0.25 m

Stats
Max: 96.32
Min: -100.00
Std Dev: 6.42
Mean: -0.08
Median: 0.44
Composite Area: 1.04 ha
Surveyed Area: 0.78505 ha

Source Grids: 26
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2 Col:0 Row:1 grids\45.xgd
3 Col:0 Row:2 grids\46.xgd
4 Col:0 Row:3 grids\47.xgd
5 Col:0 Row:4 grids\48.xgd
6 Col:0 Row:5 grids\49.xgd
7 Col:0 Row:6 grids\50.xgd
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9 Col:0 Row:8 grids\52.xgd
10 Col:0 Row:9 grids\53.xgd
11 Col:0 Row:10 grids\54.xgd
12 Col:0 Row:11 grids\55.xgd
13 Col:0 Row:12 grids\56.xgd
14 Col:1 Row:0 grids\57.xgd
15 Col:1 Row:1 grids\58.xgd
16 Col:1 Row:2 grids\59.xgd
17 Col:1 Row:3 grids\60.xgd
18 Col:1 Row:4 grids\61.xgd
19 Col:1 Row:5 grids\62.xgd
20 Col:1 Row:6 grids\63.xgd
21 Col:1 Row:7 grids\64.xgd
22 Col:1 Row:8 grids\65.xgd

Processed data

Filename: Comp 1.xcp
Stats

Filename: Comp 5 RAW.xcp
Description:
Instrument Type: Grad 601 (Magnetometer)
Units: nT
Survey corner coordinates (X/Y):
Northwest corner: 383425.889, 168876.033 m
Southeast corner: 383465.889, 168616.033 m
Direction of 1st Traverse: 106 deg
Collection Method: ZigZag
Sensors: 2 @ 1 m spacing.
Dummy Value: 2047.5

Dimensions
Survey Size (meters): 40 m x 260 m
X&Y Interval: 0.25 m

Stats
Max: 27.56
Min: -27.00
Std Dev: 2.89
Mean: 0.27
Median: 0.14
Composite Area: 1.04 ha
Surveyed Area: 0.9527 ha

Source Grids: 26
1 Col:0 Row:0 grids\95-a.xgd
2 Col:0 Row:1 grids\93-a.xgd
3 Col:0 Row:2 grids\91-a.xgd
4 Col:0 Row:3 grids\89-a.xgd
5 Col:0 Row:4 grids\87-a.xgd
6 Col:0 Row:5 grids\85-a.xgd
7 Col:0 Row:6 grids\83-a.xgd
8 Col:0 Row:7 grids\81-a.xgd
9 Col:0 Row:8 grids\79-a.xgd
10 Col:0 Row:9 grids\77-a.xgd
11 Col:0 Row:10 grids\75-a.xgd
12 Col:0 Row:11 grids\73-a.xgd
13 Col:0 Row:12 grids\71-a.xgd
14 Col:1 Row:0 grids\94-a.xgd
15 Col:1 Row:1 grids\92-a.xgd
16 Col:1 Row:2 grids\90-a.xgd
17 Col:1 Row:3 grids\88-a.xgd
18 Col:1 Row:4 grids\86-a.xgd
19 Col:1 Row:5 grids\84-a.xgd
20 Col:1 Row:6 grids\82-a.xgd
21 Col:1 Row:7 grids\80-a.xgd
22 Col:1 Row:8 grids\78-a.xgd
23 Col:1 Row:9 grids\76-a.xgd
24 Col:1 Row:10 grids\74-a.xgd
25 Col:1 Row:11 grids\72-a.xgd
26 Col:1 Row:12 grids\70-a.xgd

Filename: Comp 5.xcp
Stats
Max: 3.00
Min: -4.00

Max: 3.00
Min: -4.00
Std Dev: 1.68
Mean: -0.10
Median: 0.02
Composite Area: 0.72 ha
Surveyed Area: 0.5984 ha

Processes: 6
1 Base Layer
2 DeStripe Median Sensors: Grids: All
3 Clip at 1.00 SD
4 Clip from -4.00 to 3.00 nT
5 De Stagger: Grids: All By: 0 intervals, 50.00cm
6 Despike Threshold: 1 Window size: 3x3

Filename: Comp 2.xcp
Stats
Max: 3.00
Min: -4.00
Std Dev: 1.93
Mean: -0.36
Median: 0.01
Composite Area: 0.72 ha
Surveyed Area: 0.57075 ha

Processes: 7
1 Base Layer
2 DeStripe Median Sensors: Grids: All
3 Clip at 1.00 SD
4 Clip from -4.00 to 3.00 nT
5 Despike Threshold: 1 Window size: 3x3
6 De Stagger: Grids: All By: 0 intervals, 50.00cm
7 De Stagger: Grids: All By: 0 intervals, 20.00cm

Filename: Comp 3.xcp
Stats
Max: 2.11
Min: -3.03
Std Dev: 1.07
Mean: -0.11
Median: 0.01
Composite Area: 0.4 ha
Surveyed Area: 0.2398 ha

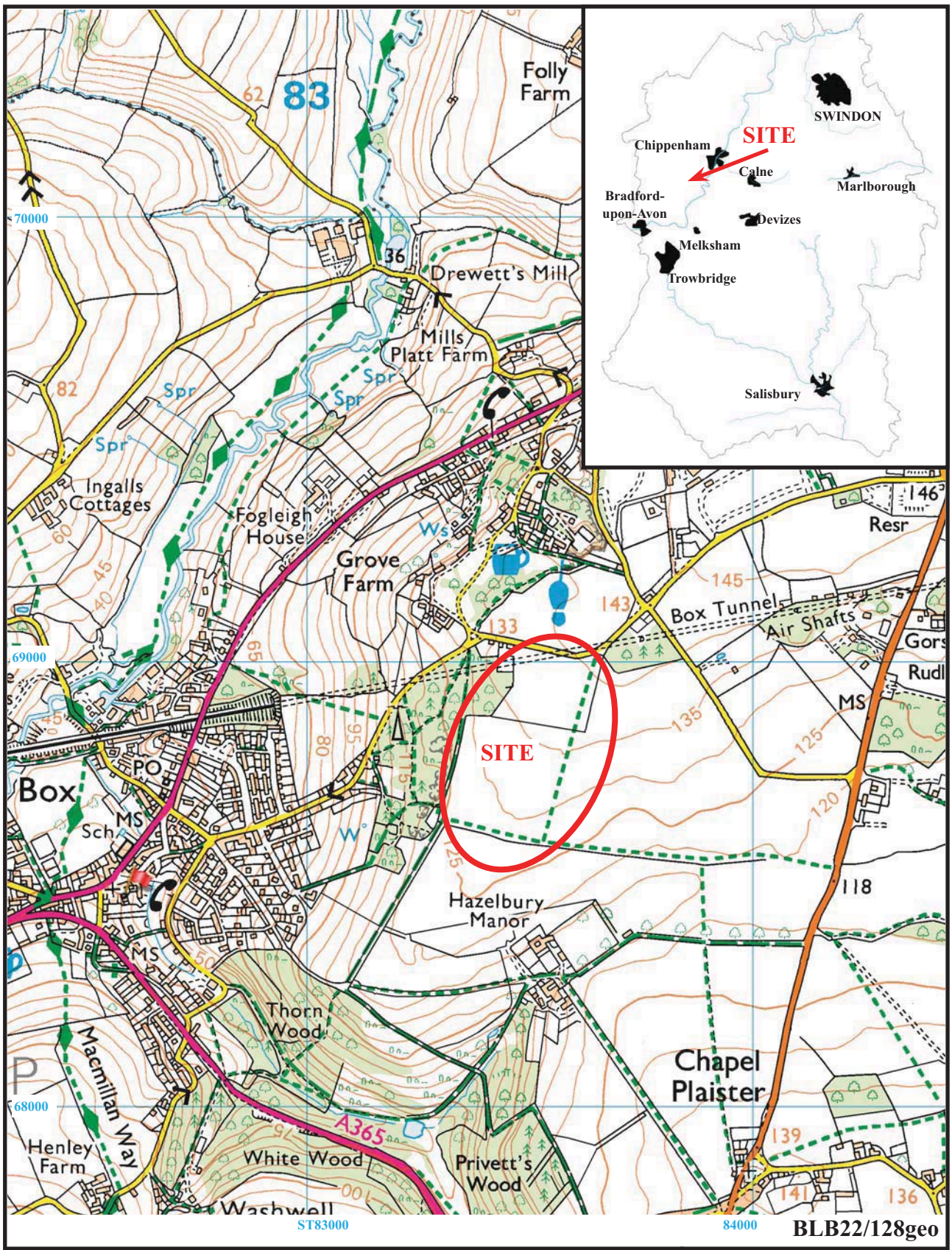
Processes: 7
1 Base Layer
2 Clip from -14.00 to 12.71 nT
3 DeStripe Median Sensors: Grids: All
4 Clip at 1.00 SD
5 De Stagger: Grids: All By: 0 intervals, 50.00cm
6 Despike Threshold: 1 Window size: 3x3
7 De Stagger: Grids: All By: 0 intervals, 20.00cm

Filename: Comp 4.xcp
Stats
Max: 3.00
Min: -3.70
Std Dev: 1.36
Mean: -0.05
Median: 0.01
Composite Area: 1.04 ha
Surveyed Area: 0.78505 ha

Processes: 6
1 Base Layer
2 DeStripe Median Sensors: Grids: All
3 Clip at 1.00 SD
4 Clip from -3.70 to 3.00 nT
5 Despike Threshold: 1 Window size: 3x3
6 De Stagger: Grids: All By: 0 intervals, 20.00cm

Std Dev: 0.86
Mean: 0.02
Median: 0.00
Composite Area: 1.04 ha
Surveyed Area: 0.9527 ha

Processes: 6
1 Base Layer
2 Clip from -26.00 to 27.56 nT
3 DeStripe Median Sensors: Grids: All
4 Clip from -4.00 to 3.00 nT
5 Despike Threshold: 1 Window size: 3x3
6 De Stagger: Grids: All By: 0 intervals, 50.00cm



Boxfield to Box Pipeline, Wiltshire
Geophysical Survey (magnetic)

Figure 1. Location of site within Box and Wiltshire.

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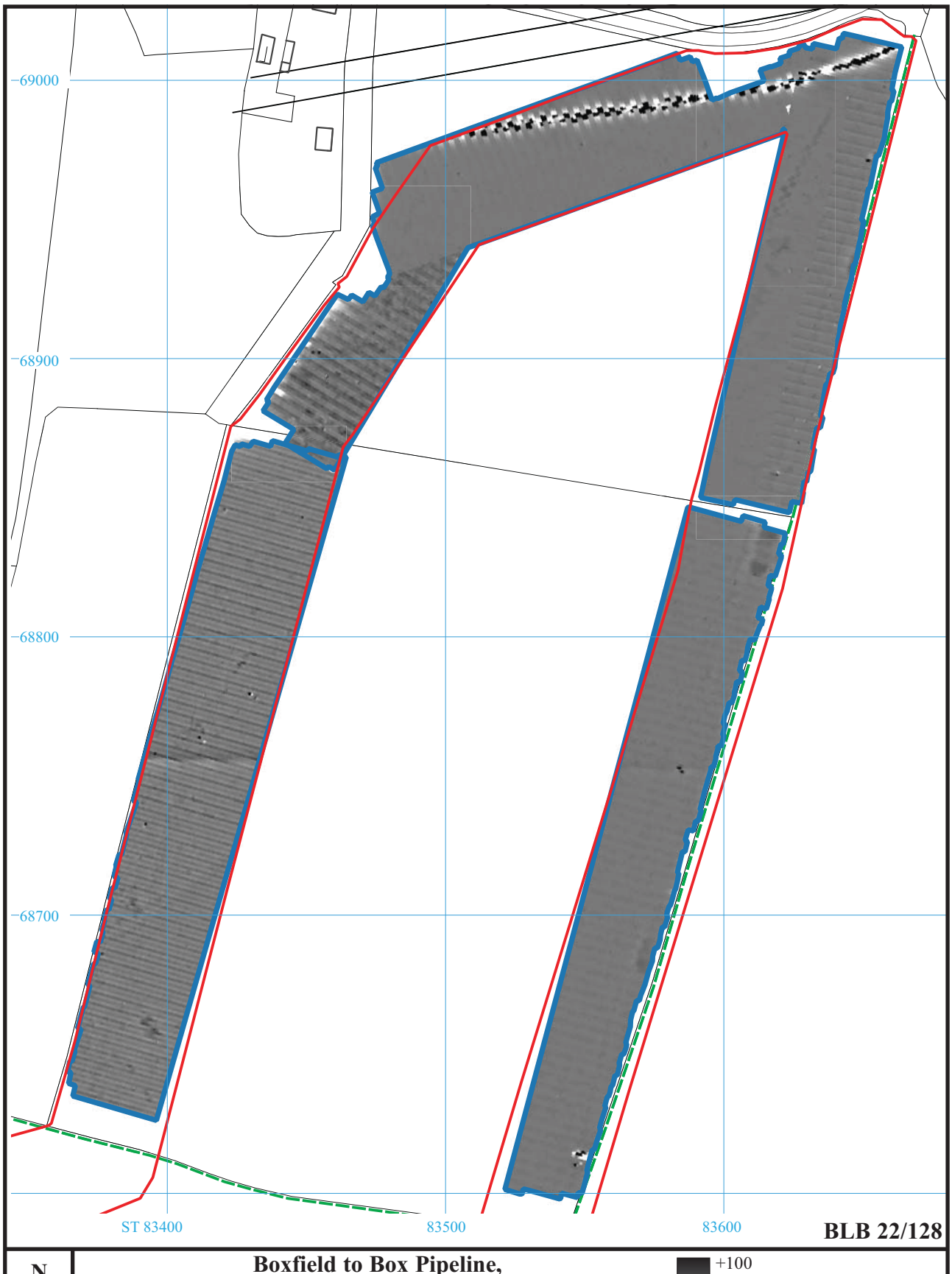

Boxfield to Box Pipeline,
Wiltshire, 2022
Geophysical Survey (Magnetic)
Figure 2. Plot of raw gradiometer data.

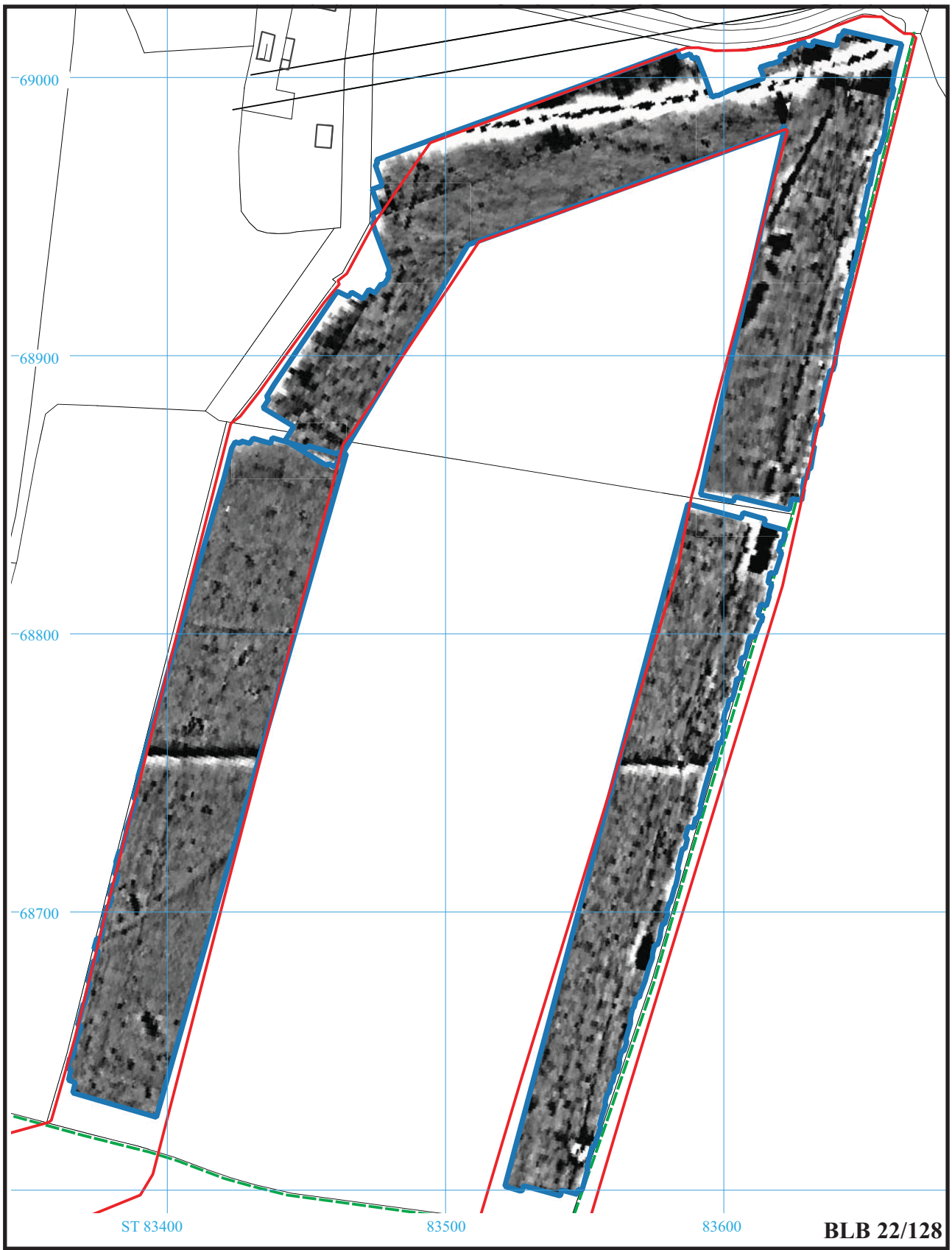
69000
68900
68800
68700
ST 83400
83500
83600
BLB 22/128
N
Boxfield to Box Pipeline,
Wiltshire, 2022
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Figure 3. Plot of processed gradiometer data.
0m
100m
+3.00
nT
-4.00
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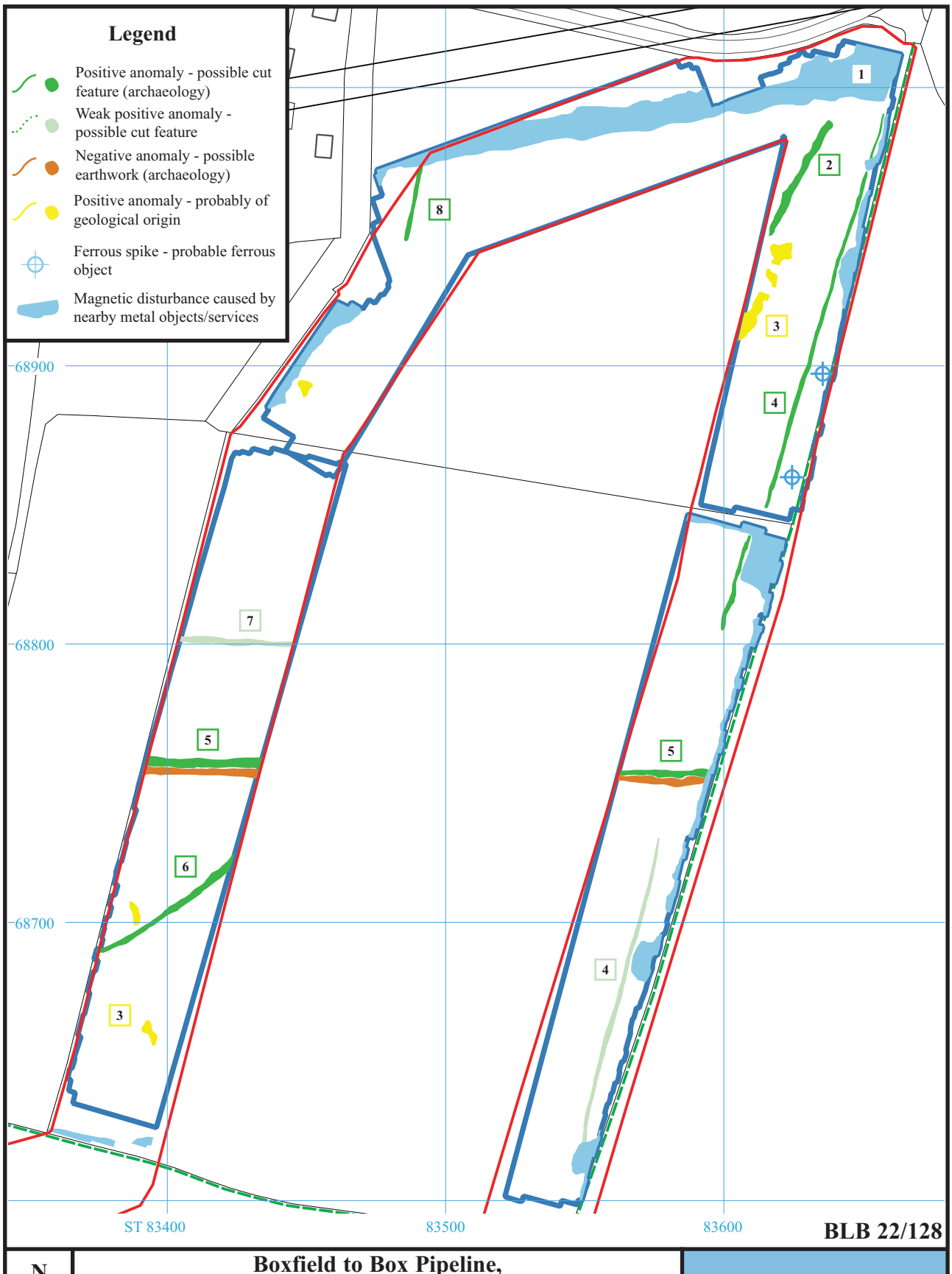

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Geophysical Survey (Magnetic)
Figure 4. Interpretation plot.

0m 100m

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Plate 1. Northern field looking south

Plate 2. Central field looking south

Plate 3. Central field showing boundary and vegitation

Plate 4. Southern field with crop.

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Boxfield to Box Pieline,
Wiltshire, 2022
Geophysical Survey (magnetic)
Plates 1 to 4.

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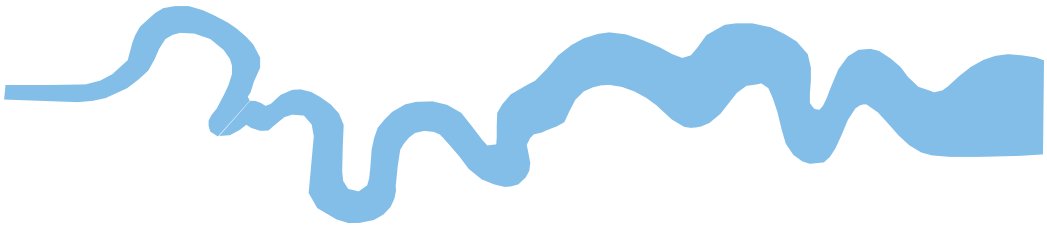
TIME CHART

	Calendar Years
Modern	AD 1901
Victorian	AD 1837
Post Medieval	AD 1500
Medieval	AD 1066
Saxon	AD 410
Roman	AD 43
	AD 0 BC
Iron Age	750 BC
Bronze Age: Late	1300 BC
Bronze Age: Middle	1700 BC
Bronze Age: Early	2100 BC
Neolithic: Late	3300 BC
Neolithic: Early	4300 BC
Mesolithic: Late	6000 BC
Mesolithic: Early	10000 BC
Palaeolithic: Upper	30000 BC
Palaeolithic: Middle	70000 BC
Palaeolithic: Lower	2,000,000 BC



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