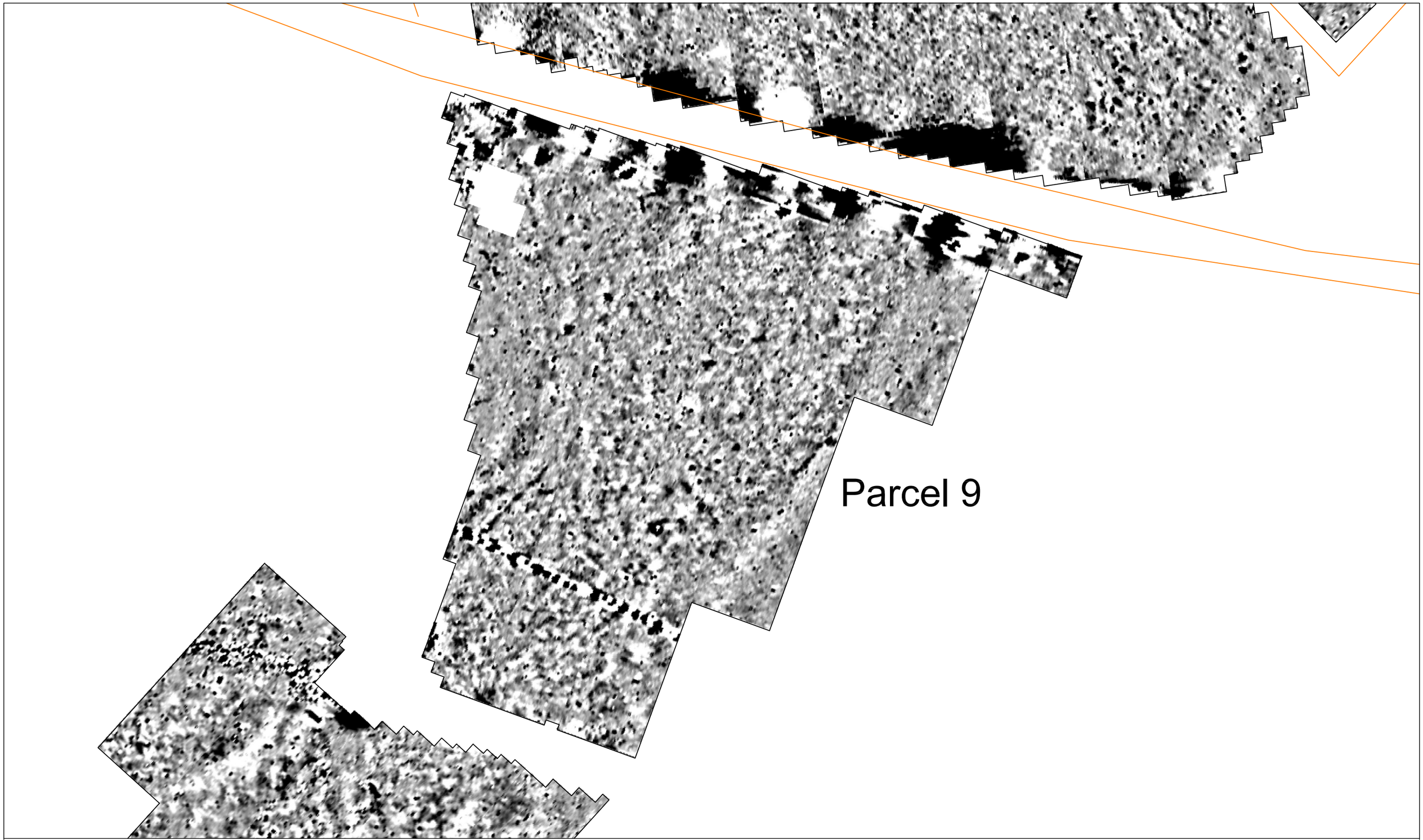
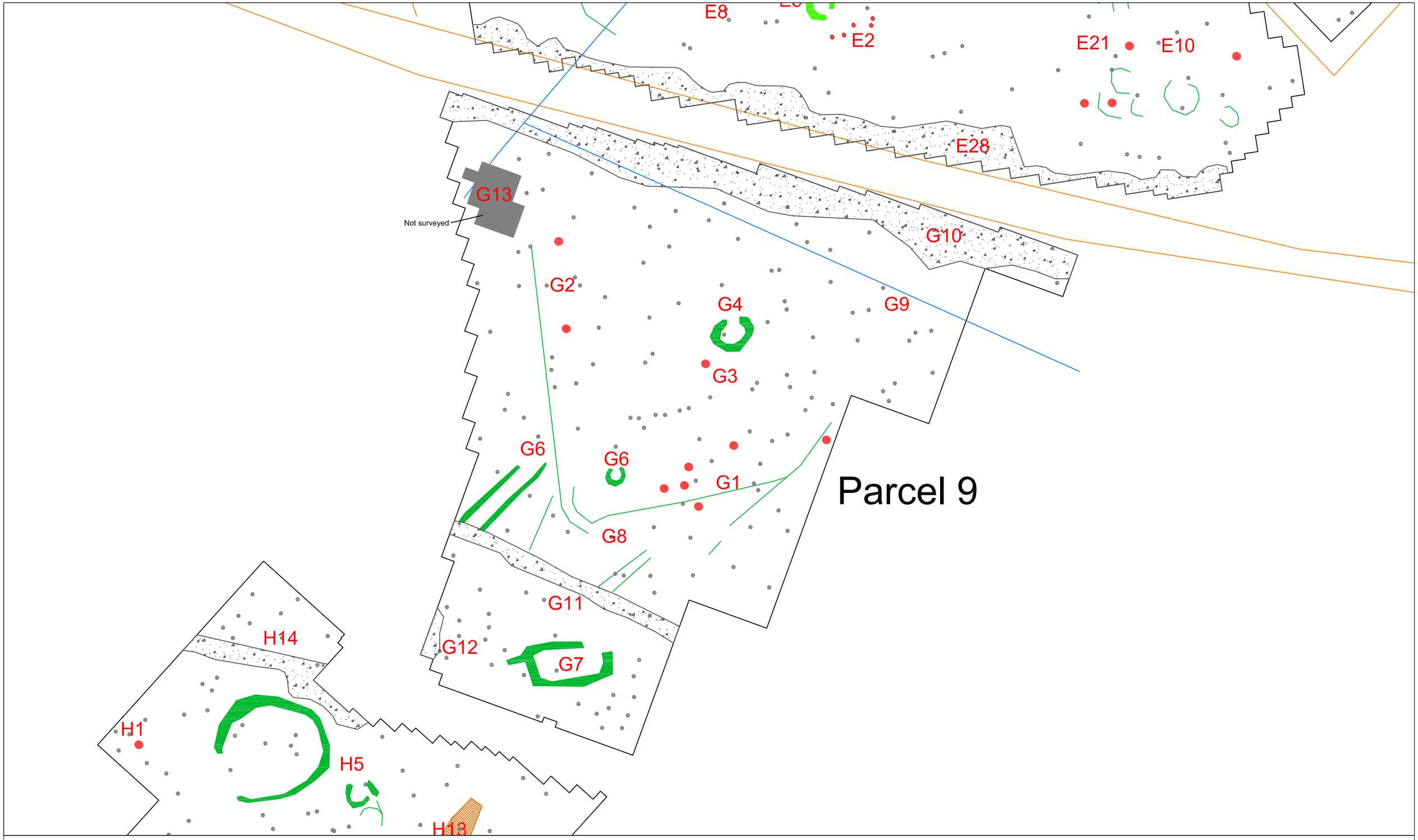


Processed Gradiometer survey results - Greyscale plot - Parcel 9

Figure 24	Scale 2nT -1nT		N 0 50m 1:1250 at A3	Project Title: A96 / A9 Inshes to Smithton Project No: 51877		AOC Archaeology Group
				Drawing Title: Figure 24 - Processed Gradiometer survey results - Greyscale plot - Parcel 9		
				V1/51877/GEO/F24/30.01.18		
				Drawn by: KT	Checked by: JL	Approved by: JL
				30/01/2018	30/01/2018	30/01/2018



Interpretation of Gradiometer survey results - Parcel 9

Figure 25

- Trend (Archaeology)
- Area of Disturbance (Archaeology)
- Pit (Archaeology)
- Discrete Trend (Archaeology?)
- Discrete Area of Disturbance (Archaeology?)
- Discrete Pit (Archaeology?)
- Trend (Unclear Origin)
- Area of Disturbance (Unclear Origin)
- Old Field Boundary
- Linear Trend (Ridge and Furrow)
- Linear Trend (Ploughing)
- Linear Trend (Field Drains)
- Geology / Natural
- Linear Trend (Modern Service)
- Area of Disturbance (Modern)
- Ferrous / Iron Spikes

N

0 50m

1:1250 at A3

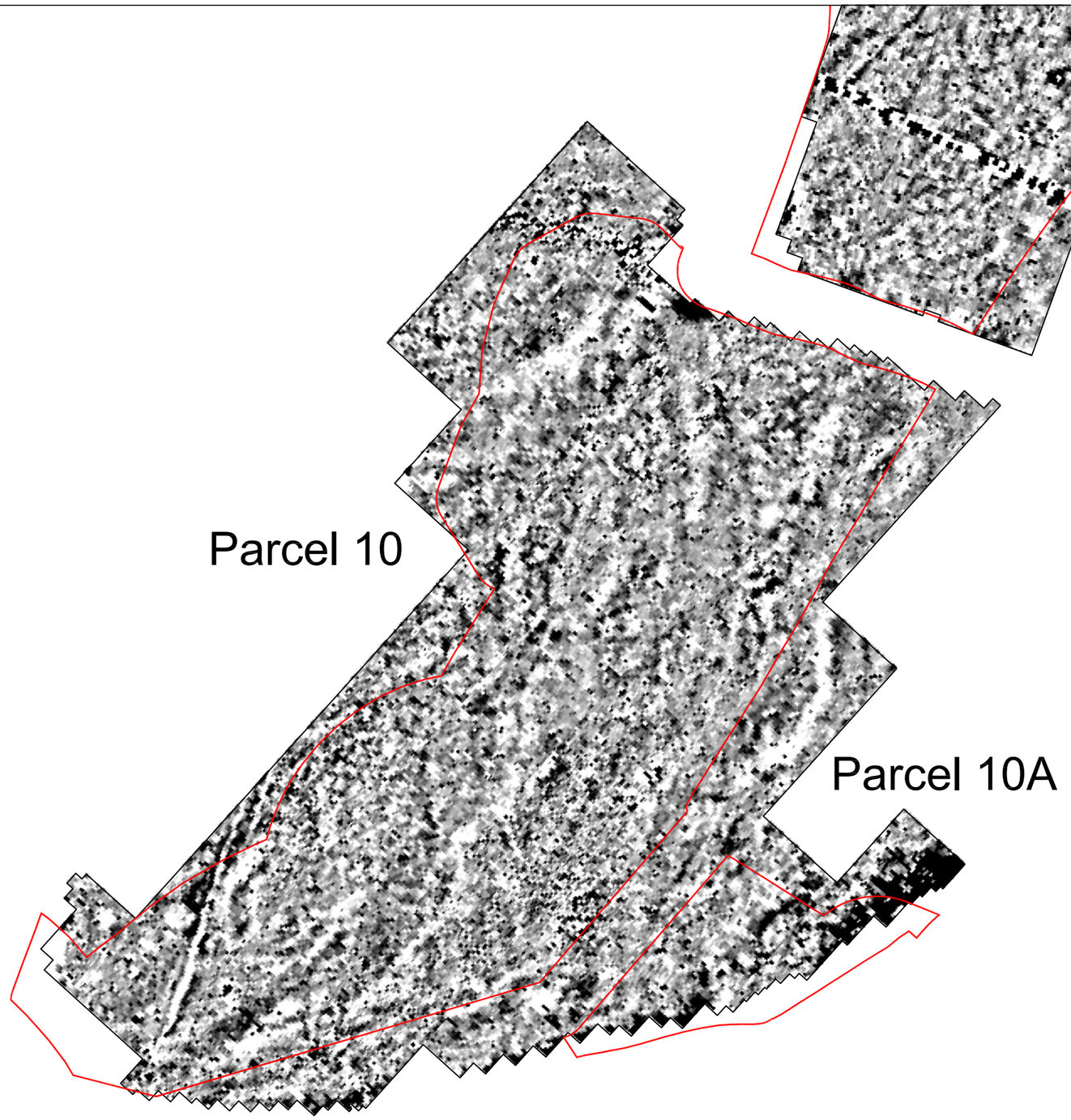
Project Title: A96 / A9 Inshes to Smithton
Project No: 51877

Drawing Title: Figure 25 - Interpretation of Gradiometer survey results - Parcel 9

V1/51877/GEO/F25/30.01.18

Drawn by: KT	Checked by: JL	Approved by: JL
30/01/2018	30/01/2018	30/01/2018

AOC Archaeology Group



Minimally processed Gradiometer survey results - Greyscale plot - Parcel 10

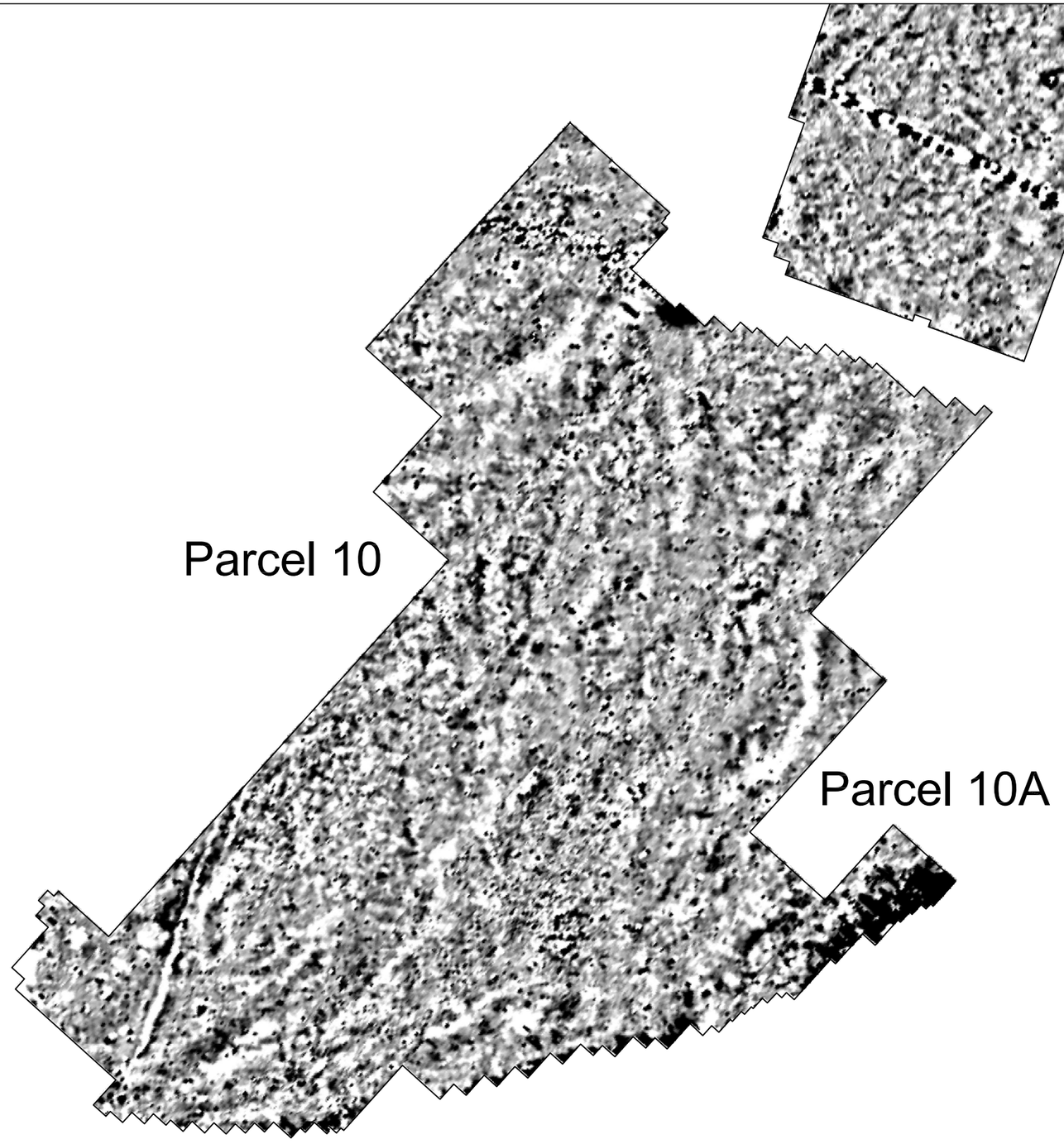
Figure 26

Scale
2nT
-1nT

N
0
60m
1:1500 at A3

Project Title: A96 / A9 Inshes to Smithton Project No: 51877		
Drawing Title: Figure 26 - Minimally processed Gradiometer survey results - Greyscale plot - Parcel 10		
V1/51877/GEO/F26/30.01.18		
Drawn by: KT	Checked by: JL	Approved by: JL
30/01/2018	30/01/2018	30/01/2018

AOC Archaeology Group



Processed Gradiometer survey results - Greyscale plot - Parcel 10

Figure 27

Scale
2nT
-1nT

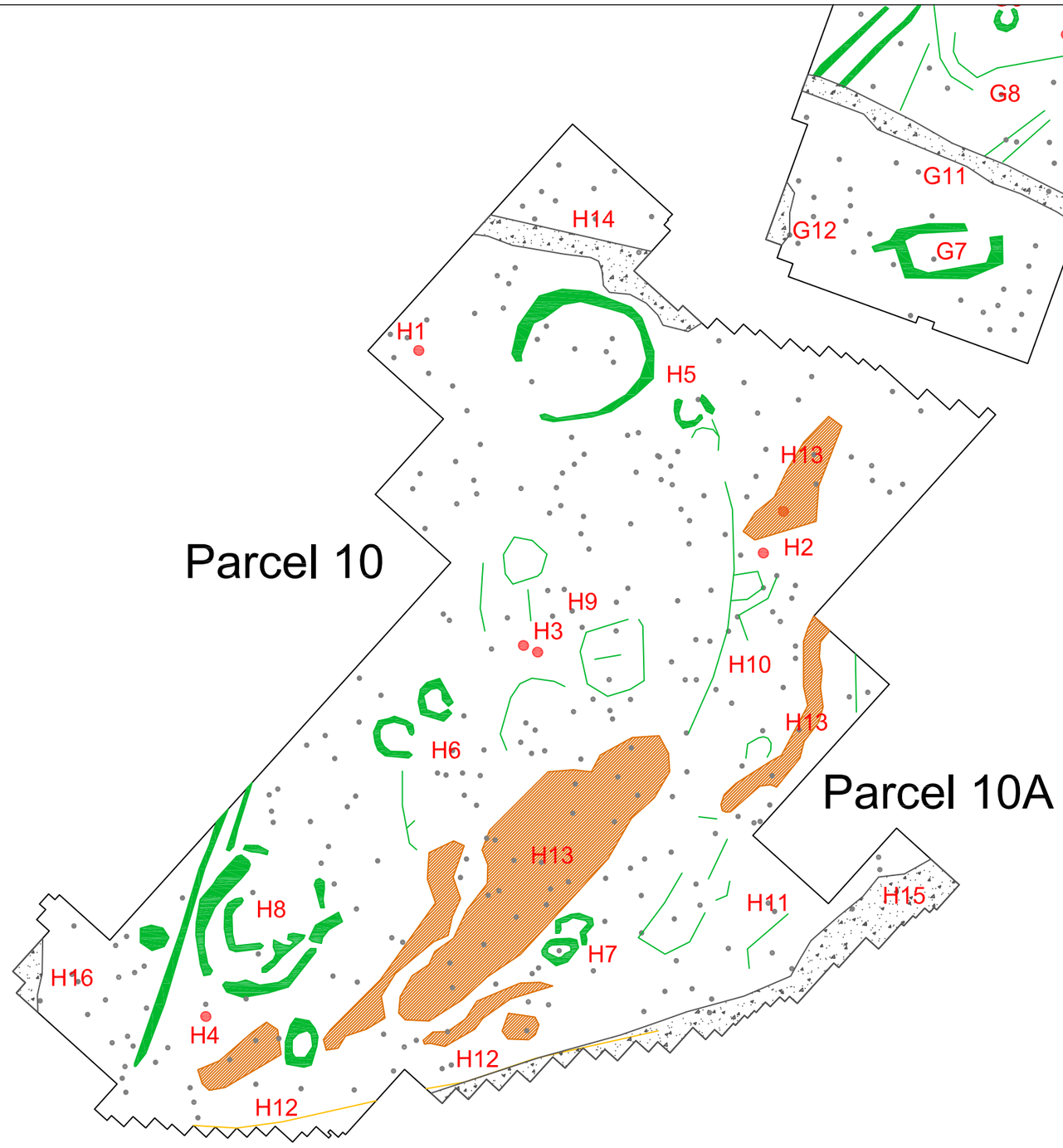
N

0 60m

1:1500 at A3

Project Title: A96 / A9 Inshes to Smithton Project No: 51877		
Drawing Title: Figure 27 - Processed Gradiometer survey results - Greyscale plot - Parcel 10		
V1/51877/GEO/F27/30.01.18		
Drawn by: KT	Checked by: JL	Approved by: JL
30/01/2018	30/01/2018	30/01/2018

AOC Archaeology Group



Interpretation of Gradiometer survey results - Parcel 10

Figure 28

- Trend (Archaeology)
- Area of Disturbance (Archaeology)
- Pit (Archaeology)
- Discrete Trend (Archaeology?)
- Discrete Area of Disturbance (Archaeology?)
- Discrete Pit (Archaeology?)
- Trend (Unclear Origin)
- Area of Disturbance (Unclear Origin)
- Old Field Boundary
- Linear Trend (Ridge and Furrow)
- Linear Trend (Ploughing)
- Linear Trend (Field Drains)
- Geology / Natural
- Linear Trend (Modern Service)
- Area of Disturbance (Modern)
- Ferrous / Iron Spikes

N

0 60m

1:1500 at A3

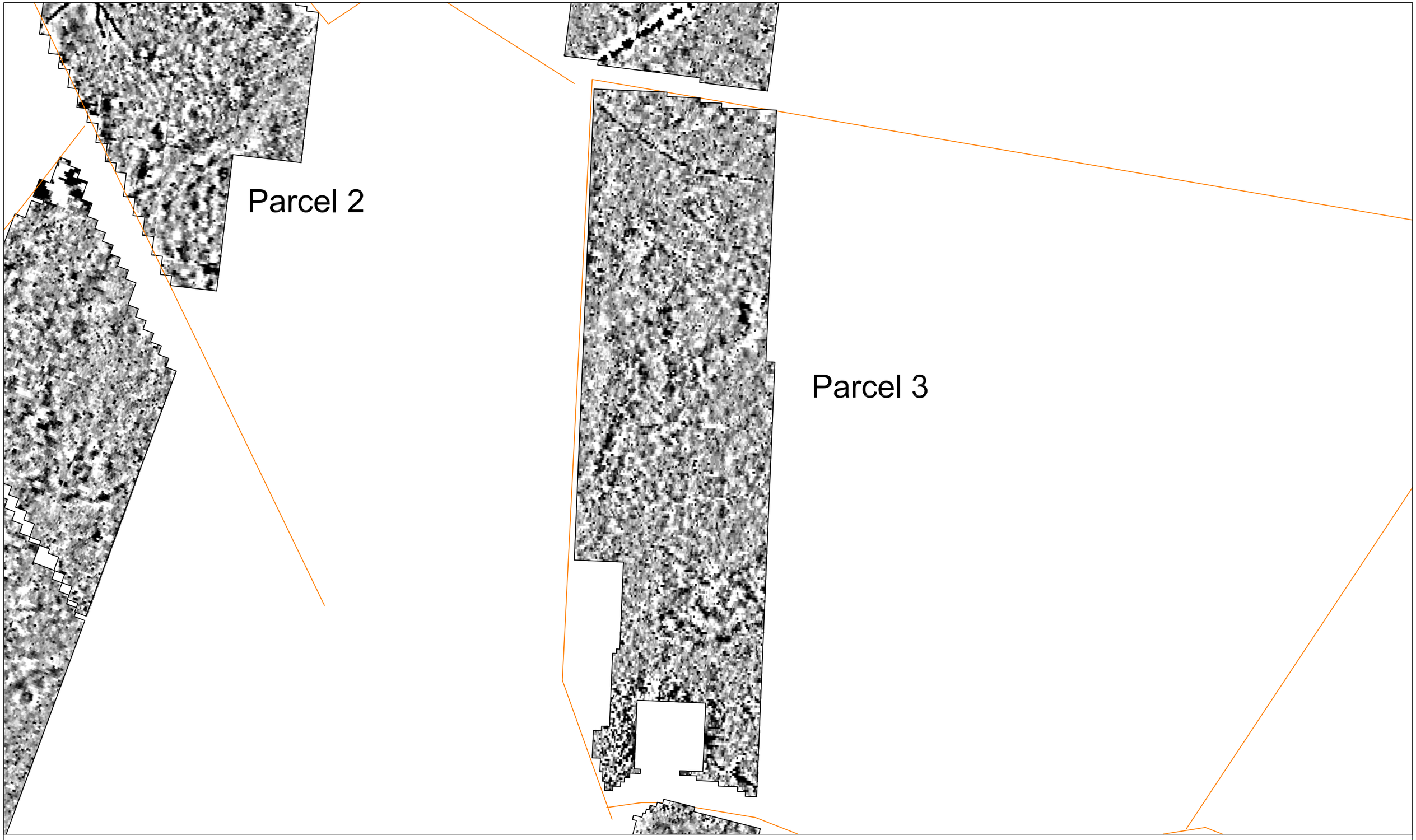
Project Title: A96 / A9 Inshes to Smithton
Project No: 51877

Drawing Title: Figure 28 - Interpretation of Gradiometer survey results - Parcel 10

V1/51877/GEO/F28/30.01.18

Drawn by: KT	Checked by: JL	Approved by: JL
30/01/2018	30/01/2018	30/01/2018

AOC Archaeology Group



Minimally processed Gradiometer survey results - Greyscale plot - Parcel 3

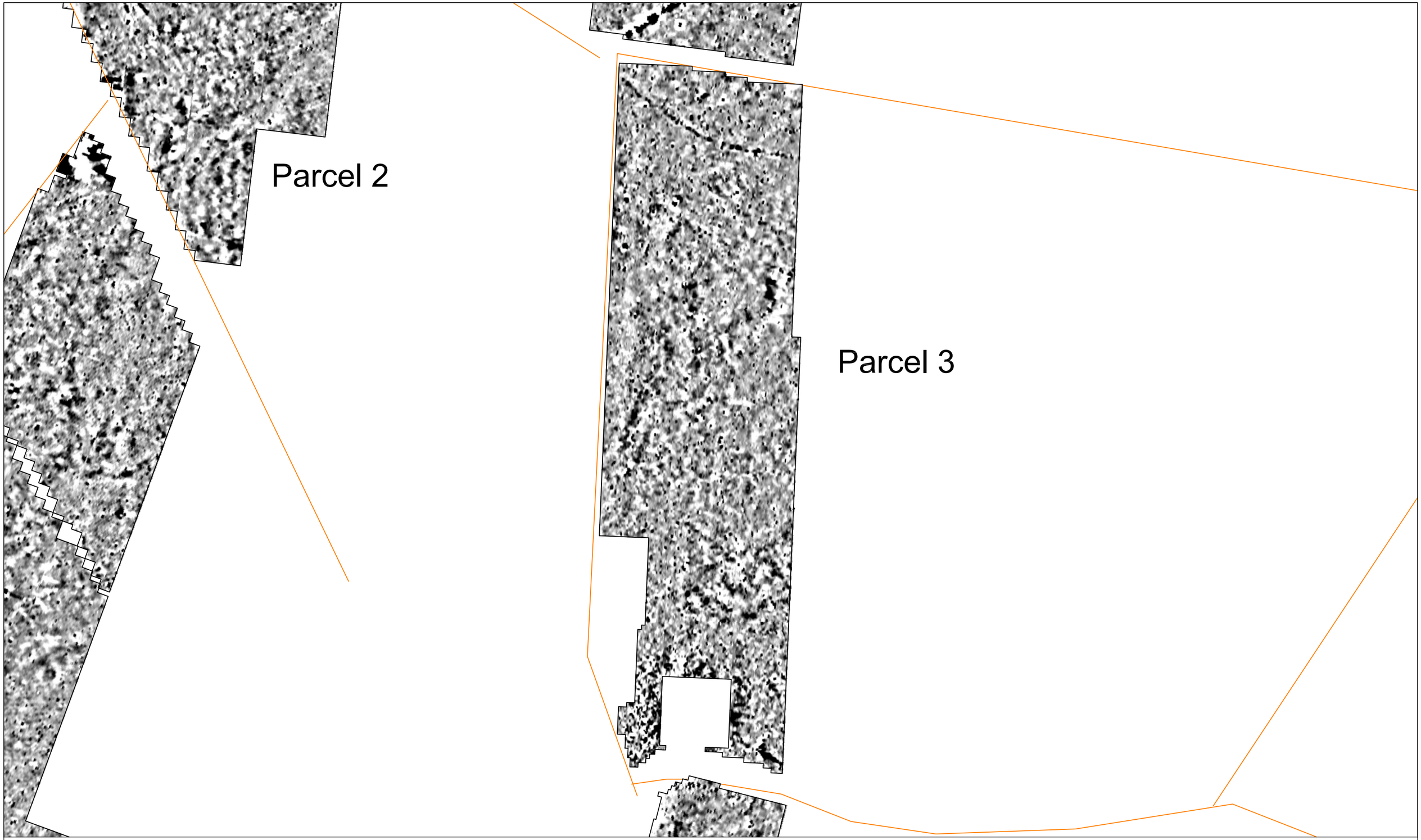
Figure 29

Scale
2nT
-1nT

N
0
60m
1:1500 at A3

Project Title: A96 / A9 Inshes to Smithton Project No: 51877		
Drawing Title: Figure 29 - Minimally processed Gradiometer survey results - Greyscale plot - Parcel 3		
V1/51877/GEO/F29/03.05.18		
Drawn by: JL	Checked by: KT	Approved by: JL
03/05/2018	03/05/2018	03/05/2018

AOC Archaeology Group



Processed Gradiometer survey results - Greyscale plot - Parcel 3

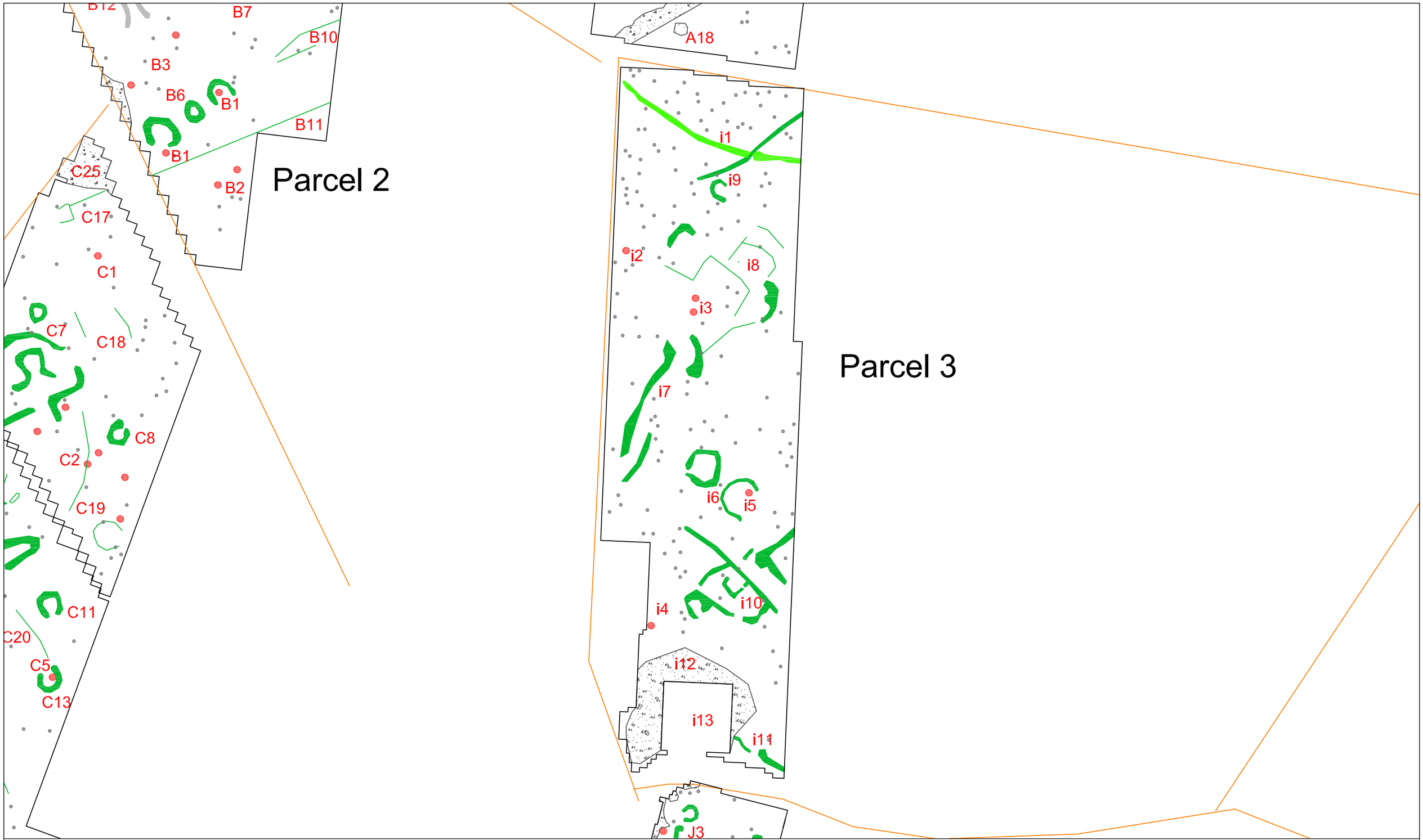
Figure 30

Scale
2nT
-1nT

N
0
60m
1:1500 at A3

Project Title: A96 / A9 Inshes to Smithton Project No: 51877		
Drawing Title: Figure 30 - Processed Gradiometer survey results - Greyscale plot - Parcel 3		
V1/51877/GEO/F30/03.05.18		
Drawn by: KT	Checked by: JL	Approved by: JL
03/05/2018	03/05/2018	03/05/2018

AOC Archaeology Group



Interpretation of Gradiometer survey results - Parcel 3

Figure 31

- Discrete Trend (Archaeology?)
- Discrete Pit (Archaeology?)
- Trend (Unclear Origin)
- Area of Disturbance (Unclear Origin)
- Area of Disturbance (Modern)
- Ferrous / Iron Spikes

N

0 60m

1:1500 at A3

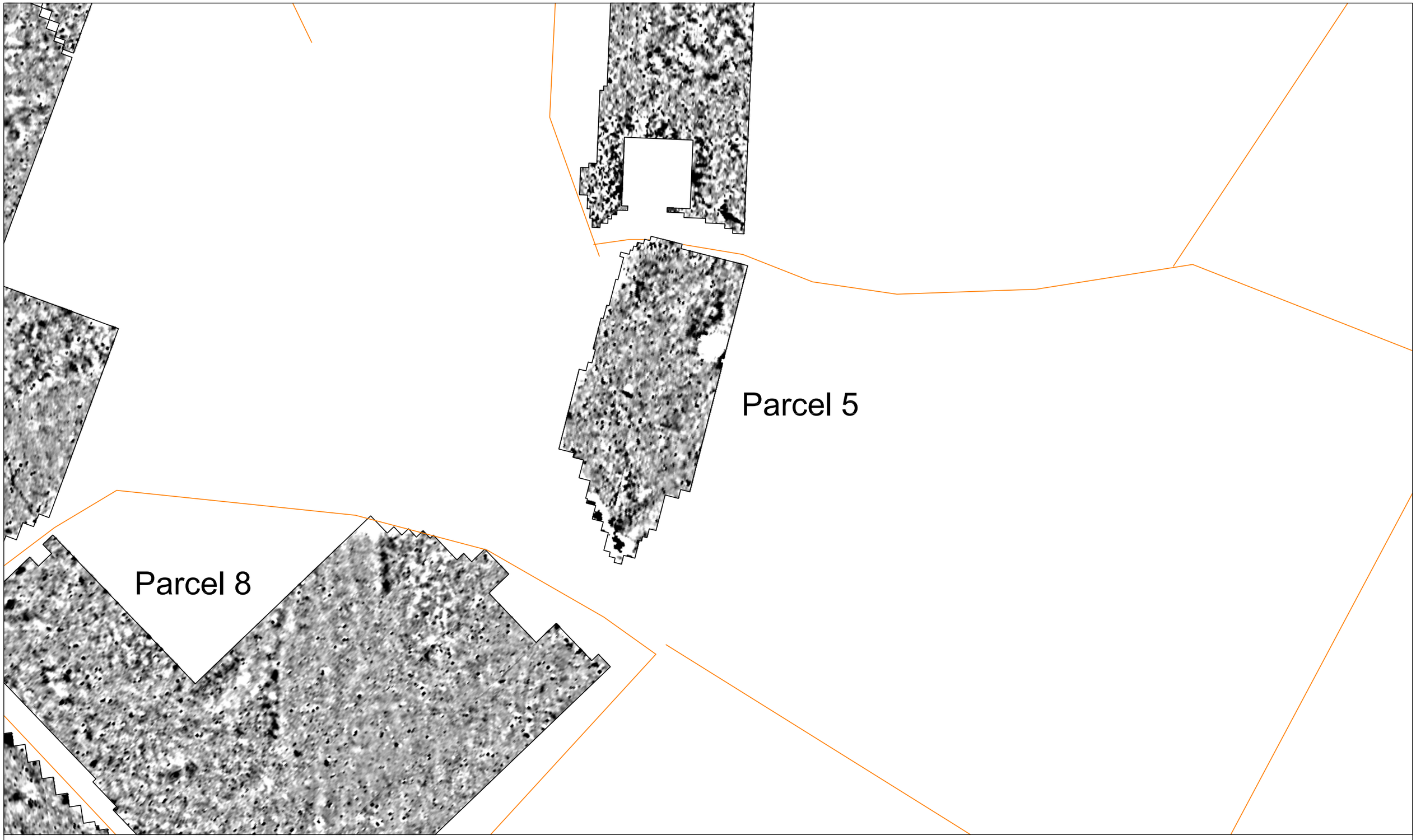
Project Title: A96 / A9 Inshes to Smithton Project No: 51877		
Drawing Title: Figure 31- Interpretation of Gradiometer survey results - Parcel 3		
V1/51877/GEO/F31/03.05.18		
Drawn by: KT	Checked by: JL	Approved by: JL
03/05/2018	03/05/2018	03/05/2018

AOC Archaeology Group

Minimally processed Gradiometer survey results - Greyscale plot - Parcel 5

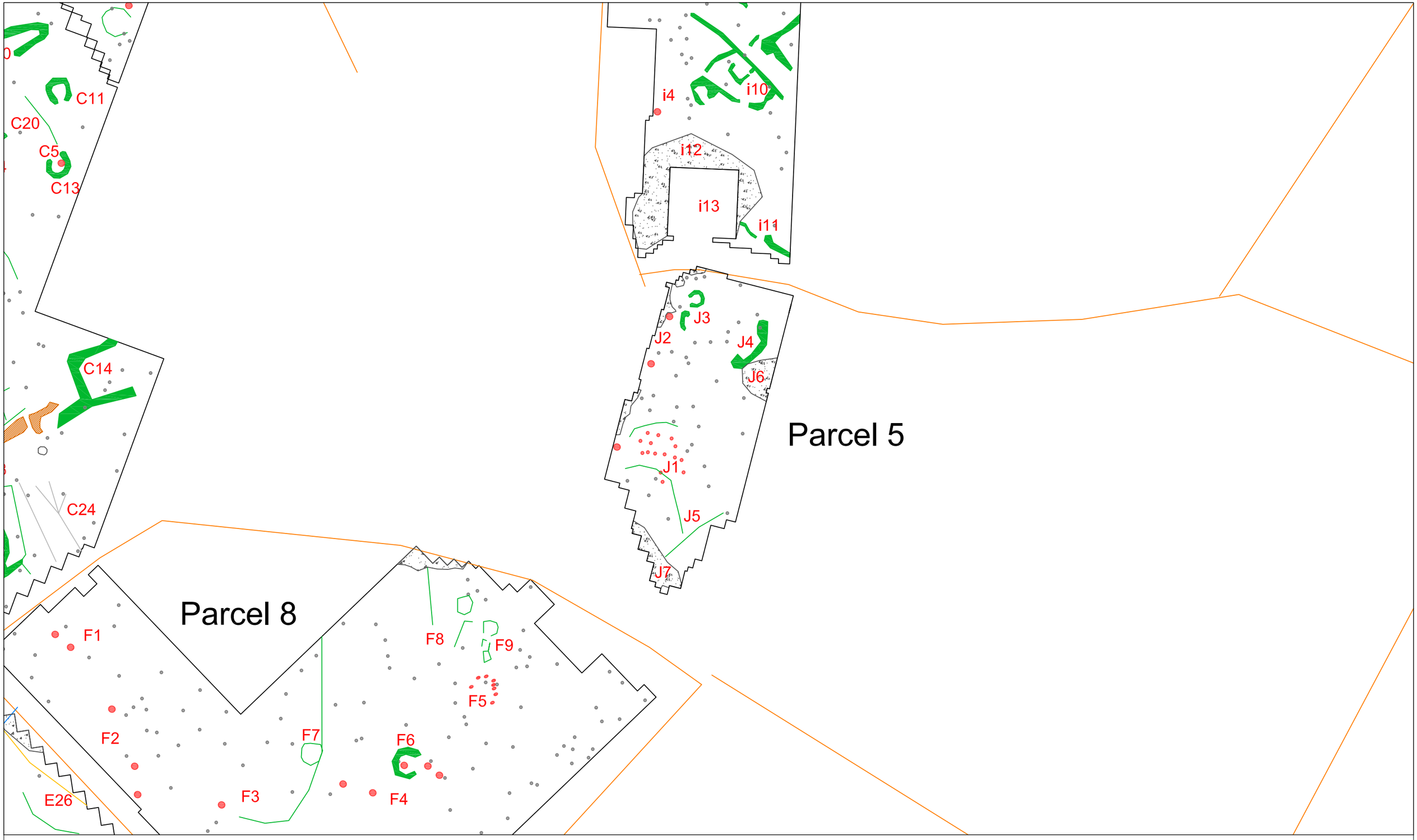
Figure 32	Scale 2nT / -1nT		N; 0 60m; 1:1500 at A3	Project Title: A96 / A9 Inshes to Smithton Project No: 51877		
				Drawing Title: Figure 32 - Minimally processed Gradiometer survey results - Greyscale plot - Parcel 5		
				V1/51877/GEO/F32/03.05.18		
				Drawn by: KT	Checked by: JL	Approved by: JL
				03/05/2018	03/05/2018	03/05/2018

AOC Archaeology Group



Processed Gradiometer survey results - Greyscale plot - Parcel 5

Figure 33	Scale 2nT / -1nT		N; 0 60m; 1:1500 at A3	Project Title: A96 / A9 Inshes to Smithton Project No: 51877		AOC Archaeology Group
				Drawing Title: Figure 33 - Processed Gradiometer survey results - Greyscale plot - Parcel 5		
				V1/51877/GEO/F33/03.05.18		
				Drawn by: KT	Checked by: JL	Approved by: JL
				03/05/2018	03/05/2018	03/05/2018



Interpretation of Gradiometer survey results - Parcel 5

Figure 34

- Discrete Trend (Archaeology?)
- Discrete Pit (Archaeology?)
- Trend (Unclear Origin)
- Linear Trend (Field Drains)
- Area of Disturbance (Modern)
- Ferrous / Iron Spikes

N

0 60m

1:1500 at A3

Project Title: A96 / A9 Inshes to Smithton Project No: 51877		
Drawing Title: Figure 34 - Interpretation of Gradiometer survey results - Parcel 5		
V1/51877/GEO/F34/03.05.18		
Drawn by: KT	Checked by: JL	Approved by: JL
03/05/2018	03/05/2018	03/05/2018

AOC Archaeology Group

Figure	35

Processed resistivity results

Jacobs supplied Parcels

Resistivity (ohms)

Value

440

120

FOR

JACOBS

Drawn/checked:	GC/JL
DWG no:	01/51877/Rep/35
AOC Project No.:	51877

AOC Archaeology Group

N

Map Frame Lower Left: 269701E 844971N m
Map Frame Upper Right: 270039E 845239N m

SYSTEM

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

SCALE

1:1,000 @ A3

SCALE

0 10 20 30 40 50

Meters

Figure	36

Interpretation of resistivity results

Scheduled Monuments

Res Interpretation (pl)

Class

- Agriculture - modern
- Linear trend - low resistance - agriculture
- Linear trend - low resistance - archaeology
- Linear trend - low resistance - archaeology (possible)

Res Interpretation (pg)

Class

- High resistance - archaeology (possible)
- Low resistance - archaeology
- Low resistance - archaeology (possible)
- High resistance - modern
- Geology

FOR

JACOBS

Drawn/checked:	GC/JL
DWG no:	01/51877/Rep/36
AOC Project No.:	51877

AOC Archaeology Group

N

Map Frame Lower Left: 269701E 844971N m
Map Frame Upper Right: 270039E 845239N m

SYSTEM

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

SCALE

1:1,000 @ A3

SCALE

0 10 20 30 40 50

Meters

Figure	37

HES Aerial Image of Scheduled Monument SM11535, Ashton Farm Cottages

Scheduled Monument boundary

FOR

JACOBS

Drawn/checked:	GC/JL
DWG no:	01/51877/029/01
AOC Project No.:	51877

AOC Archaeology Group

N

Map Frame Lower Left: 269648E 844989N m
Map Frame Upper Right: 269987E 845257N m

SYSTEM

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

SCALE

1:1,000 @ A3

SCALE

0 10 20 30 40 50
Meters

Figure 38

HES Aerial Image of Scheduled Monument SM11535, HES and AOC transcription

Scheduled Monument boundary

HES Aerial Image transcription
- C52911_SM-ROUNDHOUSE
- C52911_MC-PIT
- C52911_LU-FIELD-BOUNDARY

AOC Aerial Image transcription

Type
- Pit
- Roundhouse

FOR

JACOBS

Drawn/checked:	GC/JL
DWG no:	01/51877/030/01
AOC Project No.:	51877

AOC Archaeology Group

N

Map Frame Lower Left: 269648E 844989N m
Map Frame Upper Right: 269987E 845257N m

SYSTEM

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

SCALE 1:1,000 @ A3

SCALE 0 10 20 30 40 50 Meters

Figure	39

Ashton Farm Cottages:
magnetometry data

Scheduled Monument boundary

Magnetometry nT

Value

+2

-2

FOR

JACOBS

Drawn/checked:	GC/JL
DWG no:	01/51877/031/01
AOC Project No.:	51877

AOC Archaeology Group

N

Map Frame Lower Left: 269648E 844989N m
Map Frame Upper Right: 269987E 845257N m

SYSTEM

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

SCALE

1:1,000 @ A3

SCALE

0 10 20 30 40 50

Meters

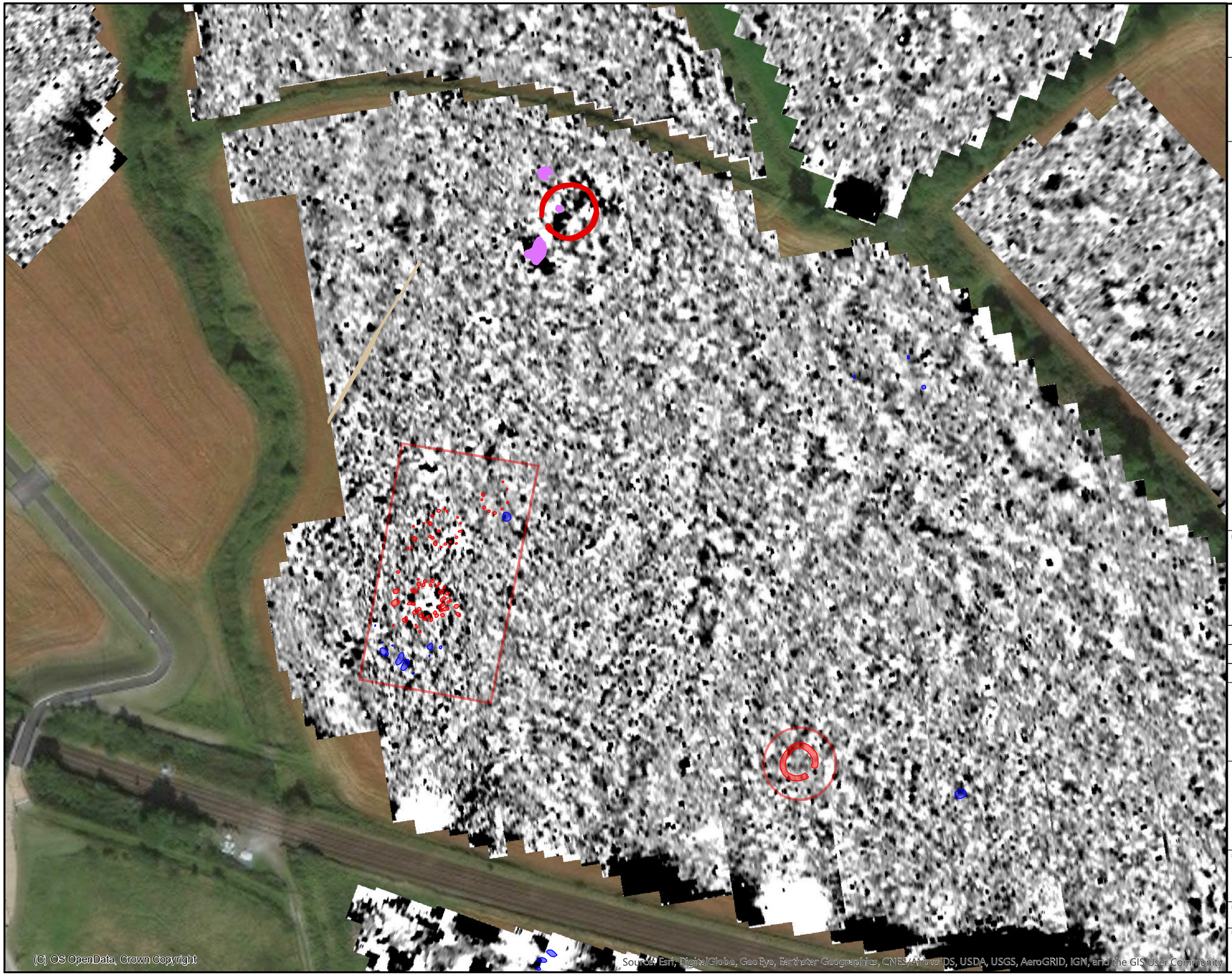


Figure	40

Ashton Farm Cottages: magnetometry data with AP transcription overlain

Scheduled Monument boundary

Magnetometry nT

Value

+2

-2

HES Aerial Image transcription

C52911_SM-ROUNDHOUSE

C52911_MC-PIT

C52911_LU-FIELD-BOUNDARY

AOC Aerial Image transcription

Type

Pit

Roundhouse

FOR

JACOBS

Drawn/checked:	GC/JL
DWG no:	01/51877/032/01
AOC Project No.:	51877

AOC Archaeology Group

N

Map Frame Lower Left: 269648E 844989N m
Map Frame Upper Right: 269987E 845257N m

SYSTEM

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

SCALE

1:1,000 @ A3

SCALE

0 10 20 30 40 50

Meters

Appendix 1: Characterisation of Identified Anomalies

Gradiometer survey

Parcel Specific Anomaly Code for Parcels 1 and 1A : **A**

Anomaly	Type of Archaeology
A1	Discrete Archaeology? Pit-like anomalies
A2	Discrete Archaeology? Pit-like anomalies
A3	Linear Trend (Unclear origin)
A4	Linear Trend (Unclear origin)
A5	Linear Trend (Unclear origin)
A6	Linear Trend (Unclear origin)
A7	Linear Trend (Unclear origin)
A8	Linear Trend (Unclear origin)
A9	Linear Trend (Unclear origin)
A10	Linear Trend (Unclear origin)
A11	Linear Trend (Unclear origin)
A12	Linear Trend (Unclear origin)
A13	Linear Trend (Unclear origin)
A14	Linear Trend (Unclear origin)
A15	Agricultural Headlands
A16	Geology
A17	Modern service
A18	Modern disturbance

Site Specific Anomaly Code for Parcel 2: **B**

Anomaly	Type of Archaeology
B1	Discrete Archaeology? Pit-like anomalies
B2	Discrete Archaeology? Pit-like anomalies
B3	Discrete Archaeology? Pit-like anomalies
B4	Discrete Archaeology? Pit-like anomalies
B5	Discrete Archaeology? Pit-like anomalies
B6	Linear Trend (Unclear origin)
B7	Linear Trend (Unclear origin)
B8	Linear Trend (Unclear origin)
B9	Linear Trend (Unclear origin)
B10	Linear Trend (Unclear origin)
B11	Linear Trend (Unclear origin)
B12	Field Drains?

Site Specific Anomaly Code for Parcel 3: **i**

Anomaly	Type of Archaeology
i1	Discrete Linear Trend Archaeology?
i2	Discrete Archaeology? Pit-like anomalies
i3	Discrete Archaeology? Pit-like anomalies
i4	Discrete Archaeology? Pit-like anomalies
i5	Discrete Archaeology? Pit-like anomalies
i6	Linear Trend (Unclear origin)
i7	Linear Trend (Unclear origin)
i8	Linear Trend (Unclear origin)
i9	Linear Trend (Unclear origin)
i10	Linear Trend (Unclear origin)
i11	Linear Trend (Unclear origin)
i12	Modern disturbance
i13	Modern disturbance

Site Specific Anomaly Code for Parcel 4: **C**

Anomaly	Type of Archaeology
C1	Discrete Archaeology? Pit-like anomalies
C2	Discrete Archaeology? Pit-like anomalies
C3	Discrete Archaeology? Pit-like anomalies
C4	Discrete Archaeology? Pit-like anomalies
C5	Discrete Archaeology? Pit-like anomalies
C6	Discrete Archaeology? Pit-like anomalies
C7	Linear Trend (Unclear origin)
C8	Linear Trend (Unclear origin)
C9	Linear Trend (Unclear origin)
C10	Linear Trend (Unclear origin)
C11	Linear Trend (Unclear origin)
C12	Linear Trend (Unclear origin)
C13	Linear Trend (Unclear origin)
C14	Linear Trend (Unclear origin)
C15	Linear Trend (Unclear origin)
C16	Linear Trend (Unclear origin)
C17	Linear Trend (Unclear origin)
C18	Linear Trend (Unclear origin)
C19	Linear Trend (Unclear origin)
C20	Linear Trend (Unclear origin)
C21	Linear Trend (Unclear origin)
C22	Linear Trend (Unclear origin)
C23	Geology?
C24	Field Drains?
C25	Modern disturbance

C26	Modern disturbance

Site Specific Anomaly Code for Parcel 5: **J**

Anomaly	Type of Archaeology
J1	Discrete Archaeology? Pit-like anomalies
J2	Discrete Archaeology? Pit-like anomalies
J3	Linear Trend (Unclear origin)
J4	Linear Trend (Unclear origin)
J5	Linear Trend (Unclear origin)
J6	Modern disturbance
J7	Modern disturbance

Site Specific Anomaly Code for Parcel 6: **D**

Anomaly	Type of Archaeology
D1	Discrete Archaeology? Pit-like anomalies
D2	Discrete Archaeology? Pit-like anomalies
D3	Discrete Archaeology? Pit-like anomalies
D4	Discrete Archaeology? Pit-like anomalies
D5	Discrete Archaeology? Pit-like anomalies
D6	Linear Trend (Unclear origin)
D7	Linear Trend (Unclear origin)
D8	Linear Trend (Unclear origin)
D9	Linear Trend (Unclear origin)
D10	Geology?
D11	Modern disturbance

Site Specific Anomaly Code for Parcel 7 and 7A: **E**

Anomaly	Type of Archaeology
E1	Archaeology – Pit-like anomalies
E2	Archaeology – Pit-like anomalies
E3	Discrete curvilinear trend
E4	Discrete curvilinear trend
E5	Discrete curvilinear trend
E6	Discrete – Pit-like anomalies
E7	Discrete – Pit-like anomalies
E8	Discrete – Pit-like anomalies
E9	Discrete – Pit-like anomalies
E10	Discrete – Pit-like anomalies

E11	Discrete – Pit-like anomalies
E12	Linear Trend (Unclear origin)
E13	Linear Trend (Unclear origin)
E14	Linear Trend (Unclear origin)
E15	Linear Trend (Unclear origin)
E16	Linear Trend (Unclear origin)
E17	Linear Trend (Unclear origin)
E18	Linear Trend (Unclear origin)
E19	Linear Trend (Unclear origin)
E20	Linear Trend (Unclear origin)
E21	Linear Trend (Unclear origin)
E22	Linear Trend (Unclear origin)
E23	Linear Trend (Unclear origin)
E24	Linear Trend (Unclear origin)
E25	Linear Trend – Old field boundary
E26	Agricultural Headland?
E27	Modern Disturbance
E28	Modern Disturbance
E29	Modern Disturbance

Site Specific Anomaly Code for Parcel 8: **F**

Anomaly	Type of Archaeology
F1	Discrete – Pit-like anomalies
F2	Discrete – Pit-like anomalies
F3	Discrete – Pit-like anomalies
F4	Discrete – Pit-like anomalies
F5	Discrete – Pit-like anomalies
F6	Linear Trend (Unclear origin)
F7	Linear Trend (Unclear origin)
F8	Linear Trend (Unclear origin)
F9	Linear Trend (Unclear origin)

Site Specific Anomaly Code for Parcel 9: **G**

Anomaly	Type of Archaeology
G1	Discrete – Pit-like anomalies
G2	Discrete – Pit-like anomalies
G3	Discrete – Pit-like anomalies
G4	Linear Trend (Unclear origin)
G5	Linear Trend (Unclear origin)
G6	Linear Trend (Unclear origin)
G7	Linear Trend (Unclear origin)
G8	Linear Trend (Unclear origin)
G9	Linear Trend – Old field boundary
G10	Modern Disturbance

G11	Modern Disturbance
G12	Modern Disturbance
G13	Unsurveyable area

Site Specific Anomaly Code for Parcel 10 and 10A: **H**

Anomaly	Type of Archaeology
H1	Discrete – Pit-like anomalies
H2	Discrete – Pit-like anomalies
H3	Discrete – Pit-like anomalies
H4	Discrete – Pit-like anomalies
H5	Linear Trend (Unclear origin)
H6	Linear Trend (Unclear origin)
H7	Linear Trend (Unclear origin)
H8	Linear Trend (Unclear origin)
H9	Linear Trend (Unclear origin)
H10	Linear Trend (Unclear origin)
H11	Linear Trend (Unclear origin)
H12	Agricultural Headlands
H13	Geology
H14	Modern Disturbance
H15	Modern Disturbance
H16	Modern Disturbance

Anomalies: Resistivity

Anomaly	Type of Archaeology
R1	Low resistance - archaeology
R2	Low resistance - archaeology
R3	Low resistance - archaeology
R4	Low resistance - archaeology
R5	Low resistance - archaeology (possible)
R6	Low resistance - archaeology (possible)
R7	Low resistance - archaeology (possible)
R8	Low resistance - archaeology (possible)
R9	Low resistance - archaeology (possible)
R10	High resistance - archaeology (possible)
R11	High resistance - archaeology (possible)
R12	High resistance - archaeology (possible)
R13	High resistance - archaeology (possible)
R14	High resistance - archaeology (possible)
R15	High resistance - archaeology (possible)
R16	High resistance - archaeology (possible)
R17	Linear trend - low resistance - archaeology
R18	Linear trend - low resistance - archaeology
R19	Linear trend - low resistance - archaeology (possible)
R20	Linear trend - low resistance - archaeology (possible)
R21	Linear trend - low resistance - archaeology (possible)
R22	Linear trend - low resistance - archaeology (possible)

R23	Linear trend - low resistance - archaeology (possible)
R24	Linear trend - low resistance - archaeology (possible)
R25	Agriculture - modern
R26	Linear trend - low resistance - agriculture
R27	High resistance - modern

Appendix 2: Survey Metadata

Field	Description
Surveying Company	AOC Archaeology
Data collection staff	Kimberley Teale, Alistair Galt, Dan Shiel, Genevieve Shaw, Sam Dollman, Leonie Teufnel, Graeme Cavers, Gemma Hudson, Jamie Humble
Client	Jacobs UK Ltd
Site name	A9/A96 Inshes to Smithton
County	Invernesshire
NGR	NH 69863 45203
Land use/ field condition	Arable stubble & pasture
Duration	17/01/2018 – 25/01/2018 and 9/04/2018 – 18/04/2018
Weather	Heavy snow showers / Sun
Survey type	Gradiometer Survey & Earth Resistance Survey
Instrumentation	Trimble R10 Bartington Grad 601-2 Earth Resistance – RM15 and MPX15
Area covered	Approx 25.45 ha Magnetometry (424 full or partial survey grids) Approx 3.85 ha Resistivity (53 full or partial survey grids)
Download software	Grad601 v313 (Magnetometer) TerraSurveyor 3.0.33.10 (Resistivity)
Processing software	Geoplot v3.0 / v4.0 (Magnetometer) TerraSurveyor 3.0.33.10 (Resistivity)
Visualisation software	AutoCAD LT 2009
Geology	The bedrock recorded geology within the survey area consists of the Hillhead Sandstone Formation; a sedimentary Devonian sandstone laid in an environment previously dominated by rivers (BGS, 2018)
Soils	Humus-iron podzols derived from fluvioglacial and raised beach sand parent materials (Scotland's Soils, 2018)
Scheduled Monument	*"Ashton Farm Cottages, ring ditch 415m SW and pit circles 460m WSW of" (SM11535)*
Known archaeology on site	Yes
Historical documentation/ mapping on site	Yes
Report title	A9/A96 Inshes to Smithton, Inverness, Scotland
Project number	51877
Report Author	James Lawton, Kimberley Teale & Graeme Cavers
Report approved by	Graeme Cavers

Appendix 3: Archaeological Prospection Techniques, Instrumentation and Software Utilised

Gradiometer survey

Gradiometer surveys measure small changes in the earth's magnetic field. Archaeological materials and activity can be detected by identifying changes to the magnetic values caused by the presence of weakly magnetised iron oxides in the soil (Aspinall *et al.*, 2008, 23; Sharma, 1997, 105). Human inhabitation often causes alterations to the magnetic properties of the ground (Aspinall et al, 2008, 21). There are two physical transformations that produce a significant contrast between the magnetic properties of archaeological features and the surrounding soil: the enhancement of magnetic susceptibility and thermoremnant magnetization (Aspinall *et al.*, 2008, 21; Heron and Gaffney 1987, 72).

Ditches and pits can be easily detected through gradiometer survey as the top soil is generally suggested to have a greater magnetisation than the subsoil caused by human habitation. Also areas of burning or materials which have been subjected to heat commonly have high magnetic signatures, examples include: hearths, kilns, fired clay and mudbricks (Clark 1996, 65; Lowe and Fogel 2010, 24). It should be noted that negative anomalies can also be useful for characterising archaeological features. If the buried remains are composed of a material with a lower magnetisation compared with the surrounding soil, the surrounding soil will consequently have a greater magnetisation resulting in the feature displaying a negative signature. For example stone materials of a structural nature that are composed of sedimentary rocks are considered non-magnetic and so will appear as negative features within the data set.

Ferrous objects- i.e. iron and its alloys- are strongly magnetic and are typically detected as high-value peaks in gradiometer survey data, though it is not usually possible to determine whether these relate to archaeological or modern objects.

Although gradiometer surveys have been successfully carried out in all areas of the United Kingdom, the effectiveness of the technique is lessened in areas with complex geology, particularly where igneous and metamorphic bedrock is present. All magnetic geophysical surveys must therefore take the effects of background geological and geomorphological conditions into account.

Gradiometer survey instrumentation

AOC Archaeology's gradiometer surveys are carried out using Bartington Grad601-2 magnetic gradiometers. The Grad601-2 is a high-stability fluxgate magnetic gradient sensor, which uses a 1m sensor separation. The detection resolution is from 0.03 nT/m to 0.1nT/m, depending on the sensor parameters selected, making the Grad601-2 an ideal instrument for prospective survey of large areas as well as detailed surveys of known archaeology. The instrument stores the data collected on an on-board data-logger, which is then downloaded as a series of survey grids for processing.

Gradiometer survey software

Following the survey, gradiometer data is downloaded from the instrument using Grad601 PC Software v313. Survey grids are then assembled into composites and enhanced using a range of processing techniques using Geoscan Geoplot v3.0 / v4.0 (see Appendix 4 for a summary of the processes used in Geoplot and Appendix 5 for a list of processes used to create final data plots).

Earth Resistance survey instrumentation

AOC Archaeology's Earth Resistance Surveys are conducted using a Geoscan Research RM15 resistance meter, with a set number of probes and remote probes depending on the chosen survey methodology, utilising a MPX15 multiplexor attachment if required (see Appendices 2 and 3).

Data was collected on an east-west alignment using zig-zag traverses, with a sample interval of 1m and a traverse interval of 1m. The gain was set appropriate to ground conditions and the local geology.

Earth Resistance survey software

Following completion of the survey, the earth resistance data is downloaded from the instrument using TerraSurveyor version 3.0.33.10. The survey grids are then assembled into composites and enhanced using a range of processing techniques using Geoscan Geoplot v3.0 / v4.0 (see Appendix 4 for a summary of the processes used in Geoplot and Appendix 5 for a list of processes used to create final data plots).

Appendix 4: Summary of Processes used in Geoplot

Process	Effect
Clip	Limits data values to within a specified range
De-spike	Removes exceptionally high readings in the data that can obscure the visibility of archaeological features. In resistivity survey, these can be caused by poor contact of the mobile probes with the ground. In gradiometer survey, these can be caused by highly magnetic items such as buried ferrous objects.
De-stagger	Corrects a misalignment of data when the survey is conducted in a zig-zag traverse pattern.
Edge Match	Counteracts edge effects in grid composites by subtracting the difference between mean values in the two lines either side of the grid edge.
High pass filter	Removes low-frequency, large scale detail in order to remove background trends in the data, such as variations in geology.
Interpolate	Increases the resolution of a survey by interpolating new values between surveyed data points, creating a smoother overall effect.
Low Pass filter	Uses a Gaussian filter to remove high-frequency, small scale detail, typically for smoothing the data.
Periodic Filter	Used to either remove or reduce the appearance of constant and reoccurring features that distort other anomalies, such as plough lines.
Wallis filter	Applies a locally adaptive contrast enhancement filter.
Zero Mean Grid	Resets the mean value of each grid to zero, in order to counteract grid edge discontinuities in composite assemblies.
Zero Mean Traverse	Resets the mean value of each traverse to zero, in order to address the effect of striping in the data and counteract edge effects.

Appendix 5: Survey Processing Steps

Gradiometer survey

Process	Extent
Zero Mean Traverse	All LMS =on, threshold -5 to 5
Despike	X=1 Y=1 Thr = 3 Repl = Mean
Clip	Min =-5 Max = 5
Destagger	All grids dir Shift = 2 Line Pattern 34-78 Dual-DS
Low Pass filter	X=1 Y=1 Wt=G
Interpolate	Y, Expand – Expand –SinX/X x2
Raw Palette Scale	Grey08 Min= -1nT Max= 2nT
Palette Scale	Grey08 Min= -1nT Max= 2nT

Resistivity survey

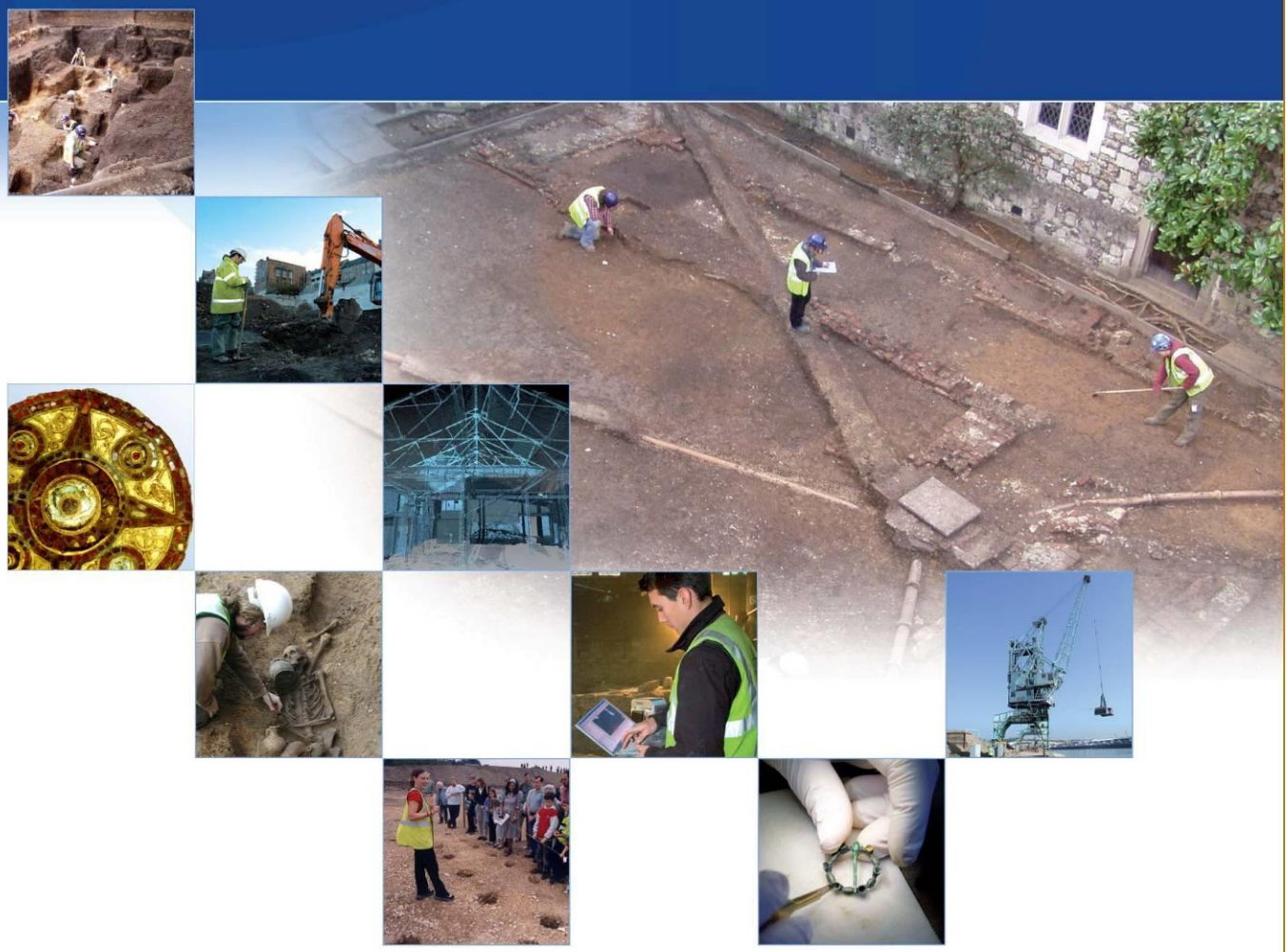
Process
1. Base Layer
2. Add/Subtract -306 (Area: Top 120, Left 90, Bottom 150, Right 119)
3. Range Match (Area: Top 150, Left 90, Bottom 151, Right 120) to Bottom edge
4. Add/Subtract -392 (Area: Top 90, Left 90, Bottom 119, Right 119)
5. Range Match (Area: Top 75, Left 119, Bottom 77, Right 150) to Top edge
6. Clip from 31.00 to 477.00 Ohm
7. Despike Threshold: 1 Window size: 3x3 (Area: Top 60, Left 120, Bottom 89, Right 149)
8. Despike Threshold: 1 Window size: 3x3 (Area: Top 30, Left 150, Bottom 59, Right 179)
9. Despike Threshold: 1 Window size: 3x3 (Area: Top 30, Left 120, Bottom 59, Right 149)
10. Despike Threshold: 1 Window size: 3x3 (Area: Top 60, Left 240, Bottom 89, Right 269)
11. Despike Threshold: 1 Window size: 3x3 (Area: Top 30, Left 180, Bottom 59, Right 209)
12. Despike Threshold: 1 Window size: 3x3 (Area: Top 150, Left 240, Bottom 179, Right 269)
13. Despike Threshold: 1 Window size: 3x3 (Area: Top 30, Left 0, Bottom 59, Right 29)
14. Despike Threshold: 1 Window size: 3x3 (Area: Top 90, Left 120, Bottom 119, Right 149)
15. Despike Threshold: 1 Window size: 3x3 (Area: Top 120, Left 120, Bottom 149, Right 149)
16. Despike Threshold: 1 Window size: 3x3 (Area: Top 150, Left 330, Bottom 179, Right 359)
17. Range Match (Area: Top 120, Left 90, Bottom 149, Right 119) to Right edge
18. Range Match (Area: Top 120, Left 60, Bottom 149, Right 89) to Right edge
19. Range Match (Area: Top 90, Left 90, Bottom 119, Right 119) to Right edge
20. Range Match (Area: Top 150, Left 90, Bottom 179, Right 119) to Left edge
21. Range Match (Area: Top 150, Left 120, Bottom 179, Right 149) to Left edge
22. Range Match (Area: Top 180, Left 90, Bottom 209, Right 119) to Right edge
23. Despike Threshold: 1 Window size: 3x3 (Area: Top 30, Left 210, Bottom 59, Right 239)
24. Despike Threshold: 1 Window size: 3x3 (Area: Top 90, Left 240, Bottom 119, Right 269)

25. Despike Threshold: 1 Window size: 3x3 (Area: Top 120, Left 270, Bottom 149, Right 299)
26. Range Match (Area: Top 0, Left 90, Bottom 150, Right 119) to Bottom edge
27. Despike Threshold: 1 Window size: 3x3 (Area: Top 148, Left 89, Bottom 152, Right 122)
28. Despike Threshold: 1 Window size: 3x3 (Area: Top 150, Left 300, Bottom 179, Right 329)
29. Despike Threshold: 1 Window size: 3x3 (Area: Top 120, Left 150, Bottom 149, Right 179)
30. Despike Threshold: 1 Window size: 3x3 (Area: Top 60, Left 120, Bottom 89, Right 149)
31. Periphery Match ALL grids in the survey.

Appendix 6: Technical Terminology

Type of Anomaly	Description
Archaeology	
Archaeology - Trend	These are made up of linear / curvilinear / rectilinear anomalies and are either characterised by an increase or decrease in values compared to the magnetic background. This evidence is normally supported by the presence of archaeological remains and is confirmed by other forms of evidence such as HER records and aerial photography.
Archaeology - Area of Disturbance	This is characterised by a general increase and decrease of magnetic responses over a localised area and does not appear as having a linear form. These anomalies do not have the high dipolar response which are manifested in an 'iron spike' anomaly. This anomaly may be supported by the known location of a former building, or other forms of evidence such as HER records and aerial photography.
Archaeology - Pit	An anomaly composed of an increase in magnetic values with a patterning on the XY trace plot that is suggestive of buried remains, such as the infill of a pit. This evidence is normally supported by the presence of archaeological remains and is confirmed by other forms of evidence such as HER records and aerial photography.
Discrete Archaeology	
Archaeology? – Trend	Anomalies of a linear / curvilinear / rectilinear form either composed of an increased or decreased signal compared to magnetic background values. It is possible these anomalies belong to archaeological remains, but poor patterning or weaker response values makes interpretation difficult. Where historical records are present, the anomalies would appear to be weak or inconclusive.
Archaeology? - Area of Disturbance	Anomalies with an increase or decrease in magnetic values compared with the magnetic background over a localised area. Poor patterning or weak signal changes creates difficulty in defining the origin of the anomaly and so interpretation is only tentative. The anomaly lacks definitive records to confirm its origin as being archaeological. Disturbed areas could indicate the presence of buried rubble relating to fallen structures, or instead denote modern material from either quarrying or agricultural activity. On certain geologies these anomalies could be caused by in-filled natural features.
Archaeology? – Pit	An anomaly composed of an increase in magnetic values with a patterning on the XY trace plot that is suggestive of buried remains, such as the infill of a pit, but is isolated in its location and association with other features.
Unclear Origin	
Linear Trend	Anomalies of a linear / curvilinear form which are composed of a weak or different change in magnetic values. Coupled with poor patterning, the anomaly is difficult to interpret and it is unclear whether it has an archaeological origin.
Area of Disturbance	An area of magnetic disturbance which consists of a variety of increased and decreased magnetic values compared with background readings, but lacks sufficient patterning or context for a conclusive interpretation. It is likely that these readings are caused by modern disturbances, but interpretation is tentative.

Agricultural	
Linear Trend (Old Field Boundary)	These isolated long linear anomalies, most often represented as a negative magnetic trend, are likely to relate to former field boundaries. The magnetic signal may appear inconsistent but when the positioning is cross referenced with historic mapping, it is confirmed as a former field boundary.
Linear Trend (Old Field Boundary?)	These isolated long linear anomalies, most often represented as a negative magnetic trend, are likely to relate to former field boundaries. The positioning is not supported by historic mapping, but is often confirmed with adjacent ploughing patterns.
Linear Trend (Ridge and Furrow / Rig and Furrow)	A series of regular linear anomalies either composed of an increased or decreased magnetic response compared to background values. The width between the anomalies is consistent with that of a Ridge and Furrow ploughing regime, which is normally wider than conventional ploughing methods.
Linear Trend (Conventional ploughing)	A series of regular linear anomalies either composed of an increased or decreased magnetic response compared to background values. The regular patterning is likely to denote the presence of ploughing, however isolated trends can occasionally be observed that follow the orientation of ploughing trends seen elsewhere in the area. Anomalies seen adjacent to field edges are representative of headlands caused by ploughing.
Linear Trend (field drainage)	A series of linear anomalies of an indeterminate date, usually with a regular or herringbone patterning and regular spacing. These are likely to represent agricultural activity such as land drainage.
Non- Archaeology	
Geology / Natural	An area of disturbance that is composed of irregular significant increases or decreases in magnetic values compared with background readings and is likely to indicate natural variations in soil composition or geology.
Linear Trend (possible modern service)	Anomalies of a linear form often composed of contrasting high positive and negative values. Such anomalies usually signify a feature with a high level of magnetisation and are likely to belong to modern activity such as pipe lines or modern services.
Disturbed Area (modern disturbance?)	An area of disturbance that is likely to be caused by modern activity and is characterised by significant increases or decreases in magnetic values compared with background readings.
Isolated Dipolar Anomalies / Ferrous (iron spikes)	A response normally caused by ferrous materials on the ground surface or within the top soil, which causes a ‘spike’ representing a rapid variation in the magnetic response. These are generally not assessed to be archaeological when surveying on rural sites, and generally represent modern material often re-deposited during manuring.



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