ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of

Mr Tim Maxwell

Felton Park
Felton
Northumberland

geophysical surveys

report 3021
January 2013

Durham University

Contents

Figures

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1. Summary

The project

1.1 This report presents the results of geophysical surveys conducted for research purposes at Felton Park, Felton, Northumberland. The works comprised detailed geomagnetic survey of four areas and earth electrical resistance survey of three areas.

1.2 The works were commissioned by Mr Tim Maxwell and conducted by Archaeological Services Durham University.

Results

1.3 Probable soil-filled features including a possible former boundary ditch have been identified in the paddock at the east of the gardens (Area 1). Former, 19th-century, paths, tracks and a possible pond have also been identified in this area, as well as more recent features such as a shooting platform and former polytunnel site.

1.4 Evidence for a former turning circle and probable pond has been identified in Area 2, within a larger area of probable former hardstanding associated with the site's use as a WWII tank depot.

1.5 Anomalies likely to relate to the demolition the former house in the west have been detected.

1.6 Probable services and drains have also been detected.

2. Project background

Location (Figure 1)

2.1 The study area was located at Felton Park, Felton, Northumberland (NGR centre: NU 1801 0013). Four geomagnetic surveys and three earth electrical resistance surveys were conducted in the grounds of the house. To the north was Park Wood, to the east were dwellings, to the south was open farmland and to the west stood St Mary's Roman Catholic Chapel and open farmland. Felton Park house stood in the north-west of the area.

Objective

2.2 The principal aim of the surveys was to assess the nature and extent of any sub-surface features of potential archaeological significance within the survey area; such features might include early buildings and former garden features.

Methods statement

2.3 The surveys have been undertaken in accordance with instructions from the client and national standards and guidance (see para. 5.1 below).

Dates

2.4 Fieldwork was undertaken on 11th October 2012. This report was prepared for 10th January 2013.

Personnel

2.5 Fieldwork was conducted by Duncan Hale (the Project Manager) and Richie Villis (Supervisor). The geophysical data were processed by Richie Villis. This report was prepared by Richie Villis and Duncan Hale, with illustrations by David Graham.

Archive/OASIS

2.6 The site code is **FFP12**, for **F**elton, **F**elton **P**ark 20**12**. The survey archive will be supplied on CD to the client for deposition with the project archive in due course. Archaeological Services Durham University is registered with the **O**nline **A**cces**S** to the **I**ndex of archaeological investigation**S** project (**OASIS**). The OASIS ID number for this project is **archaeol3-137932**.

3. Historical and archaeological background

3.1 The following information is taken from the '*keys to the past*' website, which provides a précis of known historical and archaeological sites, finds and investigations for the counties of Durham and Northumberland.

3.2 There is evidence for prehistoric activity around Felton. Mesolithic flint tools have been found at Felton Park. A remarkable number of Neolithic stone axe-heads have been also discovered around Felton in the 20th century. No evidence exists for settlement or funerary activity.

3.3 There is also evidence of Bronze Age activity, including a bronze axe-head and Bronze Age stone hammer, although there is no evidence of settlement or funerary activity.

3.4 Felton lies north of Hadrian’s Wall and there is no evidence of Iron Age or Roman activity in the parish. Following the end of Roman rule in Britain in the fifth century there is no evidence of human activity at Felton until after the Norman Conquest.

3.5 The parish was quite densely settled in the medieval period with villages and hamlets documented at Felton, Old Felton and Acton. The name Felton may derive from ‘field-farm’ and traces of ridge and furrow cultivation and medieval field systems can still be seen around the village.

3.6 The Church of St Michael and All Saints is one of two medieval buildings here, the other being Old Felton Bridge. The church is a 13th-century Grade I listed building. Felton’s position on the direct road from Newcastle to Berwick meant that the bridge was an important crossing point over the River Coquet. The bridge has a three-arch span dating to the 15th century.

3.7 The medieval period saw warfare and unrest along the English-Scottish border and in 1216 King John burned Felton to ashes. This unrest continued into the 16th and 17th centuries with the Border Reivers, as evidenced by a number of bastles in the parish.

3.8 The post-medieval period was a relatively prosperous time for the border region of England. New country houses, such as Acton House and Felton Park, were built and parkland was laid out. Through the 18th and 19th centuries there was a period of new building at local farms in response to new inventions and farming methods together with new farmhouses, such as at Elyhaugh. Other economic activities included a corn mill and saw mill at Felton Mill. A more unusual establishment in the parish was a small 19th-century gasworks at Gas Works Farm.

3.9 Felton Park was built in 1732 for Edward Horsley Widdrington, possibly by Cranston. Ownership passed to the Riddell family and in 1799 it was remodelled for Ralph Riddell. The house is a Grade II listed building. A number of associated structures are also afforded Grade II protected status. To the east is a late 18th-century heated brick fruit wall. There are several boarded up doors in this wall, with one nearest the road dated 1774. Approximately 100m north-east of the house is a mid-18th-century ice-house. The gate lodge to Felton Park was built in 1800 with later 19th-century extensions at the rear. Late 18th- and early 19th-century park boundary stones mark the boundary of Felton Park. Some of these are inscribed 'R' after the Riddell family who pastured their racehorses in this part of the park. An early 19th-century greenhouse, built in about 1830 and incorporating an 18th-century garden wall, stands in the gardens of the house. Thought to be designed by Capability Brown with a curved pent roof and fishscale glazing, it is an unusually early and well-preserved example and reputedly one of only four surviving of its style. The Roman Catholic Church of St Mary, just to the west of the house, was built in 1857 for Thomas Riddell.

3.10 Felton Park remained in the possession of the Riddell family until the mid-20th century. It was commandeered by the army during WWII and used as tank depot. The house fell into disrepair and in 1951 the main part of the house was demolished, leaving only the rear L-plan wing of the 1732 house and the east block of the 1799 house.

4. Landuse, topography and geology

4.1 At the time of survey the areas comprised lawns and gardens surrounding Felton Park house and a sheep paddock in the east. Area 1, the sheep paddock, was surrounded by metal fences. Area 2 occupied a strip of lawn between the early 19th-century glasshouse and a tennis court. Areas 3 and 4 were on lawns with hedges and trees close to the house itself.

4.2 The area was predominantly level with a mean elevation of approximately 58m OD.

4.3 The underlying solid geology of the area comprises Namurian mudstone, sandstone and limestone of the Stainmore Formation, which are overlain by Quaternary glaciofluvial sands and gravels.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with English Heritage guidelines, *Geophysical survey in archaeological field evaluation* (David, Linford & Linford 2008); the Institute for Archaeologists (IfA) *Standard and Guidance for archaeological geophysical survey* (2011); the IfA Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service *Guide to Good Practice: Geophysical Data in Archaeology* (Schmidt & Ernenwein 2011).

Technique selection

5.2 Geophysical survey enables the relatively rapid and non-invasive identification of sub-surface features of potential archaeological significance and can involve a suite of complementary techniques such as magnetometry, earth electrical resistance, ground-penetrating radar, electromagnetic survey and topsoil magnetic susceptibility survey. Some techniques are more suitable than others in particular situations, depending on site-specific factors including the nature of likely targets; depth of likely targets; ground conditions; proximity of buildings, fences or services and the local geology and drift.

5.3 In this instance it was considered likely that cut features such as ditches and pits might be present on the site, and that other types of feature such as trackways, garden features, wall foundations and fired structures (for example kilns and hearths) might also be present.

5.4 Given the anticipated shallowness of targets and the non-igneous geological environment of the study area a geomagnetic technique, fluxgate gradiometry, was considered appropriate for detecting the types of feature mentioned above. This technique involves the use of hand-held magnetometers to detect and record anomalies in the vertical component of the Earth's magnetic field caused by variations in soil magnetic susceptibility or permanent magnetisation; such anomalies can reflect archaeological features.

5.5 Given the likely presence of wall-footings and tracks an electrical resistance survey was also considered appropriate. Earth electrical resistance survey can be particularly useful for mapping stone and brick features. When a small electrical current is injected through the earth it encounters resistance which can be measured. Since resistance is linked to moisture content and porosity, stone and brick features will give relatively high resistance values while soil-filled features, which retain more moisture, will provide relatively low resistance values. Although more time-consuming than magnetometry, this method can be used in a wider range of locations since it is not adversely affected by the presence of buildings, services or igneous geology.

Field methods

5.6 A 20m grid was established across each survey area and related to known, mapped Ordnance Survey points and the National Grid using a Leica GS15 global navigation satellite system (GNSS) with real-time kinematic (RTK) corrections typically providing 10mm accuracy.

5.7 Measurements of vertical geomagnetic field gradient were determined using Bartington Grad601-2 dual fluxgate gradiometers. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was nominally 0.03nT, the sample interval was 0.25m and the traverse interval was 1m, thus providing 1,600 sample measurements per 20m grid unit.

5.8 Measurements of earth electrical resistance were determined using Geoscan RM15D Advanced resistance meters and MPX15 multiplexers with a mobile twin probe separation of 0.5m. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was 0.1ohm, the sample interval was 1m and the traverse interval was 1m, thus providing 400 sample measurements per 20m grid unit.

5.9 Data were downloaded on site into a laptop computer for initial processing and storage and subsequently transferred to a desktop computer for processing, interpretation and archiving.

Data processing

5.10 Geoplot v.3 software was used to process the geophysical data and to produce both continuous tone greyscale images and trace plots of the raw (minimally processed) data. The greyscale images and interpretations are presented in Figures 2-6; selected trace plots are provided in Figure 7. In the greyscale images, positive magnetic and high resistance anomalies are displayed as dark grey while negative magnetic and low resistance anomalies are displayed as light grey. Palette bars relate the greyscale intensities to anomaly values in nanoTesla/ohm as appropriate.

5.11 The following basic processing functions have been applied to the geomagnetic data:

clip	clips data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic
zero mean traverse	sets the background mean of each traverse within a grid to zero; for removing striping effects in the traverse direction and removing grid edge discontinuities
destagger	corrects for displacement of geomagnetic anomalies caused by alternate zig-zag traverses

interpolate increases the number of data points in a survey to match sample and traverse intervals; in this instance the data have been interpolated to 0.25m x 0.25m intervals

5.12 The following basic processing functions have been applied to the resistance data:

clip clips data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic

add adds or subtracts a positive or negative constant value to defined blocks of data; used to reduce discontinuity at grid edges

despike locates and suppresses spikes in data due to poor contact resistance

interpolate increases the number of data points in a survey to match sample and traverse intervals; in this instance the data have been interpolated to 0.25m x 0.25m intervals

Interpretation: anomaly types

5.13 Colour-coded geophysical interpretation plans are provided. Three types of geomagnetic anomaly have been distinguished in the data:

positive magnetic regions of anomalously high or positive magnetic field gradient, which may be associated with high magnetic susceptibility soil-filled structures such as pits and ditches

negative magnetic regions of anomalously low or negative magnetic field gradient, which may correspond to features of low magnetic susceptibility such as wall footings and other concentrations of sedimentary rock or voids

dipolar magnetic paired positive-negative magnetic anomalies, which typically reflect ferrous or fired materials (including fences and service pipes) and/or fired structures such as kilns or hearths

5.14 Two types of resistance anomaly have been distinguished in the data:

high resistance regions of anomalously high resistance, which may reflect foundations, tracks, paths and other concentrations of stone or brick rubble

low resistance regions of anomalously low resistance, which may be associated with soil-filled features such as pits and ditches

Interpretation: features

5.15 A colour-coded archaeological interpretation plan is provided.

Area 1

5.16 Two very strong positive magnetic anomalies have been detected in the east-central part of this area. These anomalies lie within a larger rectangular area of anomalously low electrical resistance. It is likely that these anomalies reflect former cut features, now soil-filled, such as ditches, pits, which retain more moisture than the surrounding soil. The rectangular low resistance area could reflect a former water feature.

5.17 A number of linear high resistance anomalies have been detected in this area, some at right-angles to one another. These almost certainly reflect former paths and tracks as shown on 19th-century OS editions. No corresponding geomagnetic anomalies have been detected, indicating that fired bricks or brick rubble were not used in the construction of these paths.

5.18 A strong linear positive magnetic anomaly has also been detected running through the centre of the area, aligned broadly north-south. This corresponds to a broad band of anomalously low electrical resistance. This almost certainly reflects a former ditch feature, possibly a former boundary ditch.

5.19 Several smaller and weaker positive magnetic anomalies have also been detected in this area. These may reflect the truncated remains of further soil-filled features but they are not as evident in the resistance data.

5.20 Two parallel lines of regularly spaced, very strong dipolar magnetic anomalies have been detected in the north-west of the survey area. These have no corresponding resistance anomalies. Google Earth imagery from 2002 shows a large polytunnel here; these anomalies almost certainly reflect ferrous sockets associated with the construction of this feature.

5.21 A broadly rectangular concentration of dipolar magnetic anomalies has been detected in the south-eastern part of the survey area; this corresponds to a small mound on the ground. This feature is also evident on the Google Earth imagery from 2002 and almost certainly reflects a shooting platform from the former rifle range.

5.22 Strong dipolar magnetic anomalies detected in the north of the area correspond to an adjacent building and kennels as well as near-surface ferrous materials. The strong magnetic responses along the edges of the survey area reflect the presence of metal field boundaries and gates. The large and intense dipolar magnetic anomaly in the north-west corner reflects the water pump just beyond the field boundary.

Area 2

5.23 Large and strong dipolar magnetic anomalies here correspond to existing features such as the greenhouse, the tennis court fence, the water pump and the metal fence to the paddock.

5.24 A high concentration of small dipolar magnetic anomalies has been detected across the majority of the remainder of this area. Part of this concentration almost certainly reflects the rubble/clinker remains of the former turning/parking circle, as shown on

OS editions and Google imagery. The high resistance data recorded in this area is also likely to reflect the presence of brick rubble and clinker associated with the former turning circle or older landscaping works. Gravel or similar was felt below the turf when the resistance probes were inserted into the ground. Given the former use of the garden as a tank depot it is likely that large areas were covered with such materials for hardstanding.

5.25 The former track and turning circle correspond to an area of low electrical resistance. This may be because water is not draining from the former hard surface, whereas the surrounding rubble is relatively free-draining in comparison. A semi-circular area of particularly low resistance probably reflects a former, in-filled pond. If the pond was clay-lined this would enhance the water-retention in this area, providing such low resistance data.

Area 3

5.26 A concentration of dipolar magnetic anomalies has been detected at the south end of this area. This almost certainly reflects ferrous or fired waste, such as brick rubble. Earth electrical resistance data was not collected in this area.

Area 4

5.27 A concentration of dipolar magnetic anomalies has been detected in the north-west corner of the area. These anomalies almost certainly reflect ferrous items and rubble from the house demolished in 1951.

5.28 A broadly east/west aligned band of strong magnetic anomalies has been detected across the north of the area; these anomalies correspond to a former path or track which used to approach the steps at the eastern entrance to the former house.

5.29 A broadly north/south aligned chain of dipolar magnetic anomalies has been detected in the east of the area. This probably reflects a service.

5.30 Narrow bands of low earth electrical resistance across this area could reflect drains.

6. Conclusions

6.1 Detailed geomagnetic and earth electrical resistance surveys were undertaken at Felton Park, Felton, Northumberland, at the owner's request.

6.2 Probable soil-filled features including a possible former boundary ditch have been identified in the paddock at the east of the gardens (Area 1). Former, 19th-century, paths and tracks have also been identified in this area, as well as more recent features such as a shooting platform and former polytunnel site.

6.3 Evidence for a former turning circle and probable pond has been identified in Area 2, within a larger area of probable former hardstanding associated with the site's use as a WWII tank depot.

6.4 Anomalies likely to relate to the demolition the former house in the west have been detected, along with a former path to the eastern entrance of the house.

6.5 Probable services and drains have also been detected.

7. Sources

David, A, Linford, N, & Linford, P, 2008 *Geophysical Survey in Archaeological Field Evaluation*. English Heritage

Gaffney, C, Gater, J, & Ovenden, S, 2002 *The use of geophysical techniques in archaeological evaluations*. Technical Paper **6**, Institute of Field Archaeologists

IfA 2011 *Standard and Guidance for archaeological geophysical survey*. Institute for Archaeologists

Schmidt, A, & Ernenwein, E, 2011 *Guide to Good Practice: Geophysical Data in Archaeology*. Archaeology Data Service

http://www.keystopast.info/ Local history Felton (Northumberland), accessed 21st November 2012

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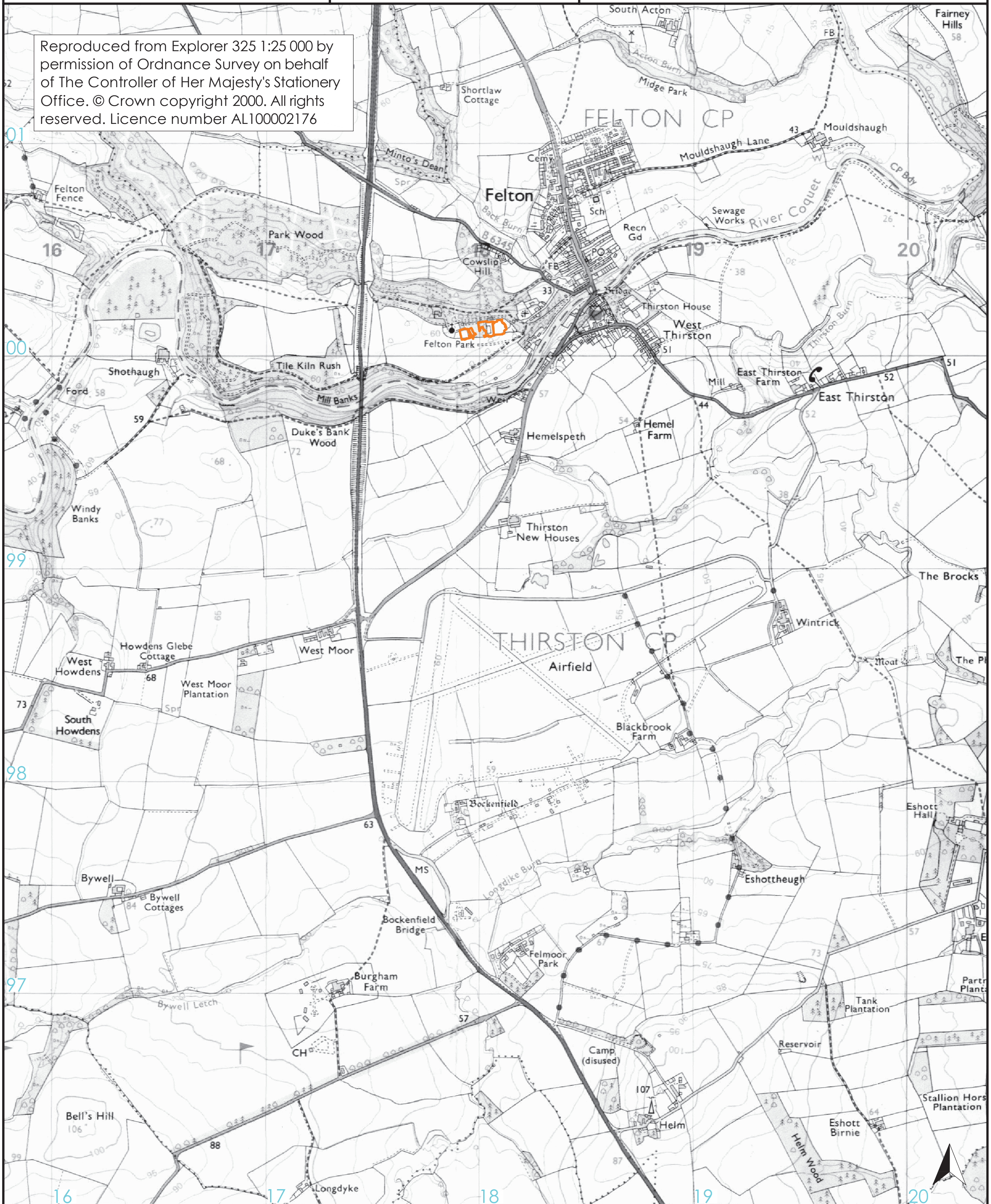
Figure 1: Site location



site location

0 1km
scale 1:25 000 for A4 plot

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magnetic survey
-10 nT 10

0 50m
scale 1:1000 for A3 plot

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Figure 2: Geomagnetic survey

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Figure 3: Geophysical interpretation of geomagnetic data

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Figure 4: Earth electrical resistance survey

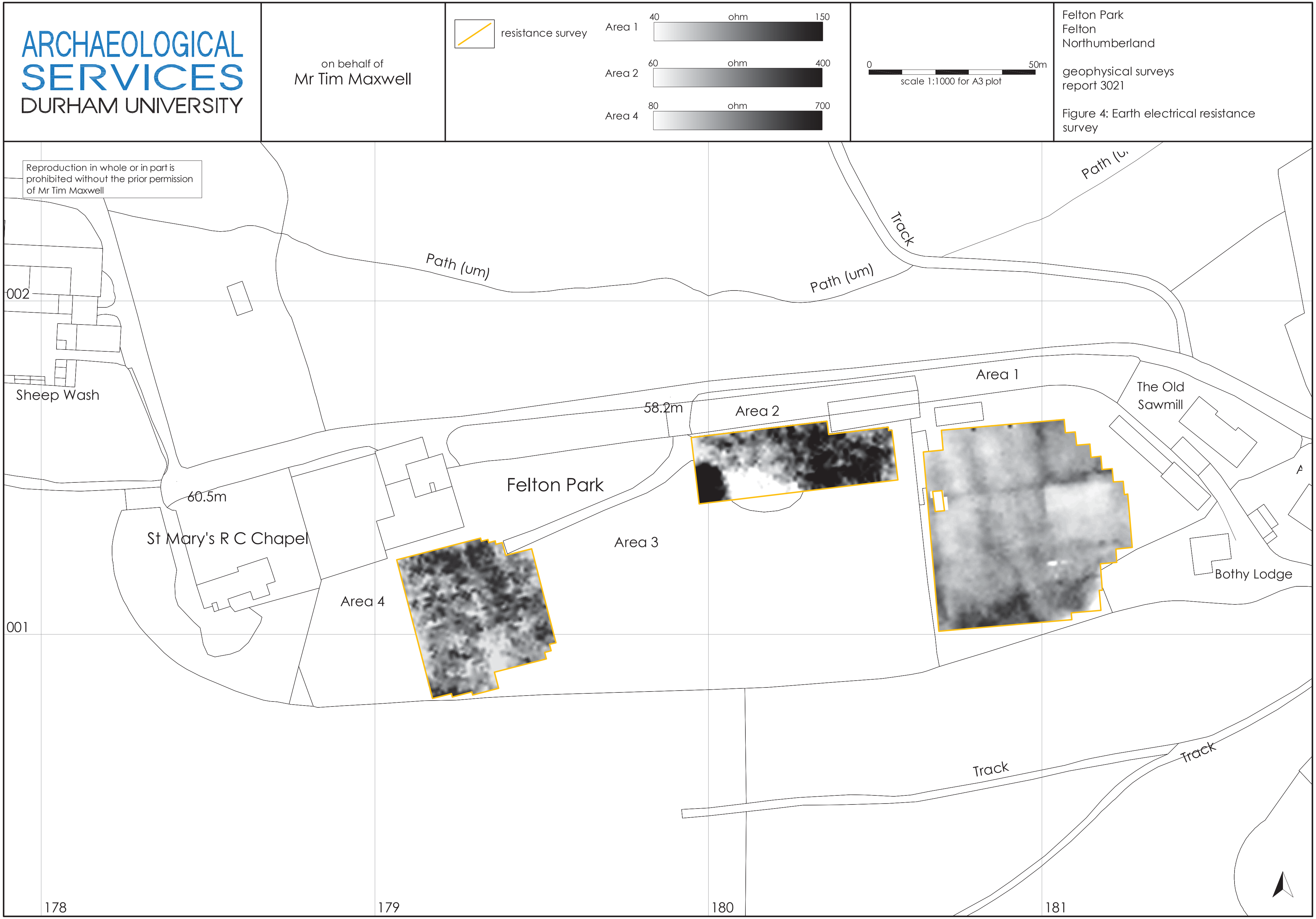

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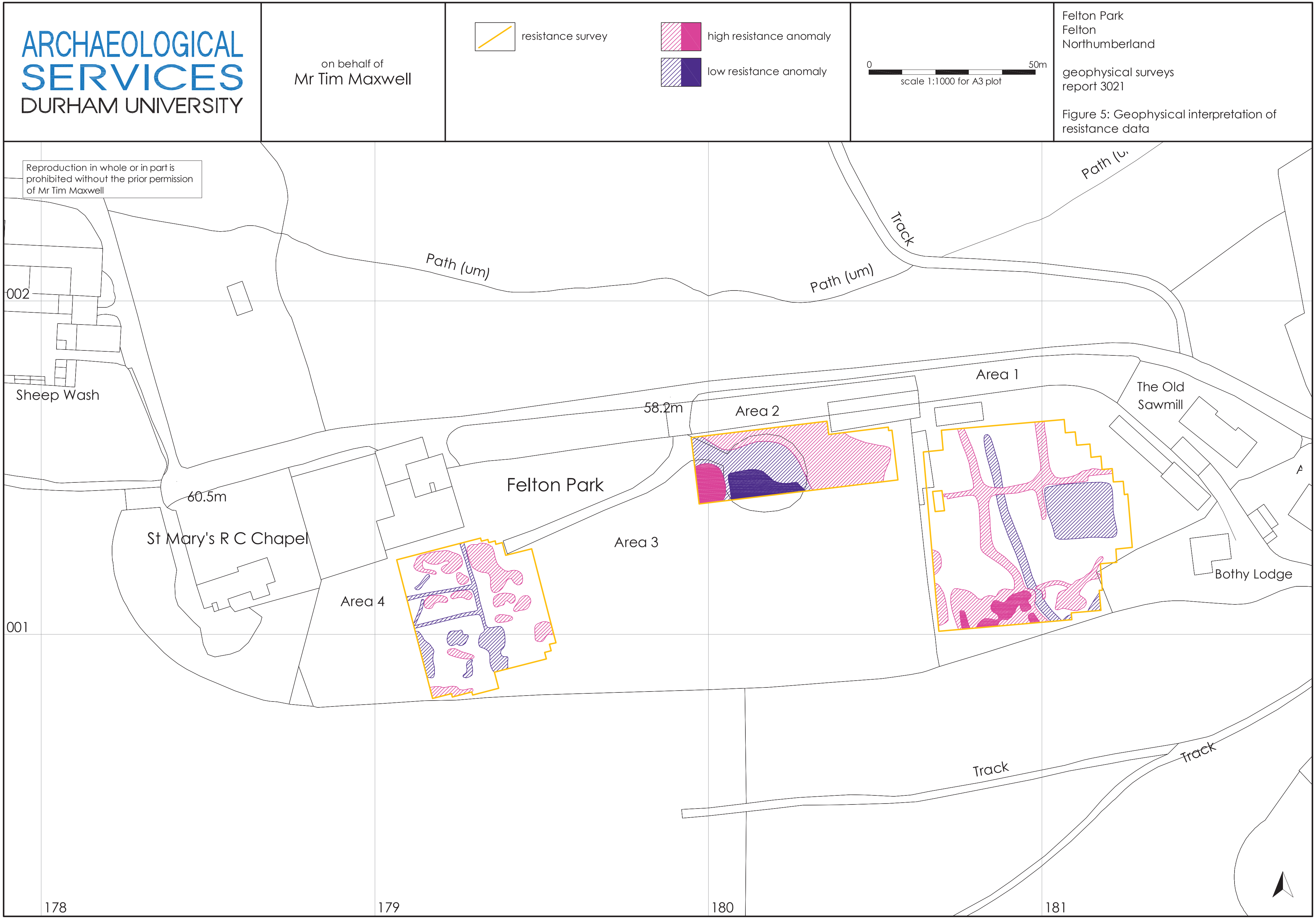
Figure 5: Geophysical interpretation of resistance data



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resistance survey	soil-filled feature
magnetic survey	shooting platform
ferrous/fired waste or rubble	path/track
service pipe	former polytunnel
land drain	

0 — 50m
scale 1:1000 for A3 plot

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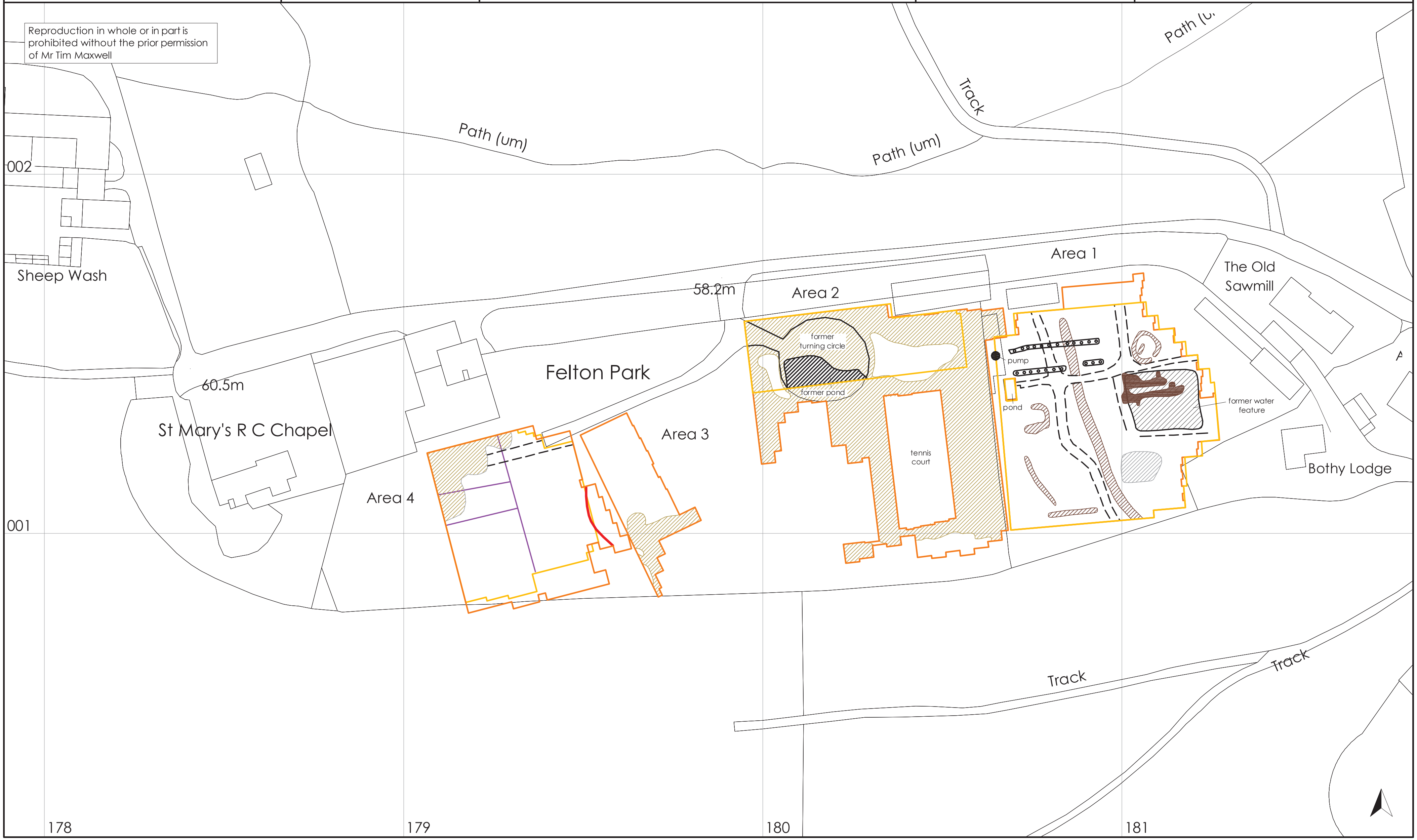
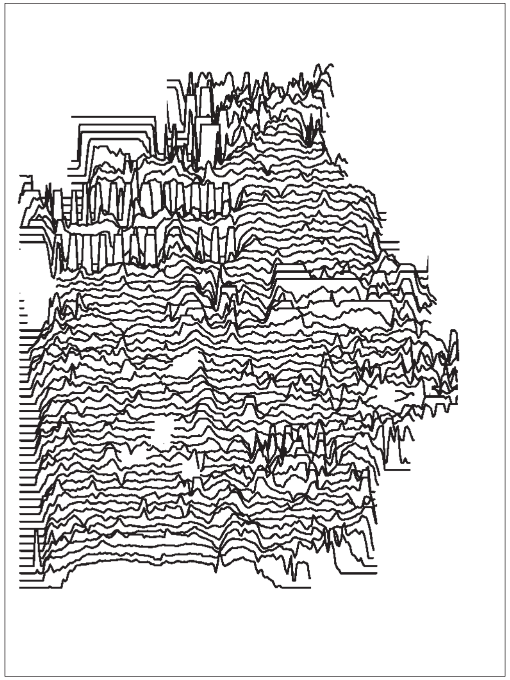
Figure 6: Archaeological interpretation



Area 1
geomagnetic data

66.70nT/cm



Area 1
resistance data

67.30ohm/cm

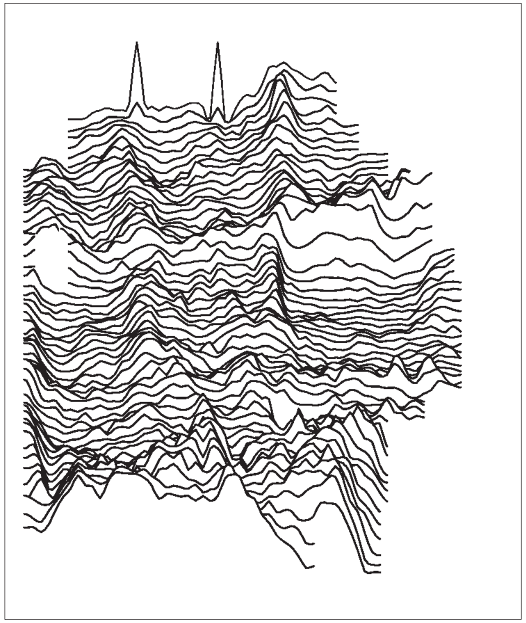


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Figure 7: Traceplots of geomagnetic and resistance data

0 50m
scale 1:1000 for A4 plot