
NPA GEOPHYSICAL SURVEY

Client Report CP499/07

June 2007

**GEOPHYSICAL SURVEYS
OF LAND AT THE PROPOSED
A182 LINK ROAD,
COLD HESLEDON,
EASINGTON,
CO. DURHAM**

on behalf of

**IAN FARMER ASSOCIATES
LTD**

NGR NZ 4070 4645

OASIS ID: northpen3-27667

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SUMMARY

In June 2007, North Pennines Archaeology Ltd, commissioned by Ian Farmer Associates, undertook a geophysical survey of 6.5ha of land at the site of the proposed A182 Link Road, at Cold Hesledon, near Easington, Co. Durham. The objective of the geophysical survey was to determine the presence/absence, nature and extent of any archaeological anomalies within the proposed development area, prior to development.

The area is known to have been exploited in prehistory. The site lies close to a Bronze Age barrow on Battle Law Hill, and a nearby possible Iron Age enclosure. A settlement is believed to have existed at Cold Hesledon from the medieval period onwards, and medieval earthworks associated with the early settlement have previously been identified to the east of the site. Historic map evidence suggests that the proposed development area has been maintained as agricultural land from the medieval period to the present, although a number of post-mediaeval and modern developments have taken place to the north, including Murton Colliery and the South Hetton to Seaham railway line.

Geomagnetic survey was undertaken over four areas within the proposed development area. The survey detected a number of features which were associated with the former agricultural use of the site. A number of modern service pipes were also detected, including a major service pipe which ran along the course of the proposed link road. Large amounts of magnetic material, believed to be associated either with the nearby colliery, or the former railway embankment were also detected along the north side of the proposed development area. This material could potentially mask archaeological features in this area.

The most significant archaeological features detected were a series of ridge and furrow earthworks, located at the west end of the proposed development area. These were broadly dated to the medieval or post-medieval periods. However, the geophysical survey has indicated that these earthworks represent several distinct phases of cultivation.

It is recommended that the survey results be evaluated, by the excavation of a series of trial trenches. These could be targeted to provide further information regarding the date and phasing of the ridge and furrow earthworks, and to determine the presence/absence of archaeological features in the area of magnetic disturbance detected along the north side of the site.

1 INTRODUCTION (*Figure 1*)

- 1.1 In June 2007, North Pennines Archaeology Ltd, commissioned by Ian Farmer Associates Ltd, undertook a geophysical survey of land at Cold Hesledon, Easington, Co. Durham. This was in advance of the development at the site, which included construction of a proposed A182 link road, and associated soil bund/compound areas and attenuation ponds. The work was conducted in accordance with brief supplied by Durham County Council Archaeology Section.
- 1.2 The site is located to the southwest of Cold Hesledon, and west of the Cold Hesledon junction on the A19, near Easington, Co. Durham. It is centred on Ordnance Survey grid reference NZ 4070 4645. The solid geology of the area comprises Magnesian Limestone with inter-bedded Anhydrite and with Marl Slate at base (BGS 2001). These are overlain by deposits of glacial boulder clay.
- 1.3 The area is dominated by Batter Law Hill, which is located to the south of the site. The hill rises to a peak of 143m OD, with the surrounding hills at 105-110m OD. The site is bounded by Hesledon Bank to the north, the A19 to the east, and open fields to the south and west. Immediately to the north of the site are a number of prominent spoil heaps, associated with the former Murton Colliery. These now form part of Dalton Park.
- 1.4 The geophysical study area comprised 6.5ha of land to the south of Hesledon Bank, subdivided into a number of small fields. At the time of the geophysical survey, two of these fields were under arable cultivation, one was pasture, and the remainder comprised formerly cultivated land that had been left to grow wild. The east end of the study area was predominantly level, but the ground rose significantly to the southeast.
- 1.5 The objective of the geophysical survey was to determine the presence/absence, nature and extent of any archaeological anomalies within the proposed development area, and the presence/absence of any known modern anomalies within the study area, which may affect the results. The results of the geophysical survey were to be used to inform the layout of evaluation trenches within the proposed development area.
- 1.6 The geophysical survey was conducted by Martin Railton and Tony Liddell between 4th and 7th June 2007, and managed by Martin Railton (NPA Senior Project Officer). This report was prepared and illustrated by Martin Railton between 8th and 15th June 2007.

2 METHODOLOGY

2.1 Standards

2.2 The geophysical survey and reporting were conducted in accordance with English Heritage guidelines (English Heritage 1995), and the recommendations of the Institute of Field Archaeologists (IFA 2002).

2.2 Technique Selection

2.2.1 Geomagnetic survey was selected as the most appropriate technique, given the non-igneous environment, and the expected presence of cut archaeological features at depths of no more than 1.5m. Previous geomagnetic surveys conducted by North Pennines Archaeology in fields immediately to the south, had already proved the effectiveness of this technique for detecting sub-surface features (Railton 2007).

2.2.2 This technique involved the use of hand-held gradiometers, which measure variations in the vertical component of the earth's magnetic field. These variations can be due to the presence of sub-surface archaeological features. Data was recorded by the instruments and downloaded into a laptop computer for initial data processing in the field using specialist software.

2.3 Field Methods

2.3.1 The proposed development area was located in six separate fields. In order to survey the site, the geophysical study area was subdivided into four survey areas (Areas 1-4). A 30m grid was established in each area, and tied-in to known Ordnance Survey points using a Trimble 3605DR Geodimeter total station with datalogger.

2.3.2 Geomagnetic measurements were determined using a Bartington Grad601-2 dual gradiometer system, with twin probes set 1m apart. It was expected that significant archaeological features at a depth of up to 1.5m would be detected using this arrangement. The survey was undertaken using a zig-zag traverse scheme, with data being logged in 30m grid units. A sample interval of 0.25m was used, with a traverse interval of 1m, providing 3600 sample measurements per grid unit. The data was downloaded on site into a laptop computer for processing and storage.

2.4 Data Processing

2.4.1 Geophysical survey data was processed using ArchaeoSurveyor II software, which was used to produce 'grey-scale' images of the raw data. Positive magnetic anomalies are displayed as dark grey, and negative magnetic anomalies are displayed as light grey. A palette bar shows the relationship between the grey shades and geomagnetic values in nT for each area (Figures 2, 5 and 8).

2.4.2 Raw data was processed in order to further define and highlight the archaeological features detected. The following basic data processing functions were used:

Despike: to locate and suppress random iron spikes in the gradiometer data

Clip: to clip data to specified maximum and minimum values, in order to limit large noise spikes in the gradiometer data

Destagger: to reduce the effect of staggered gradiometer data, sometimes caused by difficult working conditions, topography, or operator error

2.5 Interpretation

2.5.1 Four types of geophysical anomaly were detected in the gradiometer data:

positive magnetic: regions of anomalously high or positive magnetic gradient, which may be associated with the presence of high magnetic susceptibility soil-filled features, such as pits or ditches

negative magnetic: regions of anomalously low or negative magnetic gradient, which may be associated with features of low magnetic susceptibility, such as stone-built features, geological features, land-drains or sub-surface voids.

dipolar magnetic: regions of paired positive-negative magnetic anomalies, which typically reflect ferrous or fired materials, including fired/ferrous debris in the topsoil, modern services, metallic structures, or fired structures, such as kilns or hearths.

diffuse anomalies: areas of diffuse or indistinct magnetic gradient, which may be associated with the presence of geological features or be caused by modern agricultural practices.

2.5.2 Discrete dipolar magnetic anomalies were detected across the whole of the study area. These are almost certainly caused by fired/ferrous litter in the topsoil, which is typical for modern agricultural land. These anomalies are indicated on the geophysical interpretation drawings, but not referred to again in the subsequent interpretations.

2.6 Presentation

2.6.1 The grey-scale images were combined with site survey data and Ordnance Survey data to produce the geophysical survey plans. Colour-coded geophysical interpretation diagrams are provided, showing the locations and extent of positive, negative, dipolar, and diffuse magnetic anomalies (Figures 3, 6 and 9).

2.6.2 Archaeological interpretation diagrams are provided, which are based on the interpretation of the geophysical survey results, in light of the archaeological and historical background of the site (Figures 4, 7 and 10).

2.6.3 Trace plots of the unprocessed geophysical data are included in Appendix I.

2.7 Project Archive

2.7.1 The data archive for this project has been created in accordance with the recommendations of the Archaeology Data Service (ADS 2001). The archive is currently held at the company offices at Nenthead, Cumbria.

2.7.2 One copy of the survey report will be deposited with the County Historic Environment Record, where viewing will be available on request. The project is also registered with the Online Access to the Index of archaeological investigationS (OASIS). The OASIS reference for this project is **northpen3-27667**.

3 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

3.1 Historical Background

- 3.1.1 The archaeological and historical background of the site has been presented in a desk-based assessment of the surrounding area (ASUD 2006). The results of this assessment are summarised below.
- 3.1.2 There is evidence that the area of the proposed development was exploited during the prehistoric period. Mesolithic (*c.*800-4500 BC) stone tools have been found near Hawthorn Tower, Hawthorn East Farm, around Hawthorn Village, near Beacon Hill, and at Cold Hesledon. These are likely to represent the presence of nomadic hunter-gatherer groups, exploiting the resources of the surrounding area.
- 3.1.3 A Bronze Age (*c.*220-750 BC) round barrow is located immediately to the south of the proposed development area, on Batter Law Hill. This is believed to have contained a crouched human burial and possible cremation burial. Further possible barrows have been identified at Murton Moor East Farm, Murton Moor, Croup Hill and Kinley Hill, indicating that the surrounding area was occupied during this period.
- 3.1.4 Settlement evidence is located immediately east of Batter Law Hill, in the form of a possible Iron Age enclosure (*c.*750 BC-70 AD), which has been identified on air photographs of the site. Quern stones (for grinding corn) dated to the Iron Age, have previously been found in the vicinity of this enclosure.
- 3.1.5 There is no evidence for Roman (70 AD-5th century AD) activity in the vicinity of the proposed development area. However, evidence for a possible Roman road has been recorded on Murton Moor, 2km to the west of the site. The alignment of the road suggests that it may have ran eastwards towards Cold Hesledon, to the north of the proposed development area.
- 3.1.6 Place-name evidence suggests that Cold Hesledon (*'hill by the hazel valley'*) is likely to have medieval origins (5th century AD-1540). Earthworks of possible medieval date have been identified at East farm, Hawthorn Village and at Beacon House and Beacon Hill, to the east of the proposed development area. evidence for ridge and furrow cultivation has also been identified.
- 3.1.7 Early maps of the site indicate that the proposed development area was undeveloped land during the post-medieval period (1541 – 1899), being situated to the southwest of the settlement of Cold Hesledon. The *c.*1844 Tithe plan for Cold Hesledon shows the proposed development area subdivided into a number of fields by this time, with a road running east-west across the site. These features correspond to the field system and track visible at the site today.
- 3.1.8 Hesledon Bank, situated immediately to the north of the proposed development area, formerly carried the South Hetton to Seaham railway line, which was built in 1835 to transport coal from South Hetton Colliery to Seaham Harbour. Murton Colliery was situated to the north of Hesledon Bank. The railway and colliery have since closed.

- 3.1.9 Historic Ordnance Survey maps of the area indicated that little change has taken place within the proposed development area during the modern period (1900 to present). The east end of the proposed development was maintained as agricultural land until relatively recently, whilst parts of the west end were maintained as rough pasture.
- 3.2 *Previous Archaeological Works*
- 3.2.1 Batter Law round barrow was subjected to non-professional excavation in the early 20th century. This revealed the presence of a crouched burial with associated flint knife. No other known archaeological excavations have previously taken place within the immediate vicinity of the proposed development area.
- 3.2.2 Previous geophysical surveys have been conducted in fields immediately to the south of the proposed development area (Railton 2007). The surveys revealed the presence of a possible enclosure ditch, located 300m to the southeast of the present study area, which had been truncated by the construction of the A19 dual carriageway. A number of irregular features/possible pits were also detected on the lower slopes of Batter Law Hill. However, none of these features had been dated at the time of writing. All other features detected during the surveys were identified as being geological or agricultural in nature.

4 SURVEY RESULTS (Figures 2-10)

4.1 Area 1 (Figures 2-4)

4.1.1 Area 1 was situated at the east end of the proposed development area in a field that was previously used for arable cultivation. This area had been left to grow wild, and was occupied by tall grass, weeds and shrubs at the time of the geophysical survey. This area was subdivided by an embanked track at the southwest corner. A line of trees and shrubs dissected the western end, which was occupied by a small field of old pasture. Modern post and wire fences bounded Area 1 on the north and east sides. A line of electricity pylons ran northeast to southwest across the north side of Area 1, although none of the pylons fell within the survey area. The east end of the proposed development area was located over the embankment of an existing roundabout, and was also occupied by a hawthorn hedge and fences. This area was not surveyed.

4.1.2 A strongly dipolar linear magnetic anomaly was detected in Area 1, which ran across the entire length of the survey area, aligned northeast-southwest. This almost certainly reflects the presence of a modern service pipe in this location. A mass of strong dipolar magnetic anomalies were detected along the northeast side of Area 1, and indicated the presence of large amounts of magnetic material. This material was probably associated with the nearby spoil heaps of Murton Colliery, or with the former railway embankment.

4.1.3 A number of weak linear negative anomalies were detected on the west side of Area 1, aligned approximately east-west. A similar weak linear positive anomaly was detected to the east of these. These anomalies run parallel with the natural topography in this area, and may be natural in origin. However, it is also possible that they reflected the presence of a land drain, or former field boundary.

4.1.4 A weak linear negative magnetic anomaly was detected running north-south across the centre of the survey area, and corresponds to the location of a culvert. Parallel with, and to the east of this feature, were two weak linear positive magnetic anomalies. These anomalies were situated at the bottom of a natural slope, and were likely to be either natural features, or the remains of a former field boundary.

4.1.5 A series of weak and diffuse linear magnetic anomalies were detected at the west side of Area 1, aligned northeast-southwest. These were almost certainly associated with former ploughing regimes, and the presence of deep wheel ruts across the site. Two weak linear magnetic anomalies were detected at the southwest corner of Area 1, and were also interpreted as agricultural features.

4.2 Area 2 (Figures 5-7)

4.2.1 Area 2 was situated in a single field towards the west end of the proposed development in an area. This area had also been left to grow wild, and was occupied by tall grass and weeds, which hindered the survey. The ground level rose significantly towards the western end of this survey area.

4.2.2 The same strongly dipolar linear magnetic anomaly that was detected in Area 1, was also present along the southeast side of Area 2, and was interpreted as a modern service pipe.

- 4.2.3 A number of weak linear positive magnetic anomalies were detected across Area 2, aligned north-south. It is very likely that these anomalies are agricultural in origin, and they may indicate the presence of a series of land drains across the site..
- 4.2.4 Two parallel weak linear negative magnetic anomalies were detected at the west end of Area 2, aligned east-west. There are probably associated with former ploughing in this area.
- 4.3 *Area 3 (Figures 5-7)*
- 4.3.1 This area was located in a cultivated field containing a crop of wheat. A well-worn track, with deep wheel-ruts was located along the northern edge of this survey area.
- 4.3.2 A strongly dipolar linear magnetic anomaly was detected running across the centre Area 3, aligned northwest-southeast. This was interpreted as a modern service pipe.
- 4.3.3 A series of parallel weak linear positive and negative magnetic anomalies were detected, aligned east-west. These are almost certainly associated with former ploughing in this area. A series of linear positive magnetic anomalies detected along the northern edge of Area 3, were due to the presence of a visible track way.
- 4.4 *Area 4 (Figures 8-10)*
- 4.4.1 Area 4 was located at the eastern end of the proposed development area, in a field of old pasture. Visible earthworks were present throughout this field including the remains of ridge and furrow cultivation, and a number of track ways. The east side of the field contained a copse of mature trees and shrubs, and could not be surveyed. A telegraph pole occupied the northeast corner of Area 4.
- 4.4.2 A number of strong dipolar magnetic anomalies were detected in the northeast corner of Area 4, due to the presence of a metal gate, electricity pylon and metal track. At the extreme northeast corner of the survey area, the presence of a linear dipolar magnetic anomaly indicated that the service pipe detected in Area 3, was also present in this location. Another strong linear dipolar magnetic anomaly was detected at the northwest corner of Area 4, and indicated the presence of another service pipe.
- 4.4.3 A pattern of criss-crossing linear positive and linear negative magnetic anomalies was detected over the majority of Area 4. These anomalies reflected the presence of visible ridge and furrow earthworks across this area. Within this pattern of magnetic anomalies, four separate alignments of ridge and furrow earthworks could be identified, indicating at least two distinct phases of cultivation.
- 4.4.4 On the west side of the survey area, ridge and furrow earthworks, aligned east-west, appear to have been cut by a later phase of cultivation, aligned northwest-southeast. This latter phase is associated with three linear negative magnetic anomalies, and a linear positive magnetic anomaly, located at the southwest corner of Area 4. These features may mark the location of a headland, and/or former field boundaries.
- 4.4.5 On the east side of the survey area, two separate alignments of ridge and furrow earthworks are evident. Earthworks aligned north-south, appear to be cut by a later

phase of cultivation, aligned northwest-southeast. It is possible to suggest that some form of field boundary formerly existed between these earthworks, and those to the west, although this is not certain.

5 CONCLUSIONS

- 5.1 Geomagnetic survey has been conducted over four separate areas within the proposed development area, and has detected a range of features associated with the former agricultural use of the site, in addition to modern service pipes, and large amounts of magnetic material, believed to be associated either with the nearby colliery, or former railway embankment.
- 5.2 In addition to the modern features detected, a series of well-preserved ridge and furrow earthworks have been identified in a field at the west end of the proposed development area in Area 4. The geophysical survey has indicated that these earthworks represent several distinct phases of cultivation of probable medieval or post-medieval date. However, it has not been possible from the geophysical survey alone to phase these features with any confidence.
- 5.3 It is recommended that the results of the geophysical survey are evaluated through the excavation of a series of trial trenches. Further information regarding the date and phasing of the earthworks in Area 4 could be provided by targeting a number of trenches in this area.
- 5.4 It is possible that archaeological features are present within Area 1, but were not detected by the geophysical survey due to the presence of large amounts of magnetic material. It is therefore recommended that this area is subjected to trial trench evaluation prior to the development of the site.

6 ACKNOWLEDGEMENTS

North Pennines Archaeology is grateful to Ian Farmer Associates for commissioning the geophysical survey.

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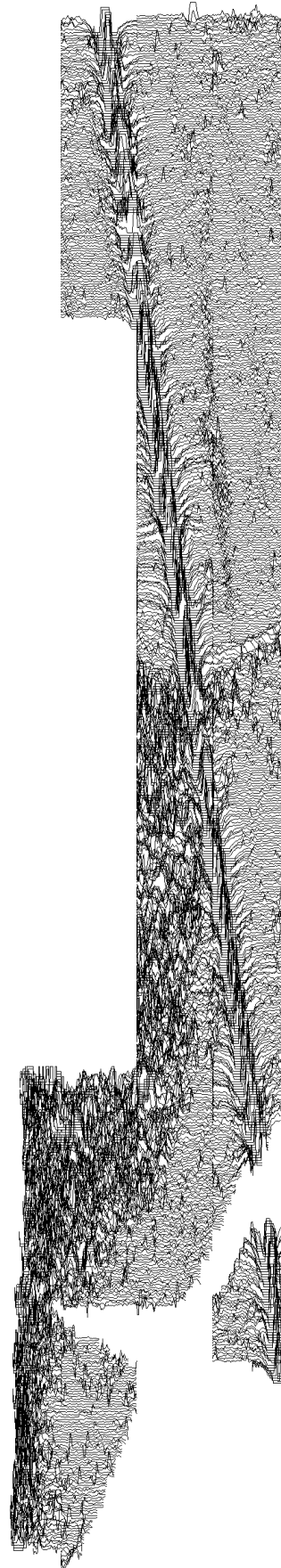
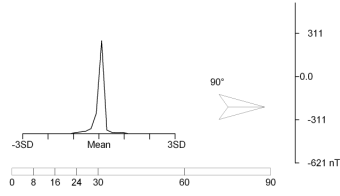
English Heritage, 1995 *Geophysical survey in field evaluation*, Research and Professional Services Guideline No.1, London

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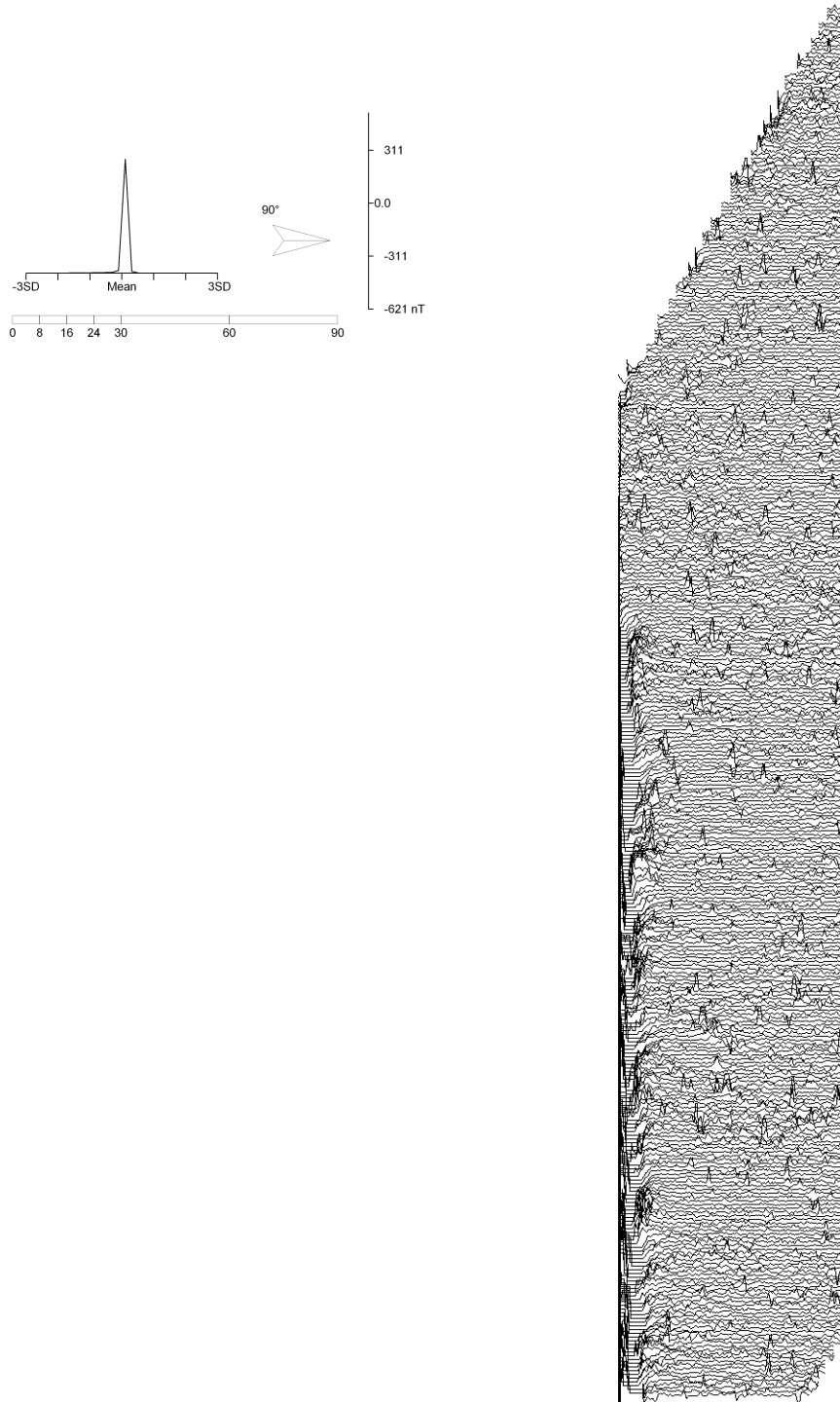
Railton, M, 2007 *Geophysical surveys on land either side of the A19, North of Hawthorn, Easington, Co. Durham*, NPA Geophysical Survey Report No CP465/07

APPENDIX I – TRACE PLOTS OF THE GEOPHYSICAL DATA

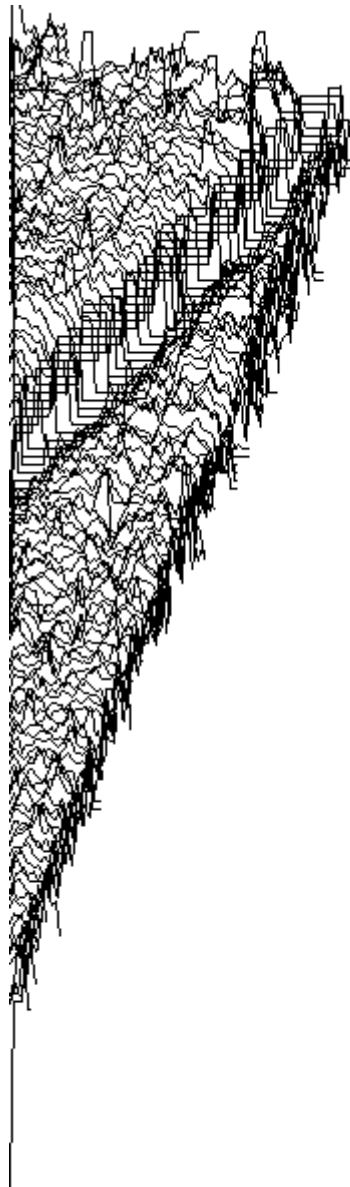
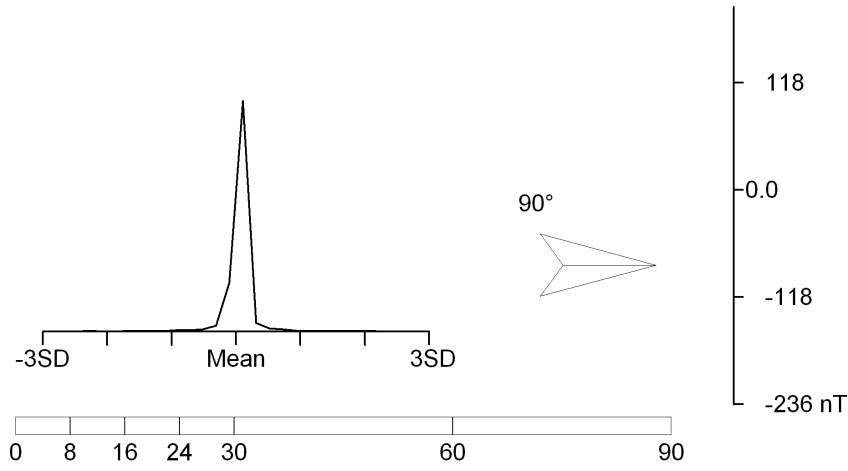
AREA 1



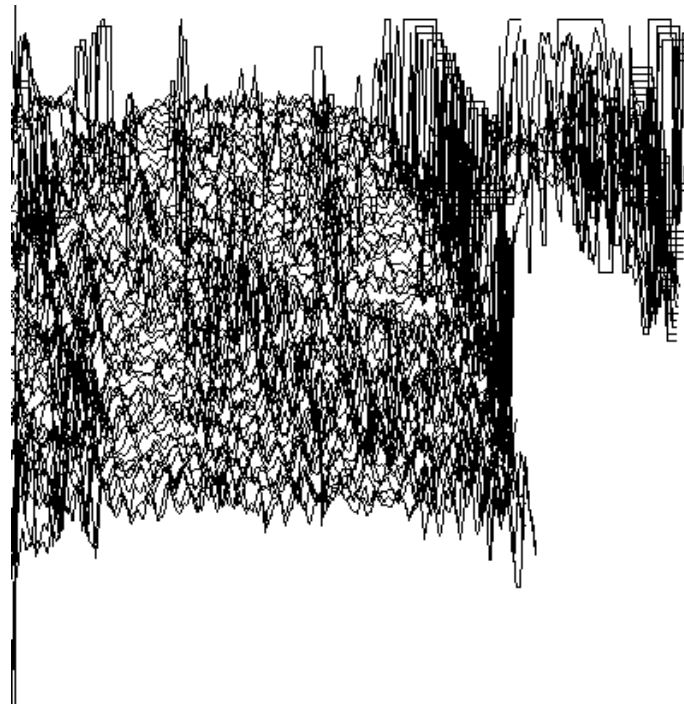
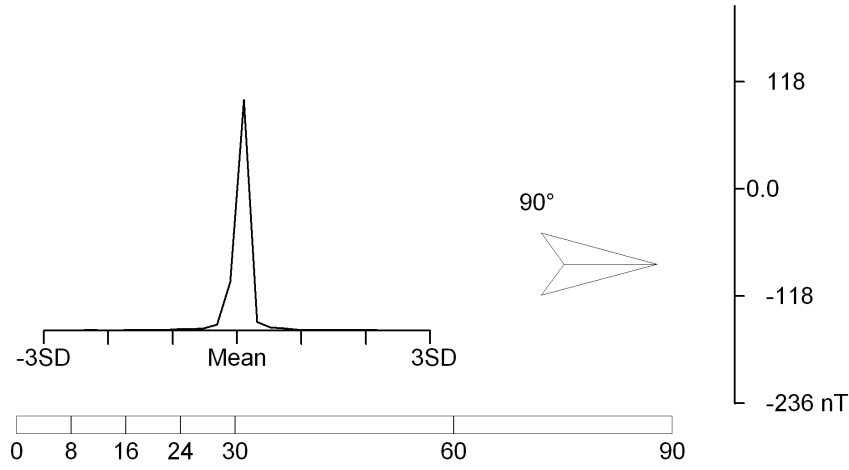
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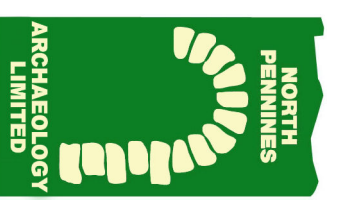
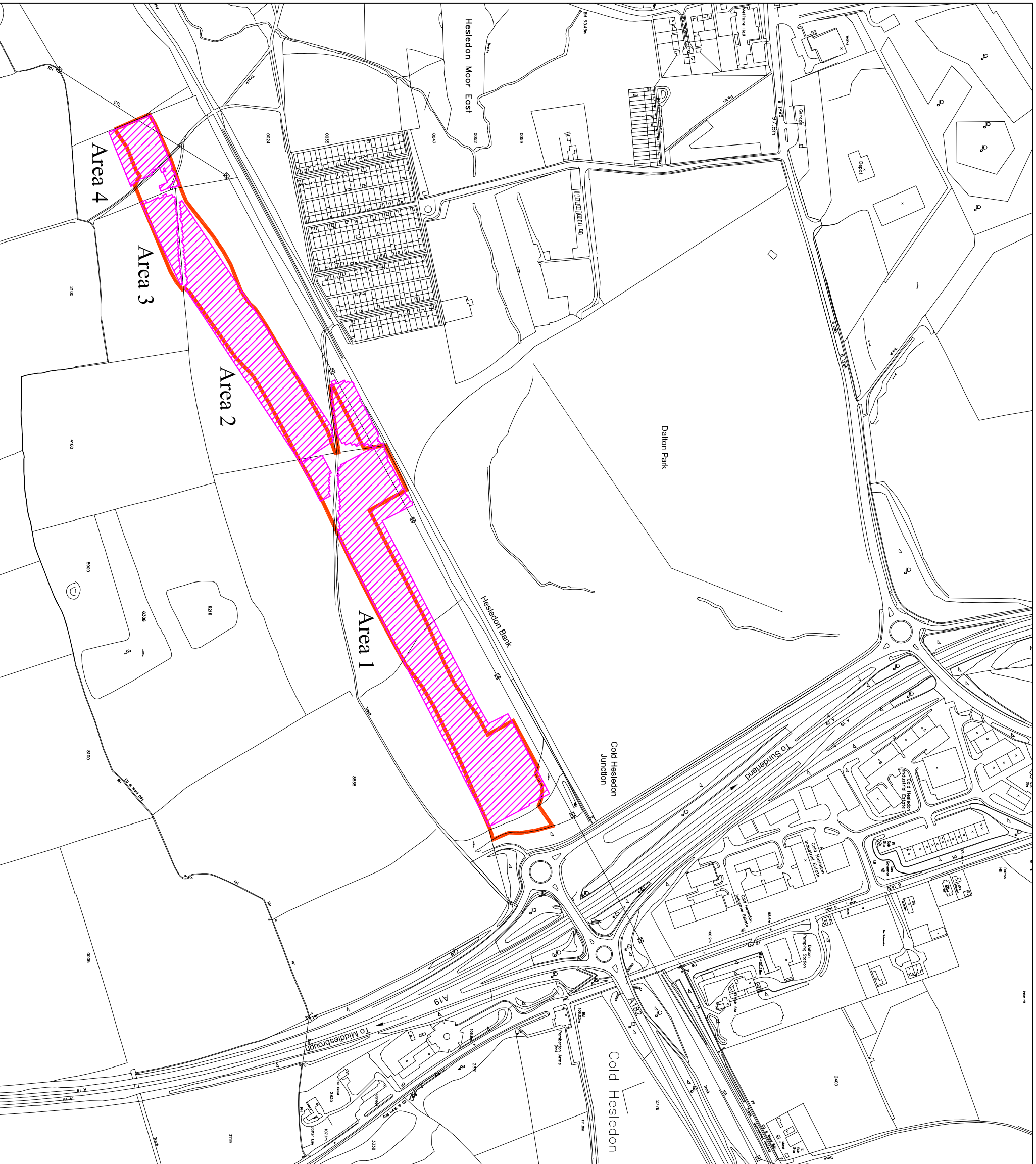
AREA 3



AREA 4



APPENDIX II – ILLUSTRATIONS





**NPA Geophysical Survey
2007**
A182 Link Road,
Cold Hesledon,
Co. Durham

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Scale **1:5000 at A3**

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DATE: **June 2007**

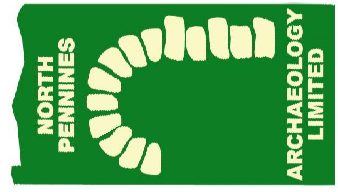
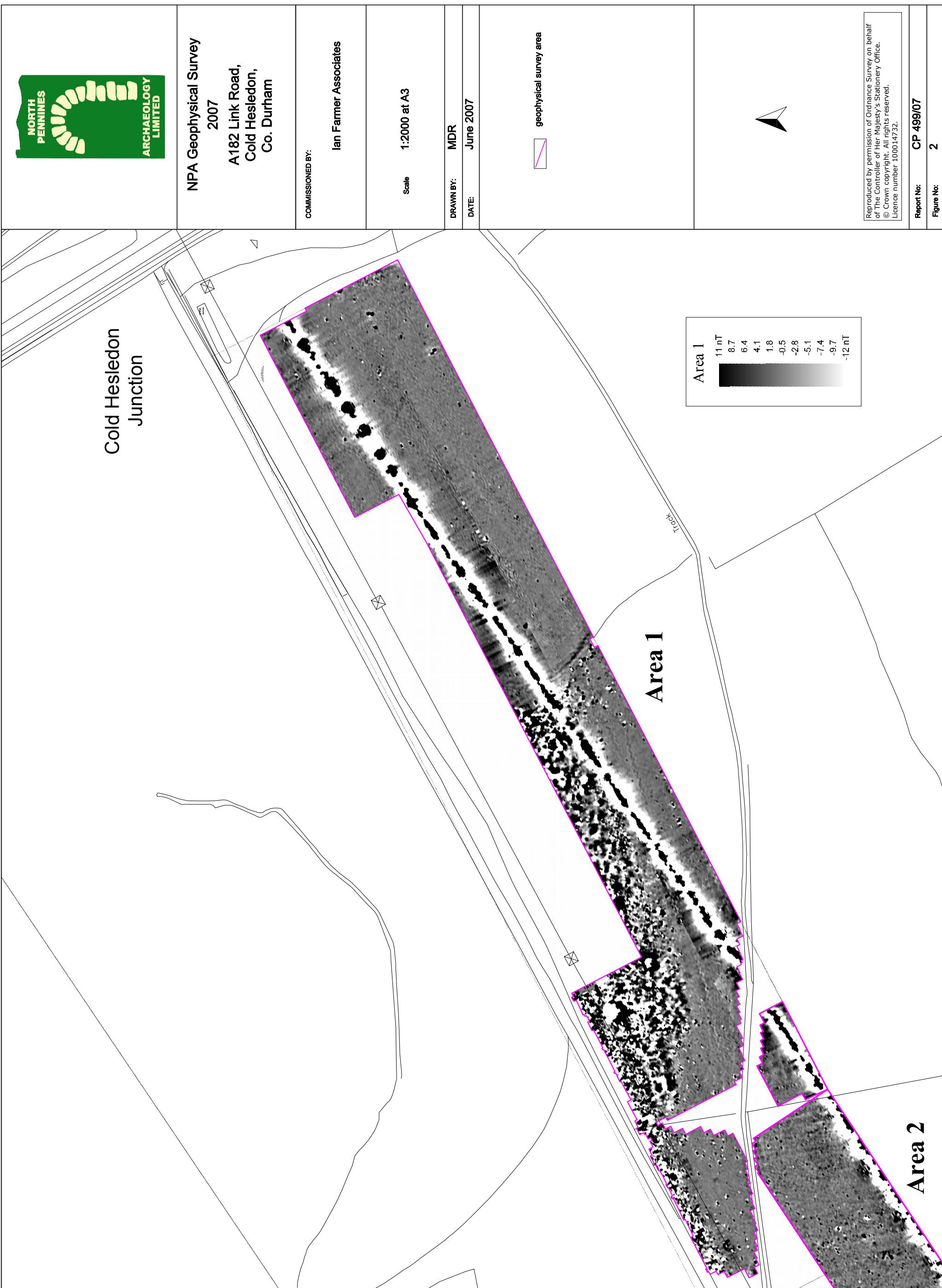
-  outline of proposed development area
-  geophysical survey area



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Figure No: **1**

Figure 1 : Location of geophysical survey areas (Areas 1-4)



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2007
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Cold Hesledon,
Co. Durham

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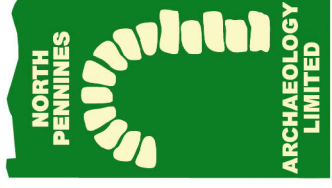
Scale **1:2000 at A3**

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Figure No: **2**

Figure 2 :Geophysical survey of Area 1



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Scale
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- geophysical survey area
- positive magnetic anomaly
- negative magnetic anomaly
- dipolar magnetic anomaly
- diffuse magnetic anomaly



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Figure No: 3

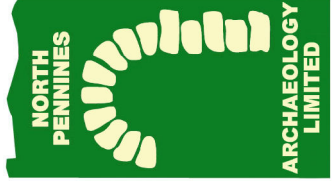
Cold Hesledon
Junction

Area 1

Area 2



Figure 3 : Geophysical interpretation of Area 1



NPA Geophysical Survey
2007
A182 Link Road,
Cold Hesledon,
Co. Durham







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Scale
1:2000 at A3

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DATE: June 2007

-  geophysical survey area
-  possible land drains
-  former field boundary
-  former ploughing
-  service pipes
-  spoil heap



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Figure No: 4

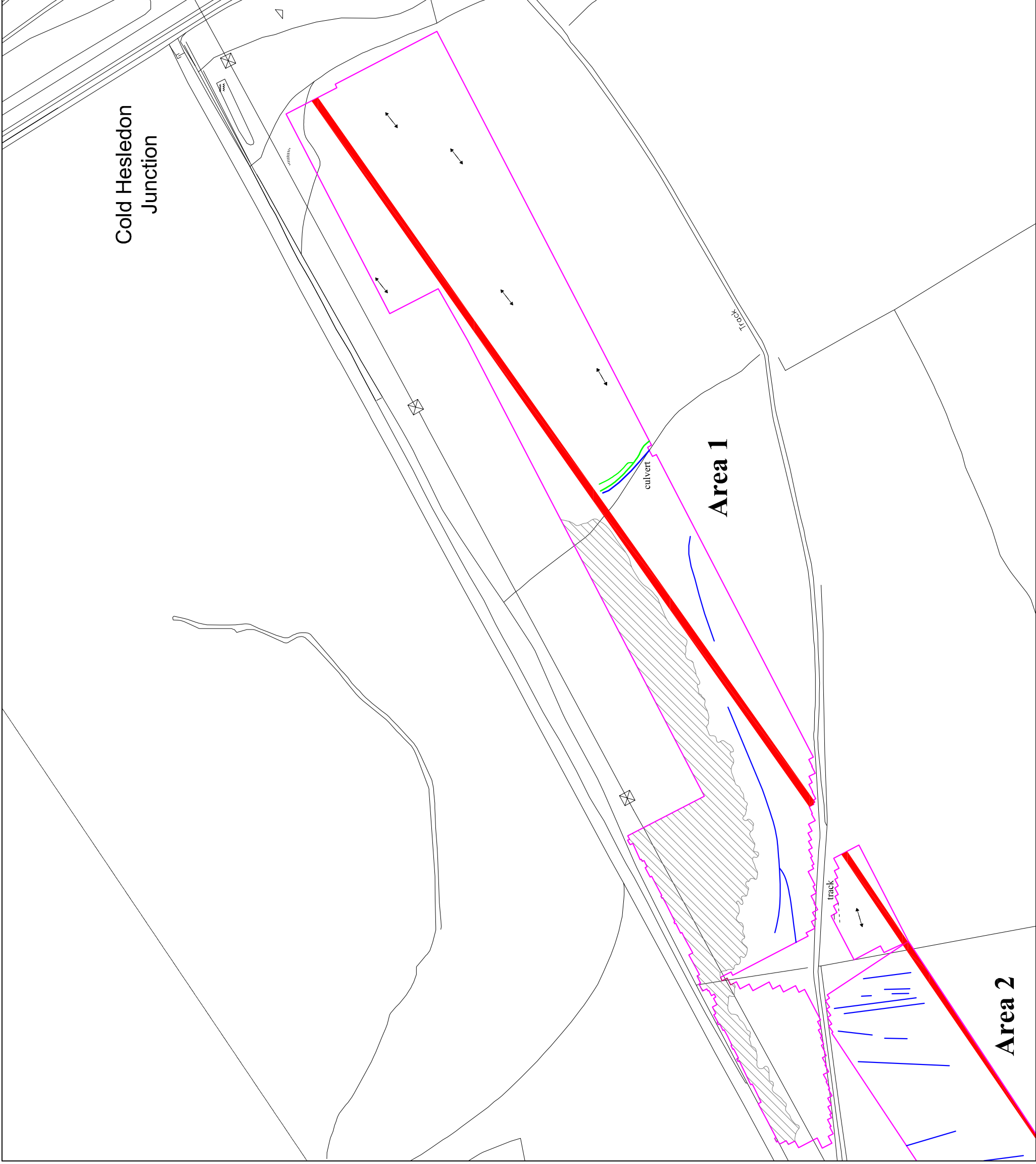
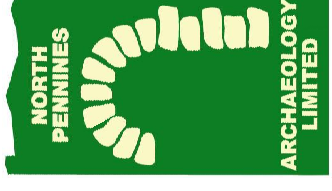


Figure 4 : Archaeological interpretation of Area 1



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Scale 1:1500 at A3

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DATE: June 2007



geophysical survey area



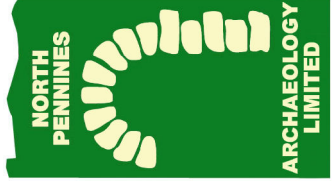
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Figure No: 5



Figure 5 : Geophysical surveys of Area 2 and Area 3



NPA Geophysical Survey
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Co. Durham

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Scale





1:1500 at A3

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DATE:

June 2007

-  geophysical survey area
-  positive magnetic anomaly
-  negative magnetic anomaly
-  dipolar magnetic anomaly



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Figure No:

6

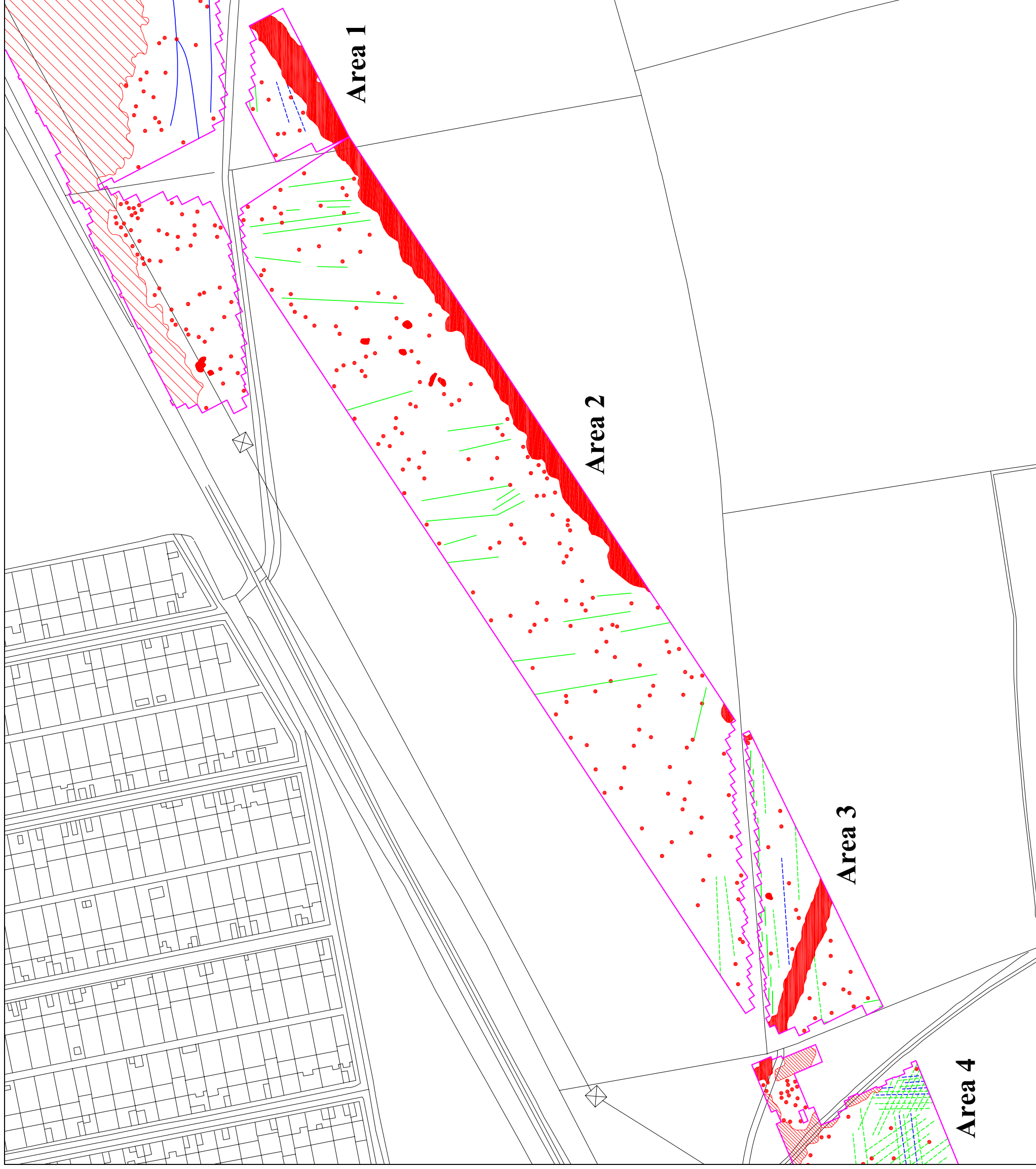
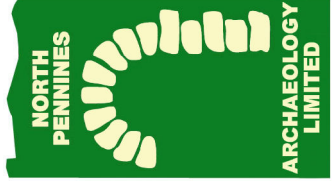


Figure 6 : Geophysical interpretation of Area 2 and Area 3



NPA Geophysical Survey
2007
A182 Link Road,
Cold Hesledon,
Co. Durham







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Ian Farmer Associates

Scale
1:1500 at A3

DRAWN BY: MDR

DATE: June 2007

-  geophysical survey area
-  possible land drains
-  former field boundary
-  former ploughing
-  service pipes
-  spoil heap



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Figure No: 7

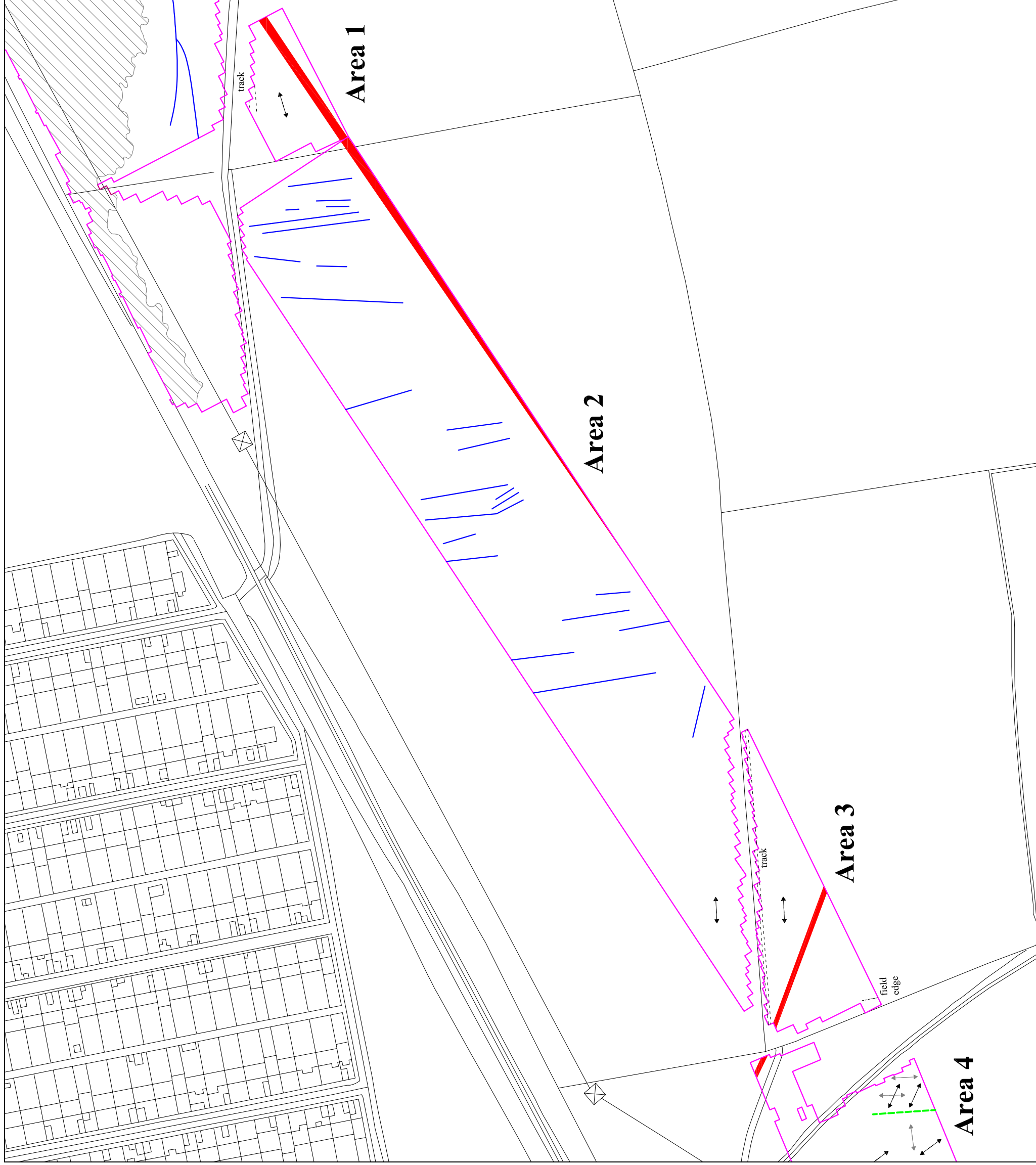


Figure 7 : Archaeological interpretation of Area 2 and Area 3

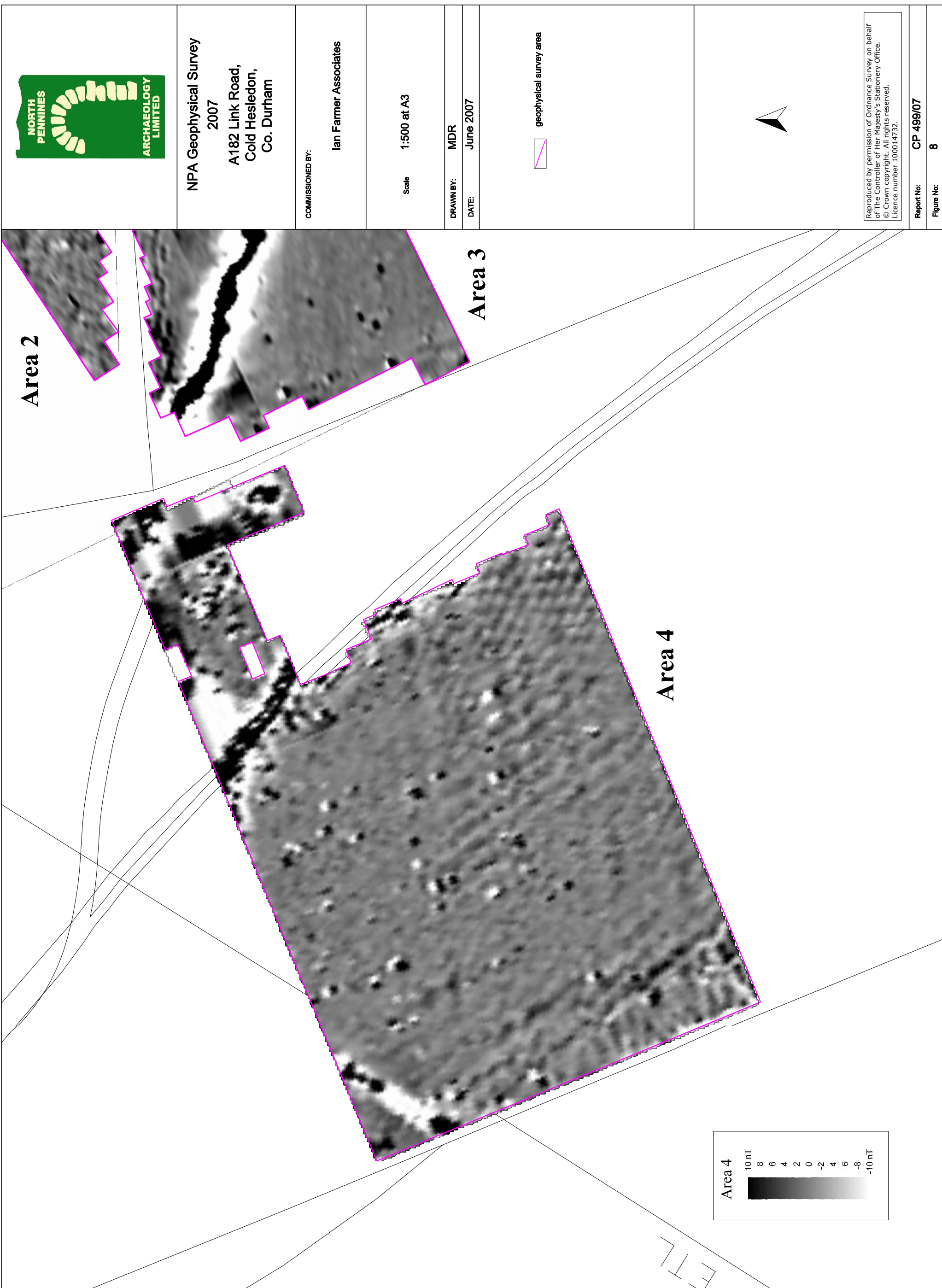
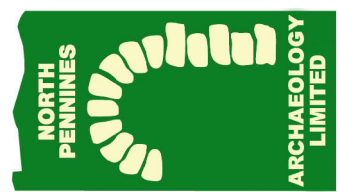
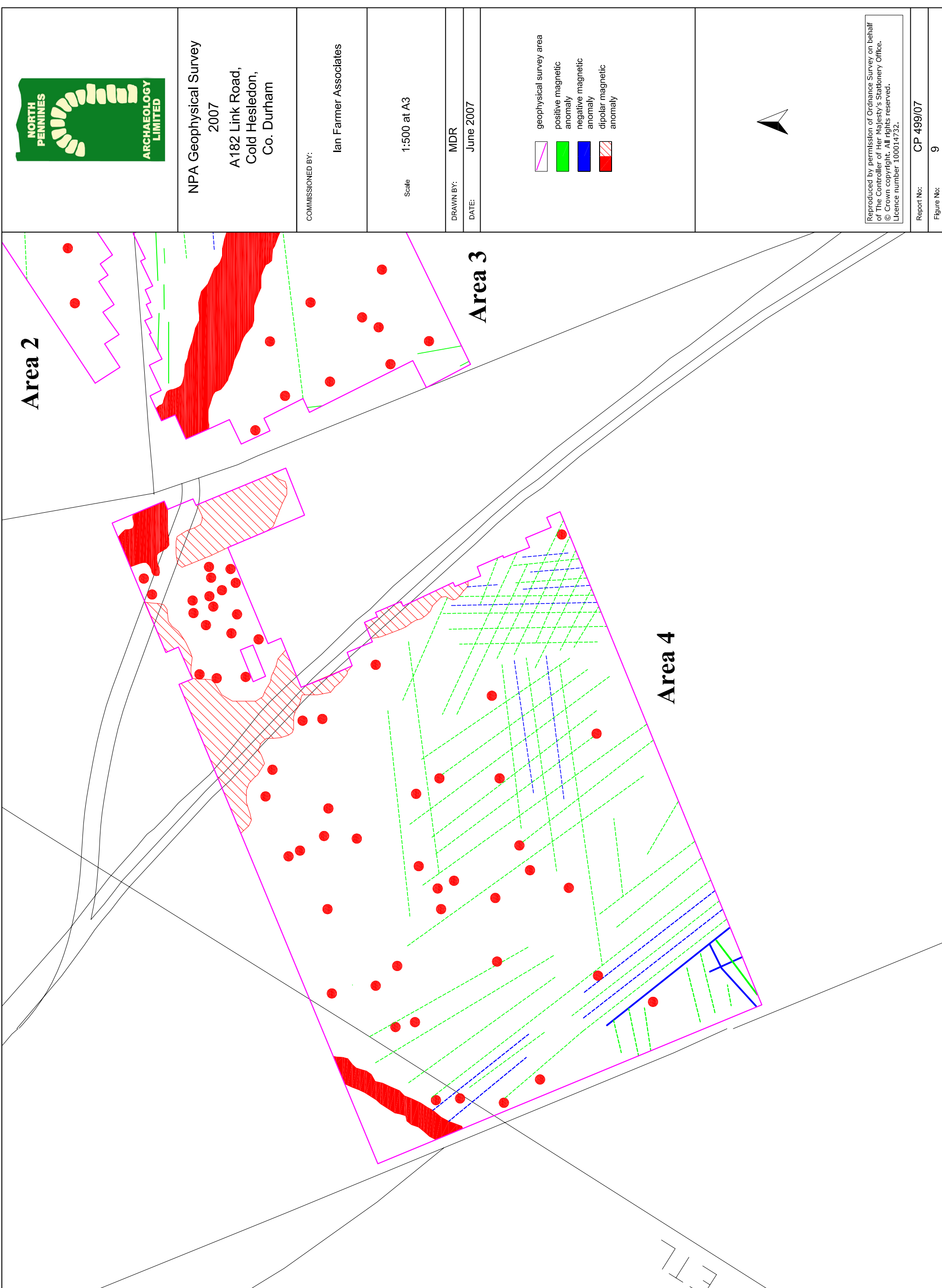


Figure 8 Geophysical survey of Area 4



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- geophysical survey area
- positive magnetic anomaly
- negative magnetic anomaly
- dipolar magnetic anomaly



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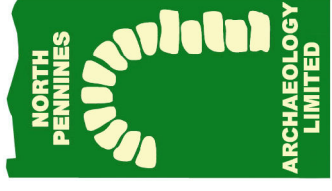
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Area 2

Area 3

Area 4

Figure 9 Geophysical interpretation of Area 4



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-  geophysical survey area
-  former field boundary
-  ridge & furrow
-  service pipes



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Figure No:

10

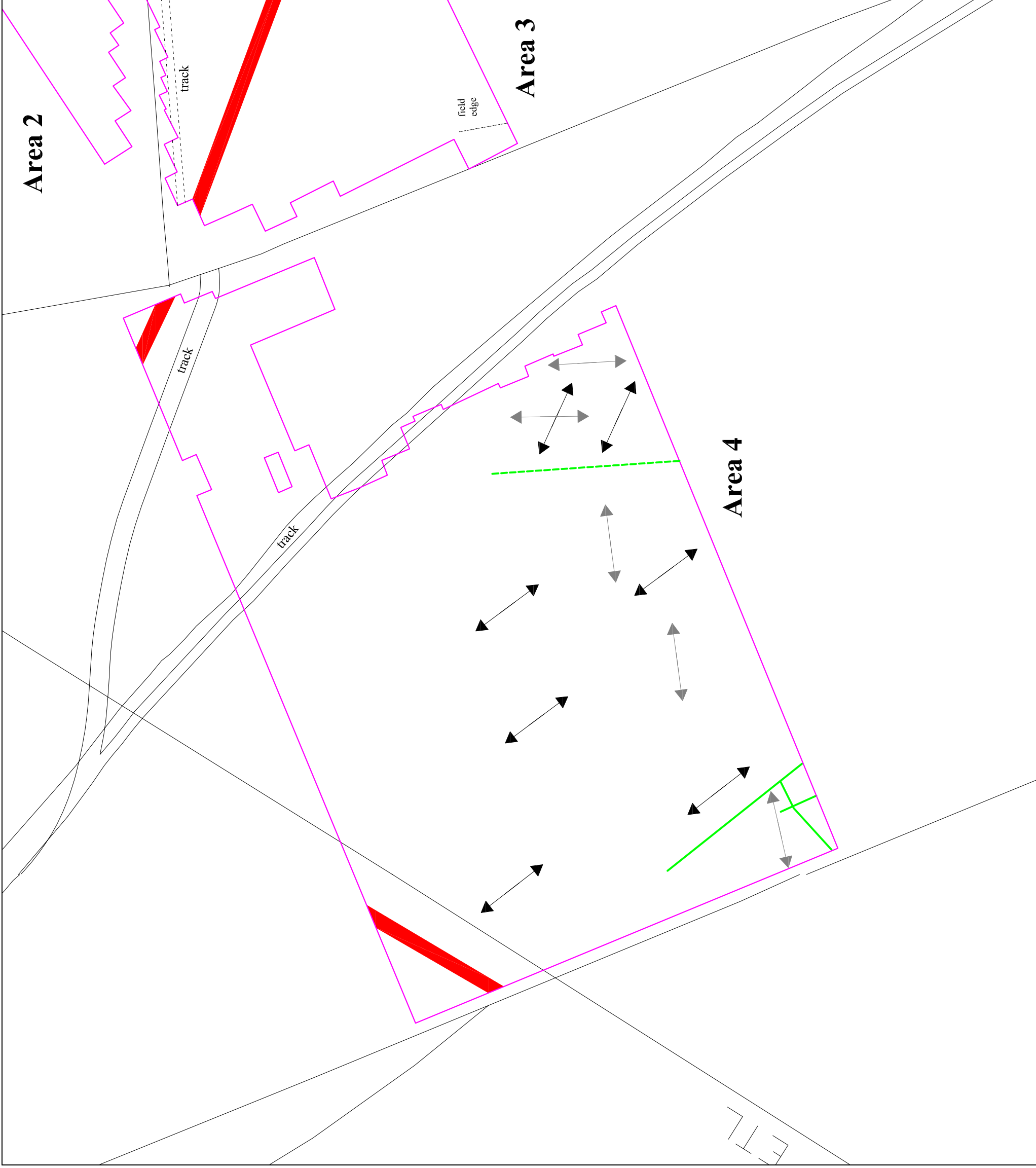


Figure 10 : Archaeological interpretation of Area 4