GeoArch

Report 2016/03

Geophysical survey in Highgate Cemetery, Highgate, NW6

Dr Tim Young
Revised 8th March 2016

Geophysical survey in Highgate Cemetery, Highgate, NW6

Dr T.P. Young

Abstract

Ground resistivity survey was undertaken of the area immediately to the north of the War Memorial to provide evidence of the ground conditions likely to be encountered during the excavation of new drainage and damp-proofing of the memorial.

Limited evidence was produced for resistivity anomalies which occur in alignment with the known graves, but in only one case is this strong enough to strongly suspect a grave cut – and this is outside the area to be affected by the groundworks.

Closer to the wall there is a concentric arrangement of anomalies – an inner positive anomaly (probably over the hard-core packing to the rear of the screen wall) and a negative anomaly slightly outside. The nature of the negative anomaly is unclear – but it may indicate a feature such as a drain or bedding trench.

Contents

Abstract 1

Methods 1
- Survey rationale and background 1
- Survey layout and topographic survey 1
- Ground resistivity 1
- Use of the report 2

Results 2
- Ground resistivity 2

Interpretation 2

Discussion 3

Figure Captions 4

Figures 5

Methods

Survey rationale and background

The survey was undertaken on 17th February 2016 to provide supporting evidence for the area, before planned maintenance to alleviate on-going water damage to the Screen Wall memorial. Evidence was sought both for constructional evidence as well as for evidence for any un-marked graves to the south of the marked and mapped graves.

The survey was commissioned by the archaeological consultant, Philip Emery of Ramboll UK Ltd., on behalf of the Commonwealth War Graves Commission. GeoArch and Ramboll acknowledge the kind assistance of Dr Ian Dungavell, CEO of Highgate Cemetery.

Survey layout and topographic survey

The survey was laid out using a baseline extending ENE from the line of gravestones just north of the Frank Perry marker, passing between the southern side of the Waple headstone, passing through the crack between the James Rosson Perry and the illegible headstone to its south and terminating after 17m just to the southeast of the Taylor headstone (having passed in a direct line towards the SE corner of the upstanding section of the Ridge monumental marker).

The baseline and rear face of the Screen Wall were mapped by EDM. The surviving grave markers were mapped by offset from the established baseline (Figure 1).

Ground resistivity

The ground resistivity survey was undertaken with a Geoscan RM15 resistivity meter, operating a 'parallel twin electrode' configuration, employing three electrodes with 0.5m probe spacing on a PA5 frame, via an MPX15 multiplexer.

In this configuration, the adjacent mobile electrode pairs had a 0.5m spacing (giving the main component of the response from 0.5-0.7m depth), with 0.5m between centres, to give a 0.5m effective traverse

interval. The outer probes therefore had a 1.0m spacing (giving the main component of the response from 1.0-1.5m depth), with a 1.0m traverse interval.

Data were collected as a series of three measurements (left 0.5m-, right 0.5m-, 1.0m-spaced). Data were collected with a 0.25m sample interval (i.e. the raw 0.5m-spaced data has 0.25 x 0.5m node spacing and the 1.0m-spaced data has a 0.25 x 1.0m node spacing). Grids were walked in parallel away from the baseline. The firmware on the RM15 does not permit setting a 0.25m sample spacing, so the grids were collected with the sample interval set to 0.5m for reduction in software later (since the traverse lengths did not exceed 10m, this provided a working solution to the limitations of the firmware).

Data were downloaded from the instrument and collated using Geoscan Research's '*Geoplot*' software. The left and right datasets at 0.5m mobile probe spacing were merged into a single composite. The raw data are presented in Figures 2 upper and 3 upper (for surveys with 0.5m- and 1.0m spaced mobile probes respectively).

Data processing was then mostly limited to two passes of the 'despike' function in Geoplot, with radius set to 1 and a threshold of 3 std. dev., using Gaussian statistics (Figures 2 lower and 3 lower).

Data were then exported from Geoplot and imported to Golden Software's 'Surfer'. The data were gridded by kriging to a node-spacing of 0.25 by 0.125m and then the Y direction was shortened by a factor of 0.5 to reduce the grid to 0.125m x 0.125m node spacing, for production of the final, less pixelated, image (Figure 4).

Use of the report

The technique chosen for the survey, ground resistivity, was selected for its utility in detecting cut features as well as buried stone structures. As with any geophysical technique, it is always possible for archaeological features to be present, but not to be distinguished, or distinguishable, by variation in the physical property being examined at the time of survey – in this case primarily water content. Absence of detectable geophysical anomalies cannot be taken as indicative of the absence of archaeological features. All anomalies have been interpreted as far as possible, with contrasting possible interpretations given where appropriate. Geophysical techniques cannot provide an unambiguous evaluation of buried features. Where a higher degree of certainty is required, physical ground-truthing of any geophysical anomalies resolved by the survey will be required.

Results

Ground Resistivity

The raw data are illustrated in Figure 2 upper (0.5m-spaced data) and Figure 3 upper (1.0m-spaced data). Figures 2 lower and 3 lower show the same data following 'despiking'. Figure 4 displays the interpolated 0.5m and 1.0m-spaced surveys on the site plan.

Data quality was generally good with minor spiking mainly over grave stonework and on the steep slope west of the wall.

In general the 1.0m-spaced dataset shows similar features to the survey with 0.5m-spaced electrodes, but with lower resistivity (corresponding to wetter conditions with depth) and a much reduced range of values (18-25Ω measured resistance compared with 20-40Ω for the narrower spacing). This may suggest that much of the featuring of the 1.0m-spaced survey is actually reflecting shallow, rather than genuinely deeper, variations in resistivity.

Interpretation

The resistivity surveys show good imaging of graves with shallow, known, stonework (as positive resistivity anomalies), as would be expected. Similar anomalies were not observed away from visible stonework, suggesting that the area does not include any unknown buried stone grave surrounds or cover slabs. Areas with such positive anomalies occur in the north-western and north-central parts of the survey (Figure 3).

Anomalies within the area of interest closer to the Screen Wall are threefold: large areas of reduced resistivity to the south of the known, mapped graves, a positive resistivity anomaly along the rear face of the Screen Wall, and a concentric negative resistivity anomaly slightly further from the rear of the Screen Wall.

Discussion

The interpretation of the geophysical results is complicated by problems reconciling observations of the grave markers with the documentary evidence (p47 of the cemetery plan). The plan shows the three western north-south rows of graves as forming a block, of which the southernmost graves broadly correspond to those seen, but the east-west alignment of the graves does not. The southernmost gave of the western row is that entitled *Butler* (#33744), with that of *Perry* to its north (#37439). The southernmost of the next row (#38661) is illegible, but presumably that of *Parsons* (which is actually south of its expected location next to the *Perry* plot. To the east of *Parsons* there is a blank on the plan, to the north of which is an illegible plot (#43248), and to the north of that is the *Waple* plot (#30809). Thus the third row has its graves one plot south of where there might be expected with respect to the row to the west according to the plan. However, there are no labelled plots to the south of those identified on the ground.

The next block of graves on the plan again comprises three north-south rows. These are problematic because of illegibility of many of the names on the plan. The central row terminates southwards in the *Whitehead* plot (#36676). To the east of this is plot (#46930) marked ® - presumably reserved. To the west the *Whitehead* plot overlaps a plot (#35906), apparently marked *Loid*, rather than *Warren* as observed.

The next block to the east includes a north-south row terminating in *Arnull* (#7228), with *Perry* (#8952) to its north. The southern gravemarker was illegible, but the one to its north was indeed *Perry*. There is no grave on the plan corresponding to the location of the partially-buried slab to the south of the row. The plan of the north-south row to the east of this includes the *Norton* plot at its southern end (#50425), with a gap to its north before the next grave, and with the *Perry* plot

(#8952) to its west. The fourth plot up the row is that of *Hoskins* (#10226), which lies east of the third grave north of *Perry* – as it does on the ground.

Thus, although there are some inconsistencies between the plan and the observed gravestones, there is no evidence on the plan for graves to the south of those observable.

The geophysical evidence suggests a possible grave (Figure 5 a)in the plot south of that between *Whitehead* and *Perry* (ie. south of the ?reserved plot #46390). This resistivity low forms part of a larger area of less-distinctly-reduced resistivity, but which shows some linear margins aligned approximately with the known graves – particularly to the south of the east end of the *Whitehead* plot (Figure 5 b-b), but also a boundary running south from the mid-length of the *Warren* plot to the west of the *Whitehead* plot (Figure 5 c-c). Further lowered resistivity occurs to the south of the row containing the *Waple* plot, although this shows a less orthogonal outline (Figure 5 d).

As well as the tentative evidence for additional graves, the resistivity survey also shows anomalies associated with the Screen Wall of the War Memorial. A narrow zone of very high resistivity lies adjacent to the Screen Wall (Figure 5 e). This zone is approximately 0.3m wide centrally to the north of the memorial and perhaps as much as 0.8m wide towards the ends of the wall. The design drawing for the memorial (Ref 10603/H24-001) shows the wall rendered to the rear with cement and 'Pudlo' (waterproof concrete), and with 6 inches of hard-core to the rear with a 3 inch agricultural land-drain at the base. The wall steps out approximately 6 inches at a level below the ground surface to the upslope side – meaning that the outer margin of the hard-core would be approximately 12 inches (0.3m) from the upstanding wall face. Thus the high resistivity zone is interpreted as the extent of the buried hard core.

Outside this zone of elevated resistivity is a narrow concentric negative resistivity anomaly (Figure 5 f). This lies 1.0 to 1.6m from the outer wall face laterally, but has its centreline just 0.5m from the wall on the upslope side. The nature of this anomaly is not clear. It might be associated with the construction cut for the memorial, but is perhaps more likely to indicate a discrete, narrow feature – perhaps an additional drain, or a bedding trench for a hedge (a hedge is known to have existed upslope of, and immediately adjacent to, the cut for the wall in 1926; drawing ref 10603/H24-001) and photographs show the area heavily overgrown before recent clearance.

Figure Captions

Figure 1: location of the survey area showing base-line (pecked), grave markers (with names of legible examples), and the rear face of the Screen Wall.

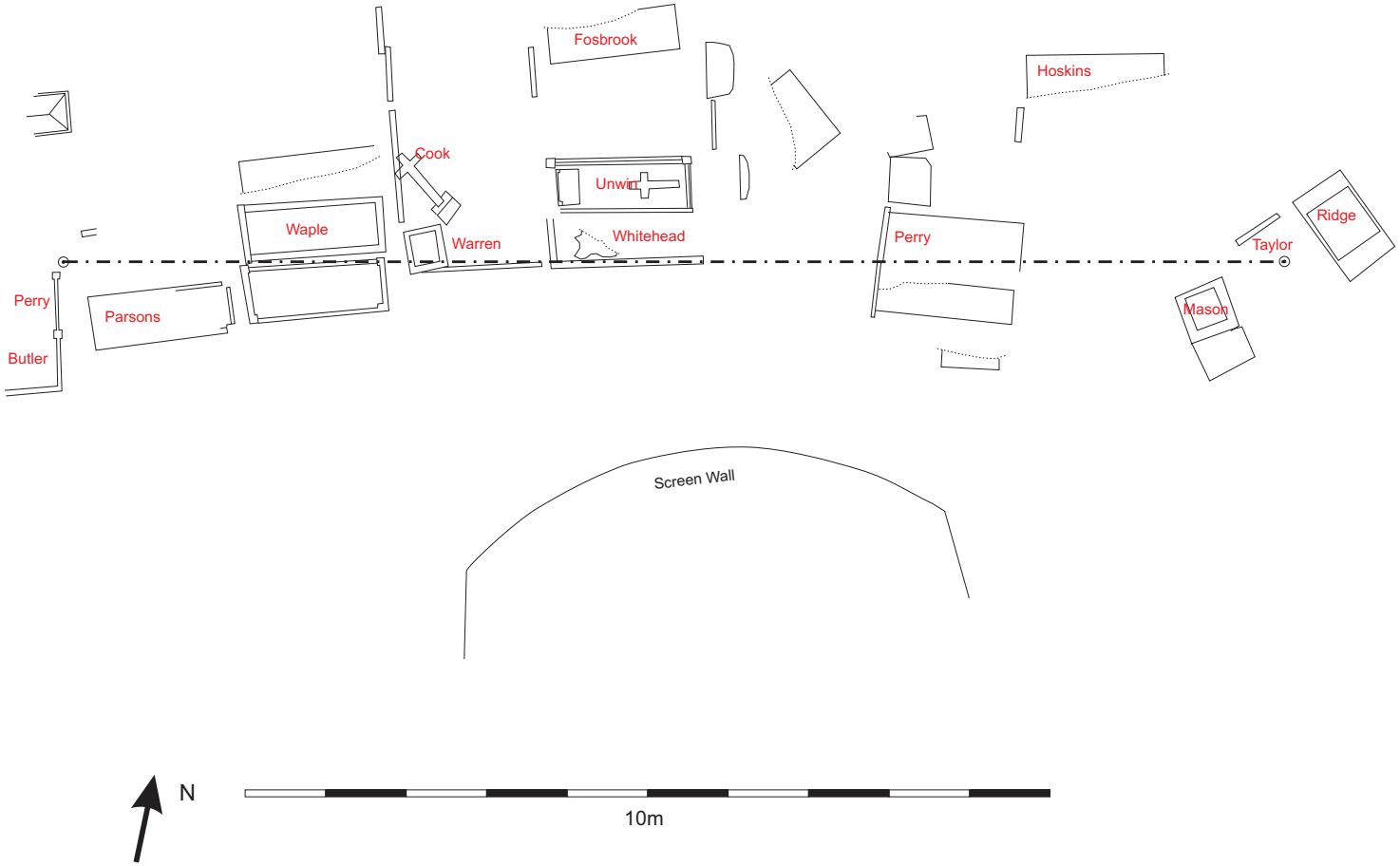
Figure 2: ground resistivity survey data – 0.5m probe spacing as bitmapped images from Geoplot.
a. raw data; greyscale: 15Ω (black) to 45Ω (white)
b. despiked data; greyscale: 15Ω (black) to 45Ω (white)

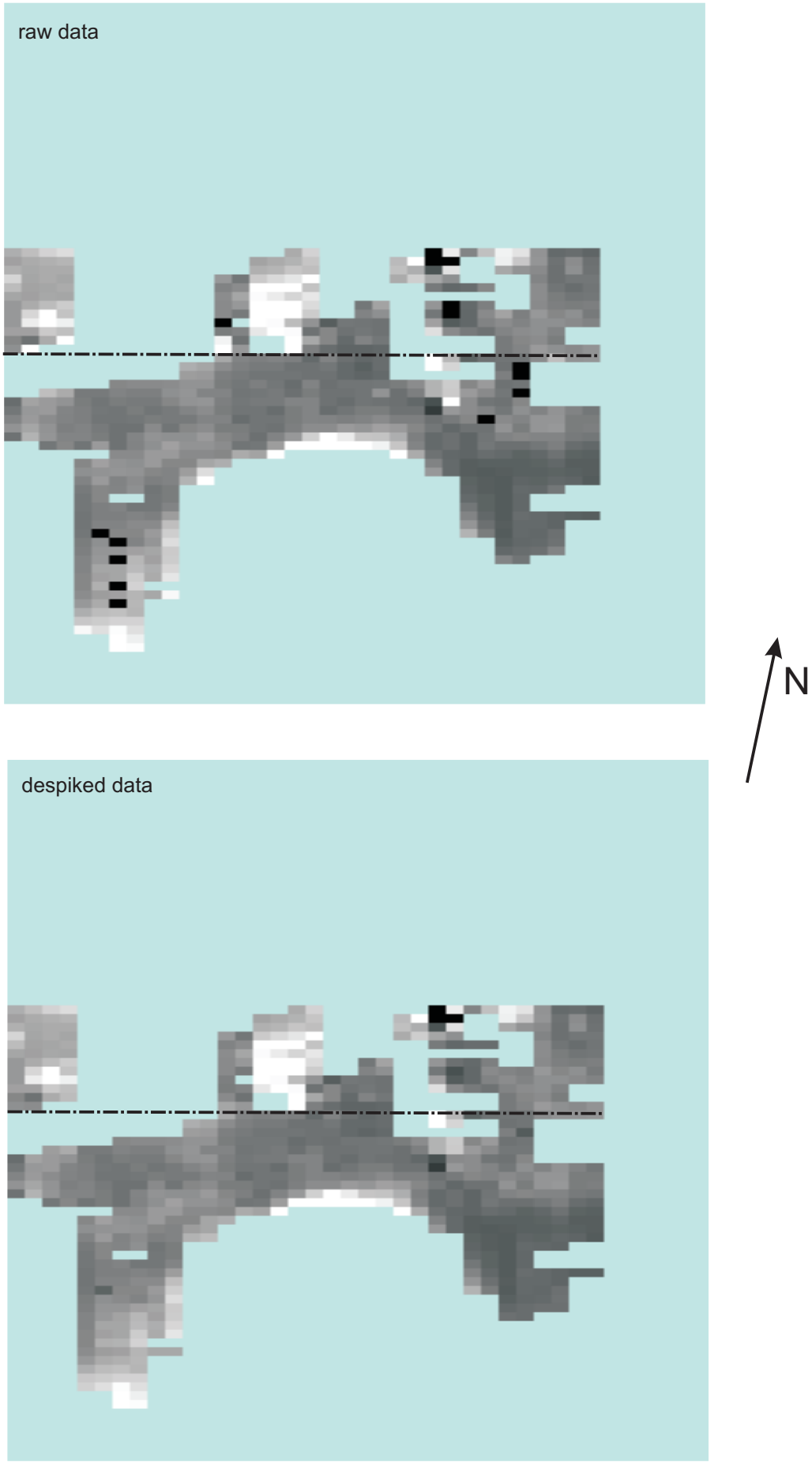
Figure 3: ground resistivity survey data – 1.0m probe spacing as bitmapped images from Geoplot.
a. raw data; greyscale: 15Ω (black) to 35Ω (white)
b. despiked data; greyscale: 15Ω (black) to 35Ω (white)

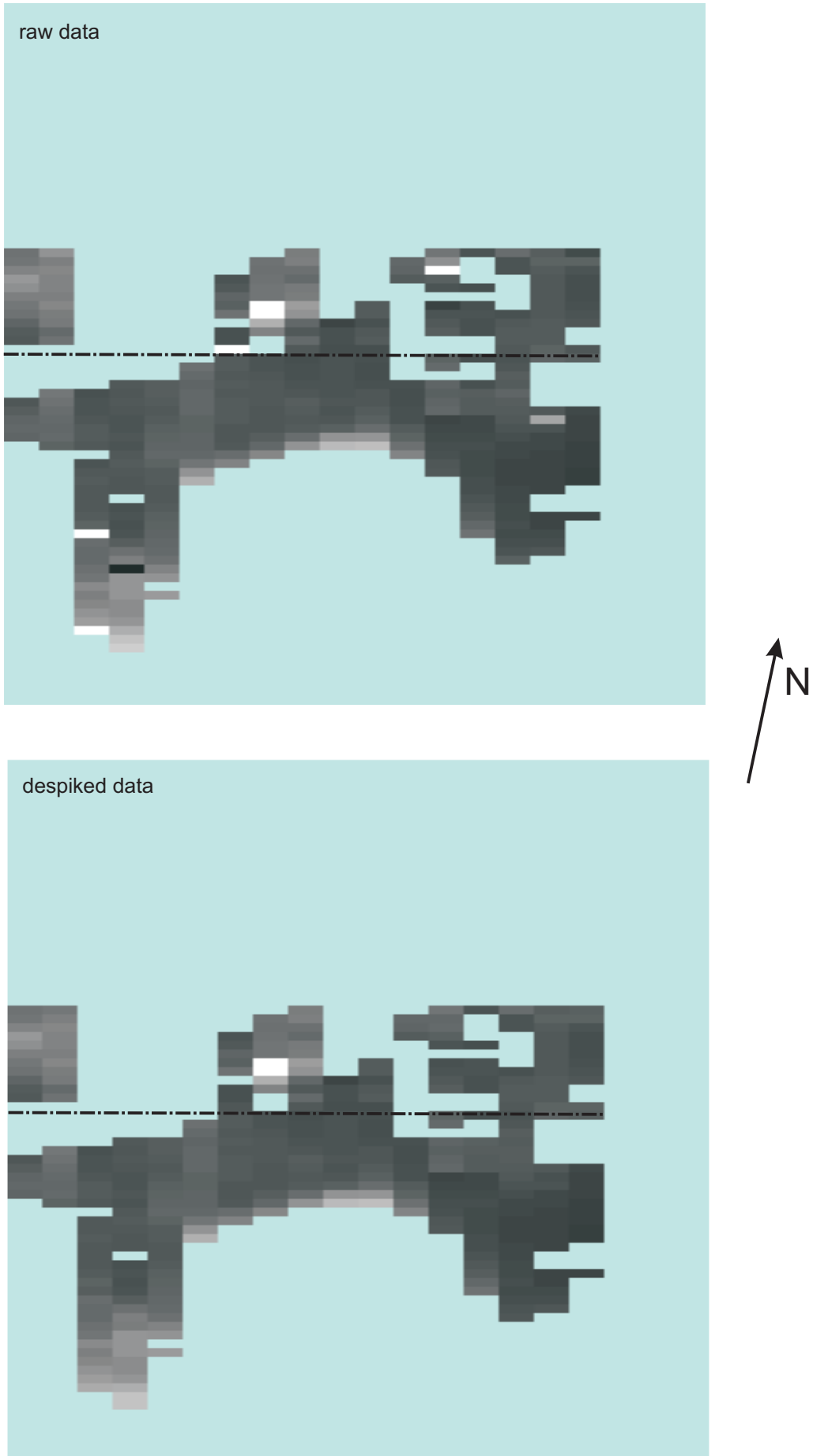
Figure 4: ground resistivity survey data as interpolated image from Surfer of despiked data; greyscales as shown. Outline of topographic survey overlain

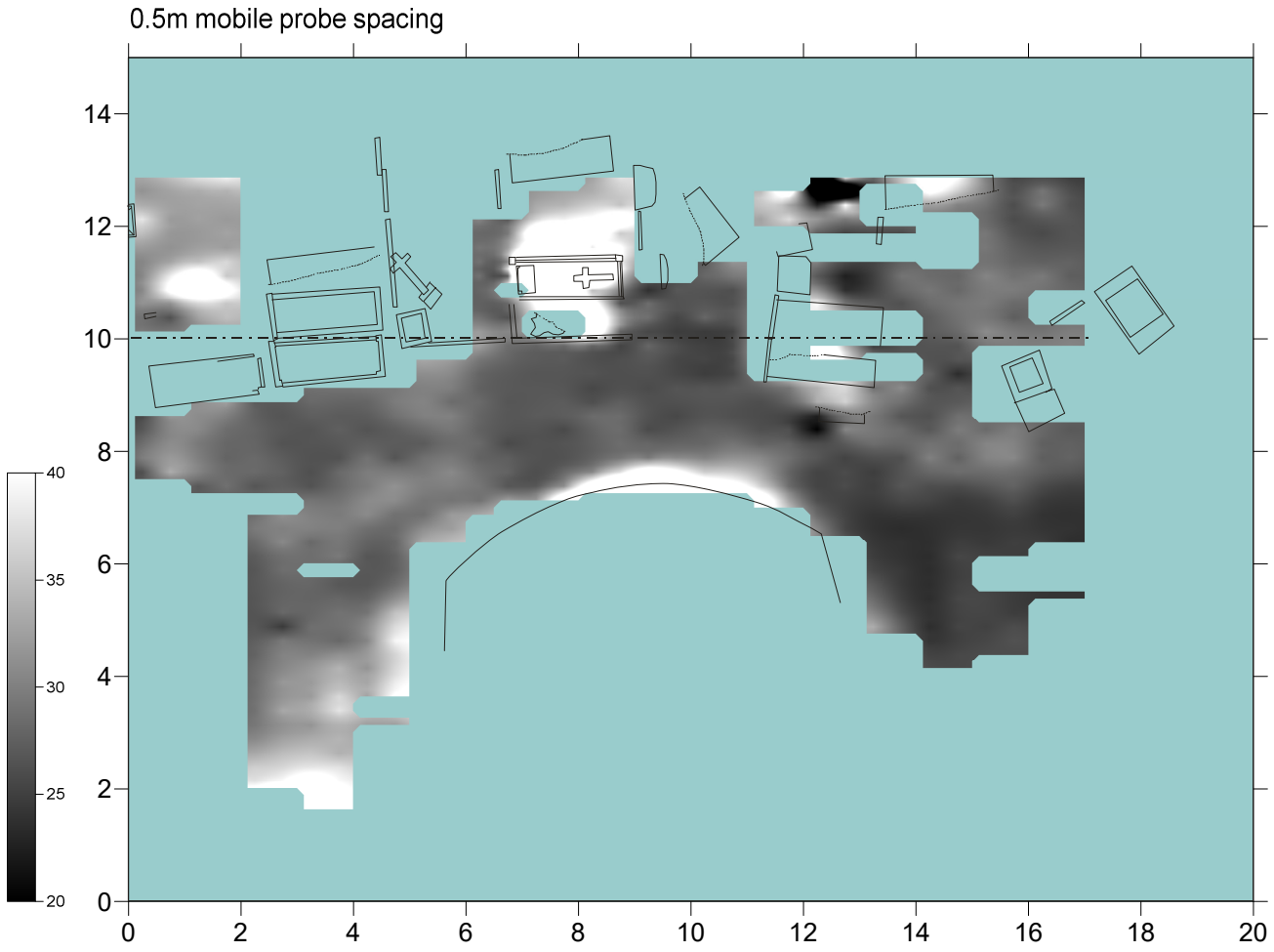
Figure 5: Summary interpretation (for explanation see text).

Figure 1


Fosbrook
Hoskins
Cook
Unwin
Waple
Warren
Whitehead
Perry
Taylor
Ridge
Perry
Parsons
Butler
Mason
Screen Wall
N
10m


raw data
despiked data
N
10m


raw data
despiked data
N
10m


0.5m mobile probe spacing
0
2
4
6
8
10
12
14
0
2
4
6
8
10
12
14
16
18
20
40
35
30
25
20

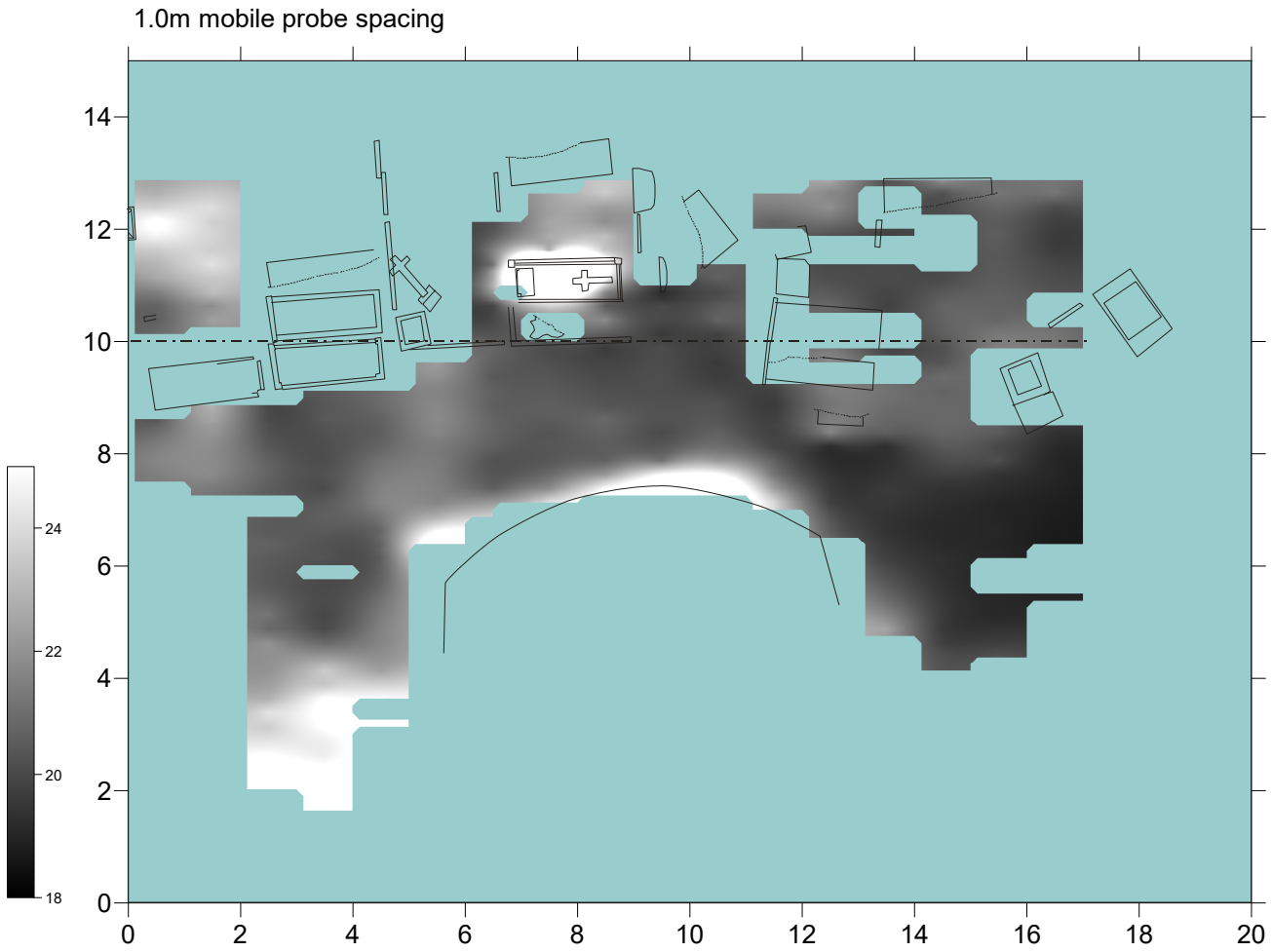
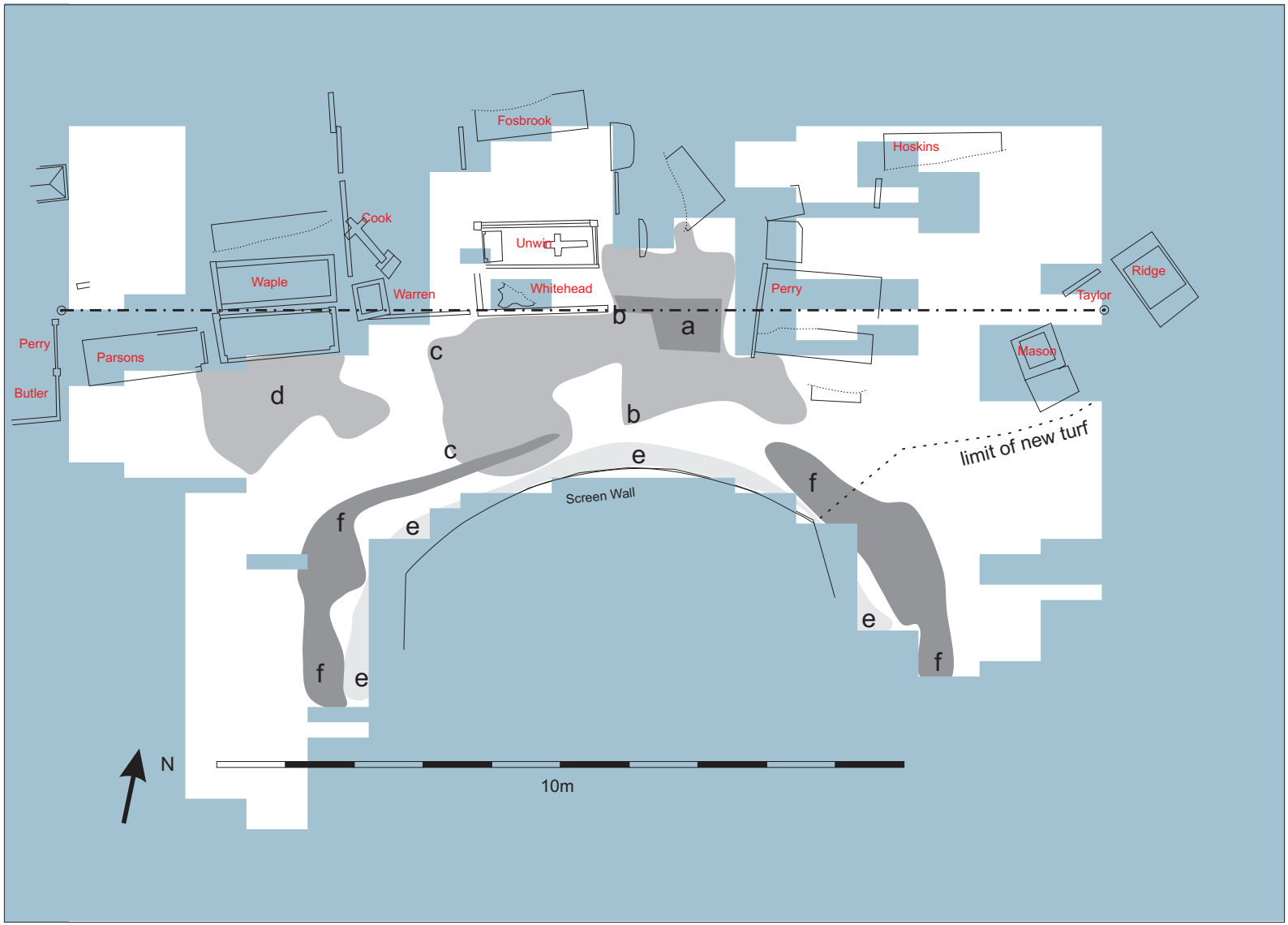

1.0m mobile probe spacing
0
2
4
6
8
10
12
14
0
2
4
6
8
10
12
14
16
18
20
24
22
20
18

Figure 5


Fosbrook
Hoskins
Cook
Unwin
Waple
Warren
Whitehead
Perry
Taylor
Ridge
Perry
Parsons
Butler
Mason
a
b
c
d
e
f
limit of new turf
Screen Wall
N
10m

GeoArch

geoarchaeological, archaeometallurgical & geophysical investigations

Unit 6, Block C,
Western Industrial Estate,
Caerphilly,
CF83 1BQ

Office: 029 20881431
Mobile: 07802 413704

E-Mail: Tim.Young@GeoArch.co.uk
Web: www.GeoArch.co.uk