Archaeological Services
University of Durham

North Gosforth Chapel, Kingsley Avenue, Newcastle upon Tyne

geophysical surveys

on behalf of
Friends of North Gosforth Chapel

and
Newcastle City Council

Report 1339
September 2005

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Tyne and Wear County Archaeologist, West Chapel, Jesmond Old Cemetery, Jesmond Road, Newcastle upon Tyne NE2 1NL

Contents

1. Summary

The project

1.1 This report presents the results of geophysical surveys conducted at North Gosforth Chapel, Kingsley Avenue, Newcastle upon Tyne. The works comprised geomagnetic and electrical resistance surveys of the grassed area around the chapel remains.

1.2 The works were commissioned by the Tyne and Wear County Archaeologist on behalf of the Friends of North Gosforth Chapel, and conducted by Archaeological Services in accordance with a specification provided by the Tyne and Wear Archaeology Officer.

Results

1.3 The geomagnetic survey does not appear to have detected features of archaeological interest, although it is possible that some of the small dipolar magnetic anomalies reflect ferrous items associated with coffins.

1.4 The resistance survey has detected the probable remains of a graveyard boundary ditch around the north side of the chapel, and the possible remains of a boundary wall to the immediate south of the ditch. Additional high resistance anomalies could reflect grave slabs or other stone features.

2. Project background

Location (Figure 1)

2.1 The study area comprised land around the scheduled remains of North Gosforth Chapel (SAM 32056), on the south side of Kingsley Avenue, North Gosforth parish, Newcastle upon Tyne (NGR: NZ 2463 7011). The area measured approximately 68m east-west by 38m north-south and was bounded by roads and housing on all sides.

Development proposal

2.2 A programme of landscape enhancement is proposed by the Friends of North Gosforth Chapel in order to improve the setting of the chapel.

Objective

2.3 The principal aim of the surveys was to determine the nature and extent of any sub-surface features of potential archaeological significance, particularly the extent of the cemetery.

Methods statement

2.4 English Heritage granted consent for the geophysical surveys under Section 42 of the Ancient Monuments and Archaeological Areas Act 1979. The surveys were undertaken in accordance with a Specification provided by the Tyne and Wear Archaeology Officer (Appendix II) and a methods statement provided by Archaeological Services. Methods are described in Section 5 of this report.

Dates

2.5 Fieldwork was undertaken on 16th September 2005. This report was prepared between 19th and 21st September 2005.

Personnel

2.6 Fieldwork was conducted by Duncan Hale and Jill Inglis. This report was prepared by Duncan Hale with illustrations by Martin Railton. The Project Manager was Duncan Hale.

Archive/OASIS

2.7 The site code is **NGC05**, for **N**orth **G**osforth **C**hapel 20**05**. The paper and data archive is currently held by Archaeological Services University of Durham. It is anticipated that the data archive will be transferred to the Archaeology Data Service in due course. Archaeological Services University of Durham 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 **archaeol3-10333**.

Acknowledgements

2.8 Archaeological Services is grateful for the assistance of the Tyne and Wear County Archaeologist, English Heritage, the Friends of North Gosforth Chapel and local residents in facilitating this scheme of works.

3. Archaeological and historical background

Scheduled Ancient Monument/National Monument No. 32056
County Sites and Monuments Record No. 166
Chapel remains listed Grade II*

3.1 Information and references to publications about the chapel are provided on the SiteLines website (see Section 7, below).

3.2 The chapel comprises a nave and chancel and measures 20.5m in length by 7m in width. The wall remains stand to one course above a plinth course. The nave has two west walls, one representing a shortening of the nave by 3m. Only the plinth course of the nave wall is visible to the west of the inner west wall. The chapel contains reused Roman material and at one time contained a Roman altar stone. Within the nave are a four-column pedestal, a stone trough (?font) and a stone slab. Two gravestones are situated by the south door of the nave and a group of gravestones lies to the east of the chancel; some of these are medieval and some are dated to the 17th century.

3.3 The earliest reference to the chapel is in 1256. The Surtees family were patrons in the 14th century. Although the last minister of North Gosforth Chapel is recorded in 1604, the chapel and graveyard apparently continued in use until the 18th century (Holmes 1883, p.205). Sheriton Holmes conducted excavations at the site in 1882, on behalf of the Society of Antiquaries of Newcastle upon Tyne (*ibid*.).

3.4 The chapel is depicted on the first edition Ordnance Survey map of 1864 with a roughly oval graveyard measuring approximately 60m by 40m.

4. Landuse, topography and geology

4.1 At the time of survey the study area comprised an open space of close-cropped grass with a few mature oak trees, surrounding the remains of the chapel. The site was bounded on all sides by modern pavements, roads and housing.

4.2 The survey area was predominantly level at a mean elevation of *c*.51m AOD.

4.3 The underlying solid geology of the area comprises Westphalian "Coal Measures", overlain by glacial drift deposits.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with English Heritage (1995) Research and Professional Services Guideline No.1, *Geophysical survey in archaeological field evaluation*; the Institute of Field Archaeologists (2002) Paper No.6, *The use of geophysical techniques in archaeological evaluations*; and the Archaeology Data Service (2001) *Geophysical Data in Archaeology: A Guide to Good Practice*.

Technique selection

5.2 Geophysical surveying enables the relatively rapid and non-invasive identification of potential archaeological features within landscapes and can involve a variety of complementary techniques such as magnetometry, electrical resistivity, ground-penetrating radar and electromagnetic survey. Some techniques are more suitable than others in particular situations, depending on a variety of 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 graves might survive on the site, and that other types of feature such as wall foundations might also be present. Given the anticipated shallowness of targets and the non-igneous geological environment of the study area two complementary techniques were considered appropriate: fluxgate gradiometry (a geomagnetic technique) and electrical resistance survey. Fluxgate gradiometry involves the use of hand-held magnetometers to detect and record minute anomalies in the vertical component (i.e. gradient) of the Earth's magnetic field caused by variations in soil magnetic susceptibility or permanent magnetisation; such anomalies can reflect archaeological features. Resistivity survey relies on the relative inability of materials to conduct an electrical current and primarily maps the volume concentration of ground moisture which varies according to lithology, porosity and time of year. Since resistance is linked to moisture content and porosity, rocky features such as wall foundations will give relatively high resistivity responses while soil-filled cut features, which retain moisture, will provide relatively low responses.

Field methods

5.4 A 20m grid was established across the study area and tied-in to known, mapped Ordnance Survey points.

5.5 Measurements of vertical geomagnetic field gradient were determined using Bartington Grad601 dual fluxgate gradiometers with automatic datalogging facilities. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was set to 0.1nT, the sample interval to 0.25m and the traverse interval to 1.0m, thus providing 1600 sample measurements per 20m grid unit.

5.6 Measurements of electrical resistance were determined using a Geoscan RM15D resistance meter with automatic logging of the data. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was set to 0.1ohms, the sample interval to 0.5m and the traverse interval to 1.0m, thus providing 800 sample measurements per 20m grid unit.

5.7 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

5.8 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 data. The greyscale images and interpretations are presented in Figures 2-6; the trace plots are provided in Appendix I. In the greyscale images, positive magnetic/high resistance anomalies are displayed as dark grey and negative magnetic/low resistance anomalies as light grey. A palette bar relates the greyscale intensities to anomaly values in nanoTesla/Ohms.

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

Clip – clips, or limits 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.

Despike – locates and suppresses random iron spikes in gradiometer data.

Interpolate – increases the number of data points in a survey; to match sample and traverse intervals and so create a smoother appearance to the data. In this instance the gradiometer data have been interpolated from 1.0 x 0.25m intervals to 0.25 x 0.25m intervals.

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

Add - used in resistance surveys to add a set value to all readings within a defined area; in this instance to adjust mean data values between adjacent grids.

Interpolate – to increase the number of data points in a survey; to match sample and traverse intervals. In this instance the resistance data have been interpolated from 1.0 x 0.5m intervals to 0.25 x 0.25m intervals.

Interpretation: anomaly types

5.11 Colour-coded geophysical interpretation plans are provided in Figures 3 & 5. One type of geomagnetic anomaly has been distinguished in the data:

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.

5.12 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

5.13 A colour-coded archaeological interpretation plan is provided in Figure 6.

5.14 The geomagnetic survey only detected intense dipolar magnetic anomalies. Chains of such anomalies were detected along the northern and southern limits of the area and almost certainly reflect buried utilities. The smaller, discrete, anomalies are likely to reflect near-surface ferrous litter. It is possible, however, that some of these smaller anomalies reflect ferrous fixings and fittings on coffins or other ferrous items within graves.

5.15 The resistance survey has almost certainly detected anomalies of archaeological significance. Broad concentrations of very high resistance values to the north, and to some extent east, of the chapel could reflect very local geological variation, but are more likely to reflect areas of stone, possibly the tumble from a boundary wall for the graveyard. A linear low resistance anomaly was also detected in the north-eastern quarter of the area, immediately north of the stone concentration, and again in two places *c*.8m west of the chapel. This anomaly almost certainly represents a soil-filled feature such as a ditch, and is clearly shown in both the greyscale and trace plot. There is an apparent entrance to the graveyard *c*.16m north of the nave, where there is a hiatus in both the ditch and possible wall remains.

5.16 It is not clear from the geophysical data if the ditch and wall were in use at the same time, or if the wall superceded the ditch; to the north-east the ditch was clearly detected, but to the north-west and east it appears to be largely overlain by stone tumble. There is remarkably good correspondence between the locations of the geophysical anomalies and the graveyard boundary as shown on the first edition Ordnance Survey map of 1864. The southern part of the cemetery boundary would have been beyond the extent of the present survey, beneath the road of Chapel Close. The 1864 map also records a boundary heading north from the apparent graveyard entrance towards Low Gosforth House.

5.17 Many high resistance anomalies were detected to the east of the chancel. Whist some of these almost certainly reflect stone tumble, it is possible that others could reflect grave slabs. Additional high resistance anomalies detected to the north of the cemetery boundary could reflect wall footings or other stone features.

5.18 Small blank areas in the resistance survey indicate the locations of trees.

6. Conclusions

6.1 Geomagnetic and electrical resistance surveys were undertaken on the grassed area around the scheduled remains of North Gosforth Chapel.

6.2 The geomagnetic survey does not appear to have detected features of archaeological interest, although it is possible that some of the small dipolar magnetic anomalies reflect ferrous items associated with coffins.

6.3 The resistance survey has detected the probable remains of a graveyard boundary ditch around the north side of the chapel, and the possible remains of a boundary wall to the immediate south of the ditch. These features correspond well with the graveyard boundary shown on the 1864 OS map. The boundary on the southern side of the chapel would be beneath the existing road. Additional high resistance anomalies could reflect grave slabs or other stone features.

7. Sources

Archaeology Data Service (2001) *Geophysical Data in Archaeology: A Guide to Good Practice*. Arts and Humanities Data Service.

Department for Culture, Media and Sport (1998) Schedule entry for National Monument No. 32056.

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

Holmes, S (1883) An account of recent investigations at the ruined chapel of North Gosforth. *Archaeologia Aeliana* Series 2, Volume IX, pp205-210.

Institute of Field Archaeologists (2002) Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations*. Birmingham.

Ordnance Survey (1864) 1st edition map

SiteLines web-based resource for the archaeology of Tyne and Wear: http://sine7.ncl.ac.uk/sl/Home.htm

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Figure 1
Location plan showing the surveyy area in red

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Figure 2
Geomagnetic survey

on behalf of
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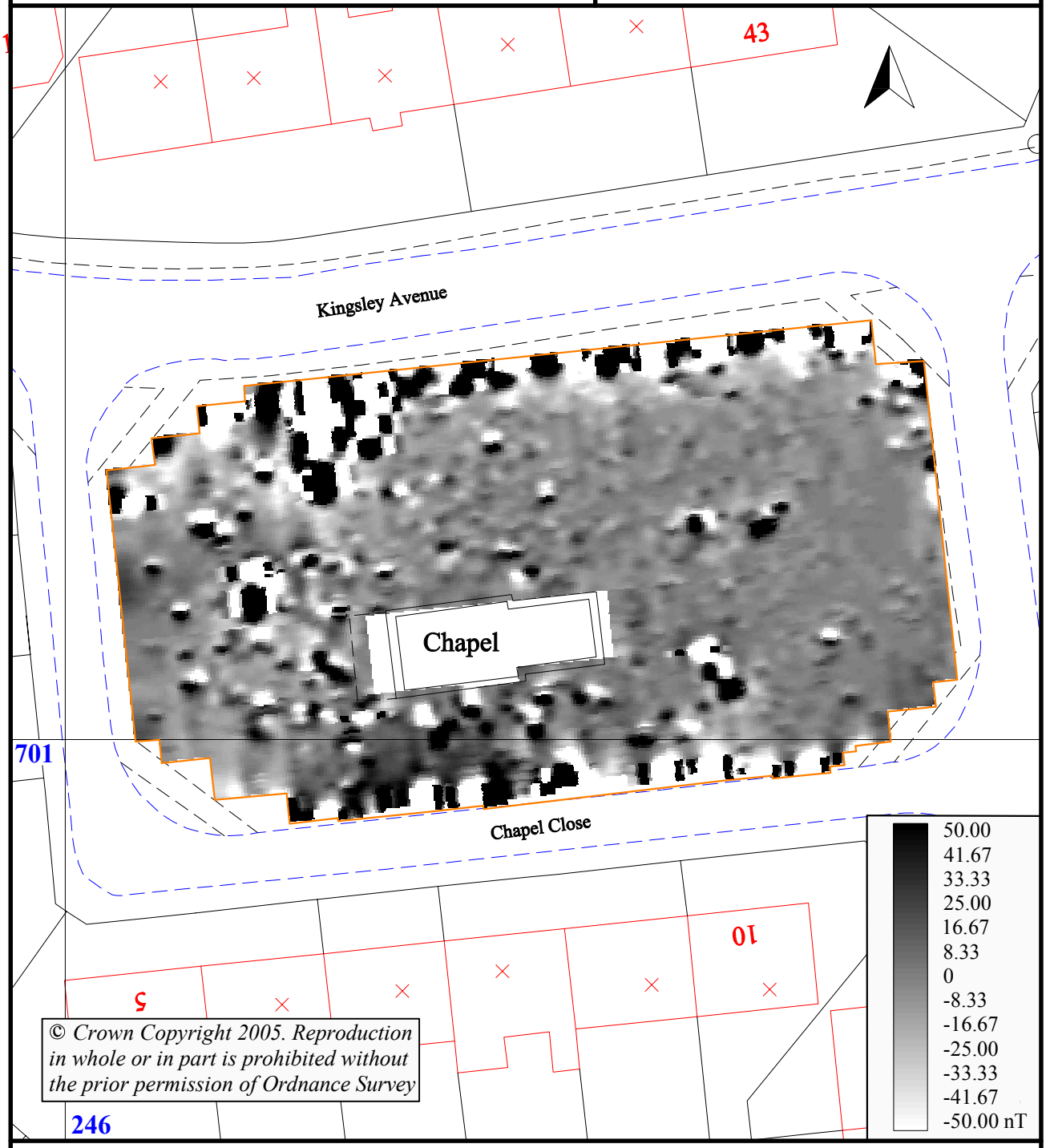
Newcastle City Council

0 25m

scale 1:500 - for A4 plot



outline of geomagnetic survey area

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Figure 3
Geophysical interpretation of geomagnetic survey

on behalf of
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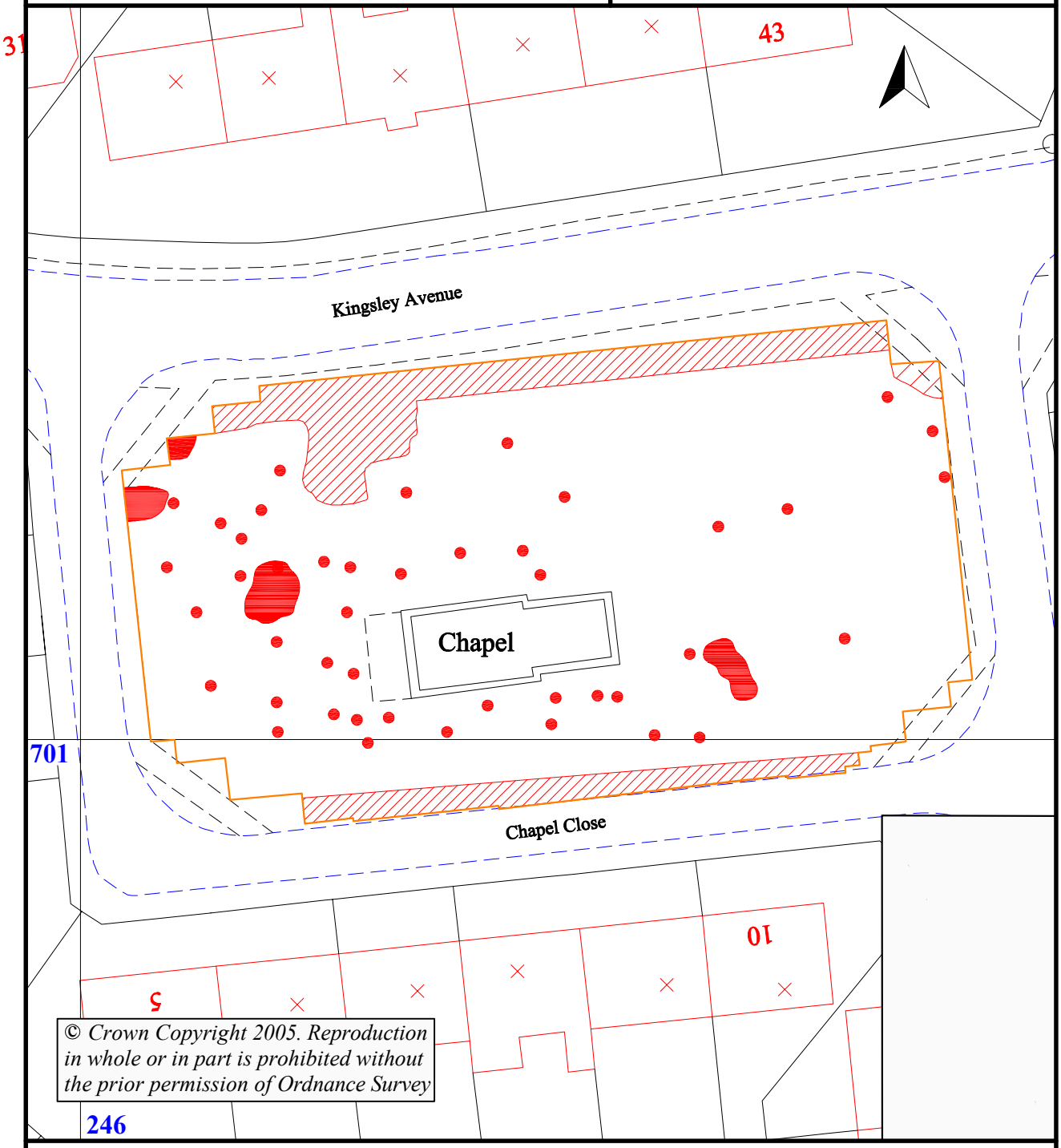
Newcastle City Council

0 25m
scale 1:500 - for A4 plot



outline of geomagnetic survey area

dipolar magnetic anomalies

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Figure 4
Resistance survey

on behalf of
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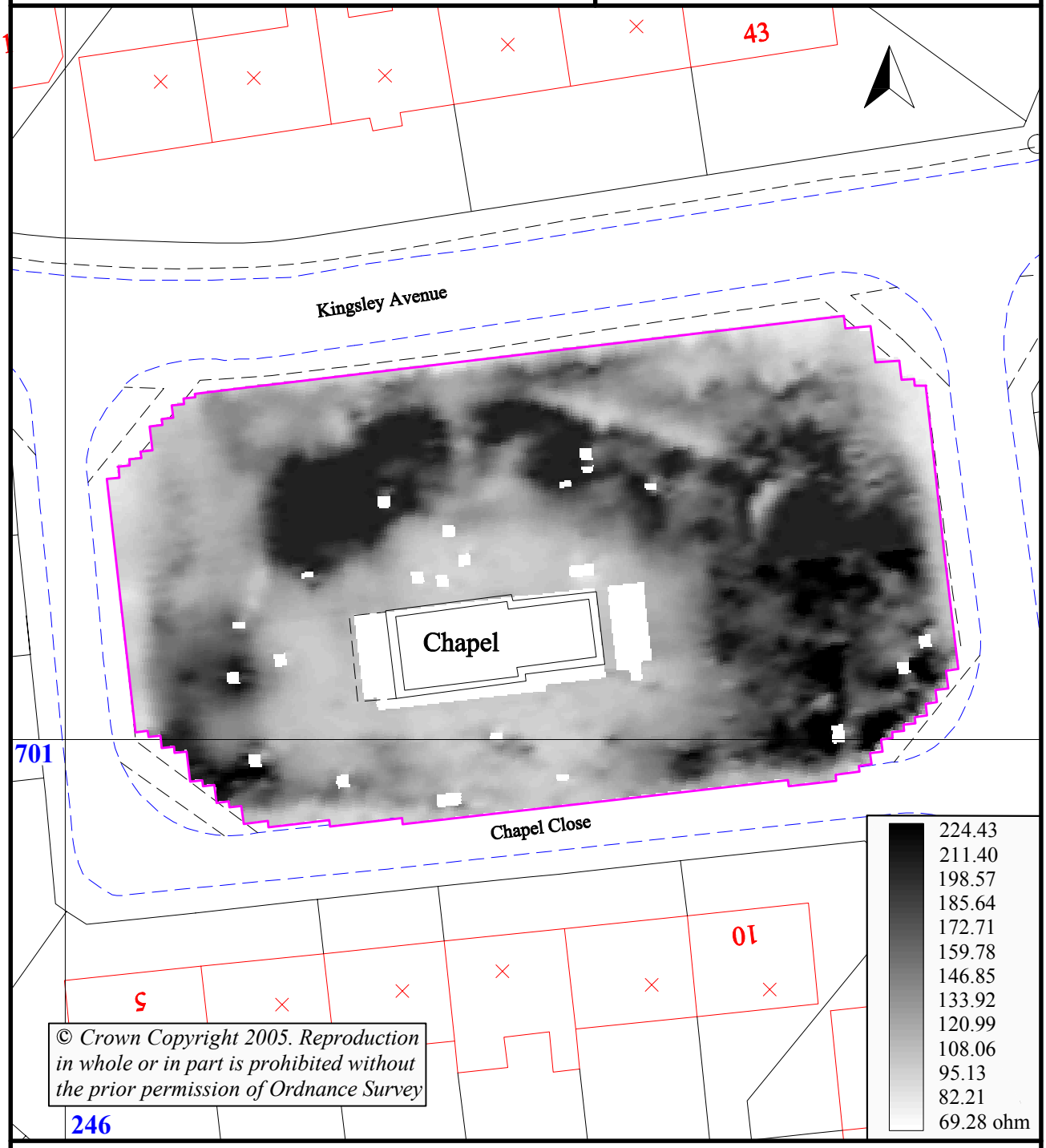
0 25m
scale 1:500 - for A4 plot



outline of resistance survey area

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Figure 5
Geophysical interpretation of resistance survey

on behalf of
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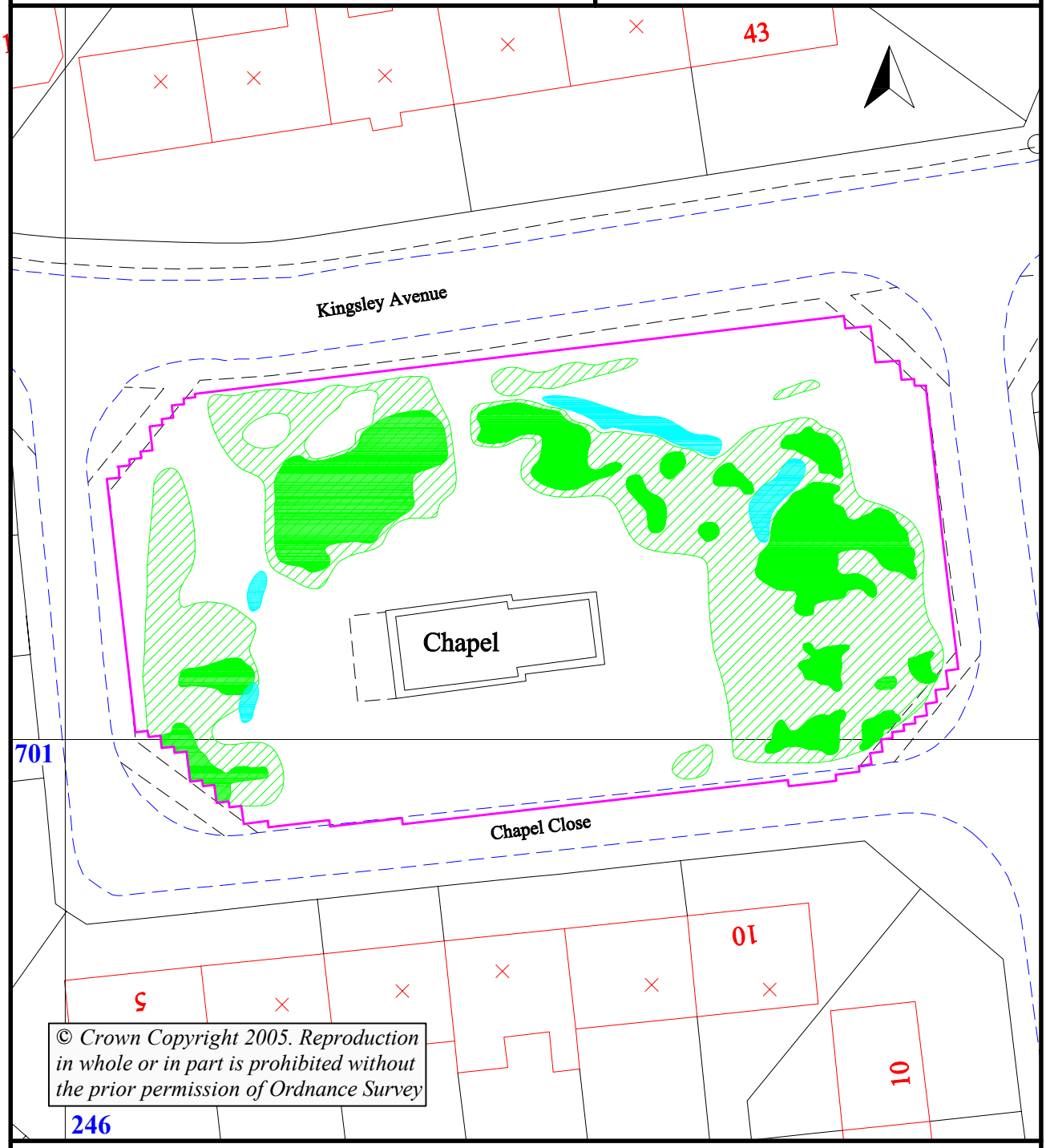
Newcastle City Council

0 25m

scale 1:500 - for A4 plot



outline of resistance survey area

high resistance

low resistance

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Figure 6
Archaeological interpretation

on behalf of
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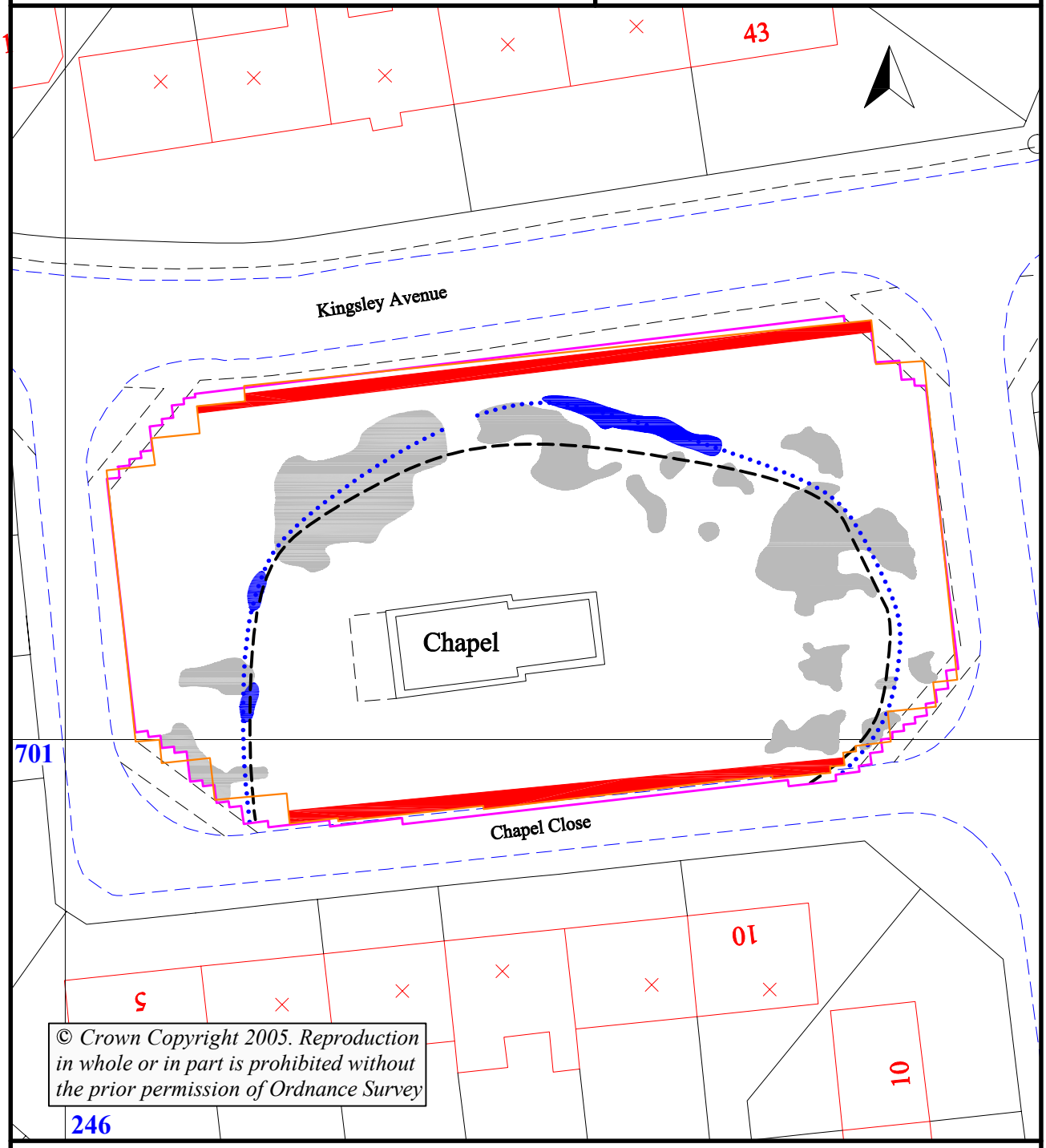
Newcastle City Council

0 25m

scale 1:500 - for A4 plot

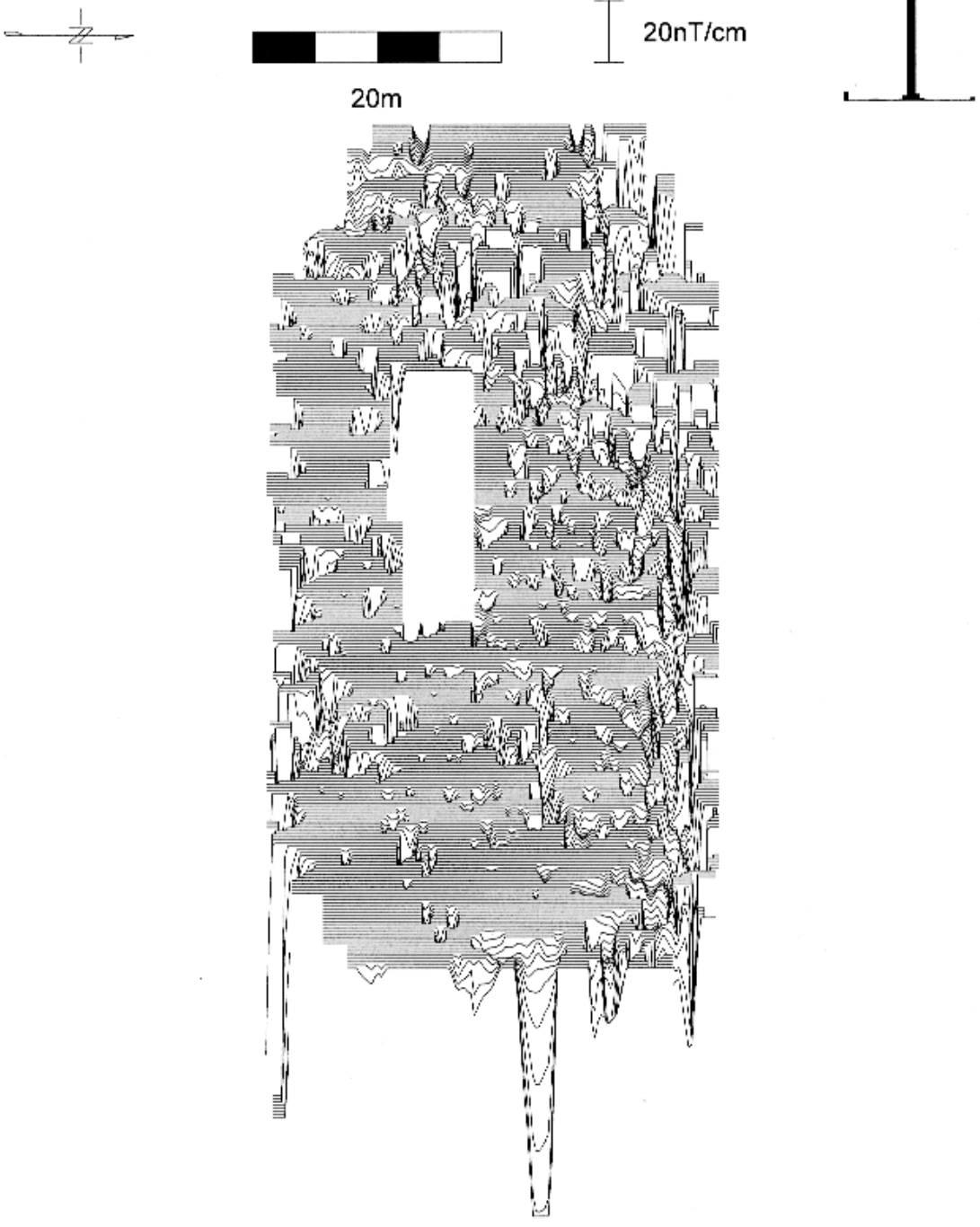


outline of geomagnetic survey area
outline of resistance survey area
utilities
ditch
possible wall tumble
location of former cemetery boundary from 1864 1st edition Ordnance Survey map

Appendix I: Trace plots of geophysical data

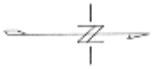
North Gosforth Chapel

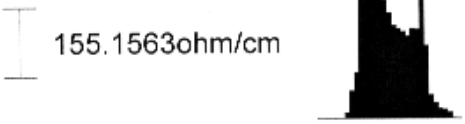
Geomagnetic survey, 1:500 @ A4

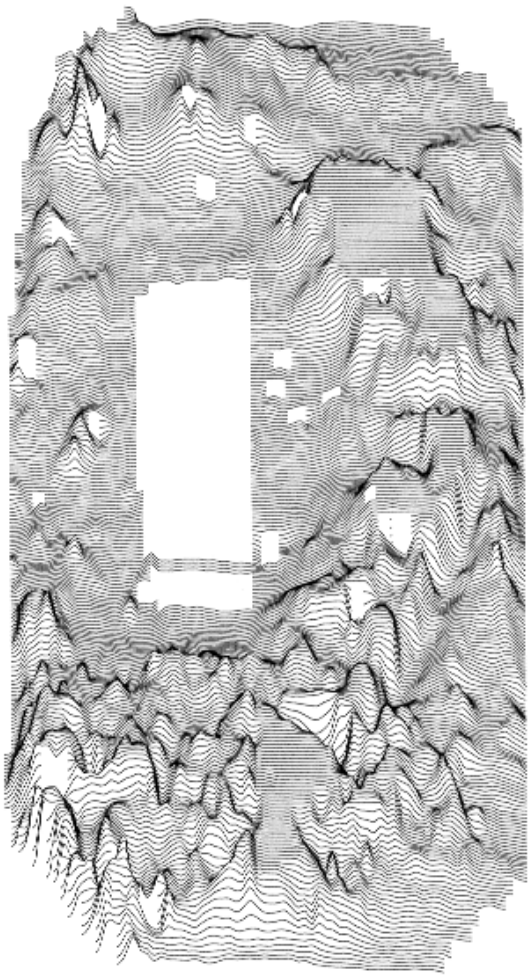


North Gosforth Chapel

Electrical resistance survey, 1:500 @ A4







Appendix II: Project specification

Specification for Geophysical Survey at North Gosforth Chapel, Kingsley Avenue, North Gosforth, Newcastle

Introduction

North Gosforth Chapel and its surrounding cemetery are protected as a Scheduled Ancient Monument (SAM 32056).

Little survives of the chapel above ground, but visible remains include the nave and chancel foundations and a number of gravestones (medieval and C17 in date). Earliest reference to the chapel is in 1256. The Surtees family were patrons of the church in C14. The last minister of North Gosforth Chapel is recorded in 1604. It was used for burial until the C18. The chapel is Scheduled as an example of a medieval chapel and cemetery, which also contains Roman material. More information is available in the County HER.

A group of local residents have formed the Friends of North Gosforth Chapel group in order to raise awareness of the historic importance of the monument and to improve the setting of the chapel. A programme of landscape enhancement is proposed. The extent of the cemetery and other subsurface archaeological remains needs to be ascertained before the landscape proposals are drawn up.

Geophysical survey is required to ascertain the extent of the archaeological remains in order to advise the landscape proposals.

The site measures circa 31m x 61m (the chapel itself is 20.5m x 7m and is to be omitted from the survey). The site is under closely cropped grass.

The appointed archaeological contractor must be a specialist in geophysical survey techniques.

All staff employed by the Archaeological Contractor shall be professional field archaeologists with appropriate skills and experience to undertake work to the highest professional standards.

All fieldwork, data processing and reporting must comply with English Heritage guidelines of 1995 ("Geophysical Survey in Archaeological Field Evaluation").

A licence is required to carry out a geophysical survey on a Scheduled Ancient Monument. The appointed archaeological contractor will be responsible for obtaining this licence, by writing to Kate Wilson, English Heritage, Bessie Surtees House, 41-44 Sandhill, Newcastle upon Tyne NE1 3JF (tel. 0191 2611585 or kate.wilson@english-heritage.org.uk) . The geophysical survey cannot take place until this licence is granted.

The Archaeological Contractor must inform the County Archaeologist of the start and end dates of the work to enable the CA to monitor the work in progress.

Methodology

A programme of geophysical survey should be drawn-up which provides 100% coverage of the site as detailed above.

The survey aims to map subsoil disturbances and locate anomaly-producing structures or deposits which might indicate the presence of archaeological sites.

It is assumed that a fluxgate gradiometer will provide the main survey data, however the price of a resistivity survey should also be quoted in the tender as a contingency figure, in the event that this is a more suitable technique for this particular site.

The data is to be recorded on a 1.0 x 0.5m grid.

The Archaeological Contractor must maintain a Site Diary for the benefit of the Client, detailing the nature of work undertaken on a day by day basis, with full details of Site Staff present, duration of time on site, etc. and contact with third parties.

Geophysics Report

The production of Site Archives and Finds Analysis will be undertaken according to English Heritage Guidelines (Managing Archaeological Projects 2nd Edition).

A full report should be produced within six months of the completion of the field-work. All drawn work should be to publication standard. The Evaluation report must contain and synthesise the results of the geophysical survey mentioned above. Some form of Digital Mapping, in CAD or GIS software that supports DFX or similar format would be greatly helpful.

Report drawings should show the National Grid. Surveys are to be tied in to known Ordnance Survey points with a Total Station. This is to enable a third party to later relocate any features of interest identified by the surveys.

The report must have the following features:-

1. Brief history of the site
2. Site location plan and grid reference
3. List of all sources consulted, and their location
4. Details of field methodology undertaken by the contractor and equipment used
5. Details of the stages employed to process the data
6. Plots of the geophysical data images accurately scaled and displayed on a base map which can be related to the Ordnance Survey

7. Plots of the archaeological interpretain of the geophysical survey displayed on a base map which can be related to the Ordnance Survey
8. A card cover with title, date, author, contractor organization and commissioning client
9. Some form of binding that permits photocopying.

Five copies of the report need to be submitted, one for the County Archaeologist, two for the Friends Group commissioning client, one for English Heritage and one for deposition in the County HER. The HER also requires a copy of the report on CD.

The tender

Tenders for the work should contain the following:-

1. Brief details of the staff and their relevant experience in handling data of this type
2. An indication of the earliest date for starting the survey, an indication of the time needed to complete the tasks outlined above, and the amount of notice required before commencement.
3. A quotation of cost, broken down into suitable sub-heads (travelling, staff-time, overheads etc).

Monitoring

The Archaeological Contractor will inform the County Archaeologist of the start and end dates of the work to enable the CA to monitor the work in progress.

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