

St Cuthbert's Church, Beltingham, Northumberland

geophysical surveys for the Sacred Yew Project

on behalf of

Volunteering Tynedale

Report 1519
August 2006

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1. Summary

The project

- 1.1 This report presents the results of geophysical surveys undertaken for the Sacred Yew project in the churchyard at Beltingham, Northumberland. The project is a collaborative venture between Volunteering Tynedale and local people.
- 1.2 The works comprised earth electrical resistance surveys around the ancient yew tree, within the graveyard on the north side of St Cuthbert's Church.

Results

- 1.3 The surveys have detected a particularly regular concentration of high resistance anomalies to the north of the nave, which could represent the remains of an early structure on the site.
- 1.4 A few very small high resistance anomalies could reflect buried grave slabs or fallen headstones.

2. Project background

Introduction

- 2.1 The Sacred Yew project is a collaboration between Volunteering Tynedale and the local community, and is based on the ancient yew tree in the churchyard of St Cuthbert's, Beltingham. The project aims to enable both visually-impaired and sighted people not just to conduct research on the tree and its setting but also to compose poetry and prose based on their perceptions and feelings for the tree and the space around it. Other elements of the project comprise local history, archery, art, music, botanical DNA analysis, dowsing and the publication of a booklet and audio CD.

- 2.2 Archaeological Services were invited to participate in the project by Volunteering Tynedale.

Location (Figures 1 & 2)

- 2.3 Two areas have been surveyed within the churchyard on the north side of St Cuthbert's Church, Beltingham, Northumberland, at NGR: NY 7895 6395.

Objective

- 2.4 The principal aim of the surveys was to determine the extent and nature of any sub-surface features of likely archaeological interest in the area of the ancient yew tree. Previous dowsing at the site by members of the British Society of Dowsers had identified the former presence of a small wooden building to the east of the yew, and the plan of an earlier, smaller church beneath the existing church.

Dates

- 2.5 The surveys were undertaken on 1st August 2006. This report was prepared between 4th and 7th August 2006.

Personnel

- 2.6 The fieldwork was conducted by Duncan Hale and local volunteers. This report was prepared by Duncan Hale with illustrations by Janine Fisher.

Acknowledgements

- 2.7 Archaeological Services is grateful to Volunteering Tynedale, the local community and the vicar of St Cuthbert's for assistance with the surveys.
- 2.8 Archaeological Services' involvement in the project has been possible thanks to Durham University's Partnership Venture Fund, part of the University's Higher Education Innovation Fund.

Archive/OASIS

- 2.9 The survey archive will be deposited with the Museum of Antiquities at the University of Newcastle upon Tyne. Archaeological Services is registered with the **Online Access to the Index of archaeological investigationS** project

(OASIS). The OASIS ID number for this programme of survey is ‘**archaeol3-17111**’.



The survey team

3. Landuse, topography and geology

- 3.1 The two small survey areas were within the churchyard at Beltingham. This comprised areas of both mown grass and overgrown vegetation, and contained paths, trees and gravestones.
- 3.2 The land immediately surrounding the church is predominantly level at a mean elevation of 90m OD. The churchyard occupies the end of a small promontory overlooking the floodplain of the River South Tyne, with land falling away quite steeply on all sides except to the south-west. Even within the churchyard there is a pronounced break in slope with land falling away northwards.
- 3.3 The solid geology of the area comprises Namurian ‘Millstone Grit Series’, which is variously overlain by glacial sands and gravels, boulder clay and alluvial deposits.

4. The geophysical surveys

Standards

- 4.1 The surveys and reporting were conducted in accordance with English Heritage Research and Professional Services Guideline No.1, *Geophysical survey in archaeological field evaluation* (David 1995); the Institute of Field Archaeologists Paper No.6, *The use of geophysical techniques in*

archaeological evaluations (Gaffney *et al.* 2002); and the Archaeology Data Service *Geophysical Data in Archaeology: A Guide to Good Practice* (Schmidt 2001).

Technique selection

- 4.2 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.
- 4.3 In this instance, given the anticipated shallowness and nature of targets, and the presence of standing structures on the site, an earth electrical resistance technique was considered appropriate for detecting any archaeological features which might be present. Earth resistance is the most widely used electrical survey method and relies on the relative inability of materials to conduct an electrical current. When a small electrical current is injected through the earth it encounters sub-surface resistance which can be measured. In the dry state most soils and rocks are insulators but when they become moist, electric currents are able to flow through the movement of ions dissolved in the porewater. As the soil or rock absorbs more water its conductivity increases. Hence electrical resistance surveying 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 resistance values while soil-filled cut features, which retain more moisture, will provide relatively low resistance values. When measurements are taken over a regular grid, a map of sub-surface archaeological features can be produced. Although more time-consuming than magnetometry, this method can be used in a wider range of locations since it is not affected by the presence of buildings, ironwork or igneous geology.

Field methods

- 4.4 A 20m grid was set-out at each of two relatively open areas to the north of the church. Measurements of earth electrical resistance were determined using a Geoscan RM15D resistance meter with twin probe array and 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.
- 4.5 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 collection

Data processing

- 4.6 Geoplot v3 software was used to process the geophysical data and to produce continuous tone greyscale images of the raw data. The greyscale images (Figure 3) have been imported directly into a digital basemap supplied by the Ordnance Survey. In the greyscale images, high resistance anomalies are displayed as dark grey and low resistance anomalies as light grey. Palette bars relate the greyscale intensities to anomaly values in ohms.

- 4.7 The following basic processing functions have been applied to the data:

Despike – locates and suppresses spikes caused by very high probe contact resistance

Interpolate – increases the number of data points in a survey. In this instance the data have been interpolated to 0.25m intervals.

Interpretation

- 4.8 A colour-coded interpretation plan is provided (Figure 4). One type of geophysical anomaly has been distinguished in the data:

high resistance regions of anomalously high resistance, which may be associated with areas of low moisture content such as wall foundations, tracks, paths and other concentrations of stone or brick rubble or voids

- 4.9 Electrical resistance values were typically high throughout the survey areas, almost certainly due to the prolonged dry weather prior to survey, however it was possible to detect variations in resistance in each area. A particularly regular, rectangular, zone of high resistance anomalies, measuring approximately 11m by 7m, was detected parallel to and north of the nave. These anomalies could reflect a concentration of stone or brick, either in the form of a deliberately laid surface or as a spread of rubble. Particularly high values within the larger, rectangular anomaly may represent greater depth or concentration of such material in those places. If this high resistance feature reflects the remains of a former structure, then it was almost certainly earlier than the yew tree, given their proximity.
- 4.10 Two areas of very high resistance values were also recorded in the second survey, to the north of the chancel. These anomalous areas are very small and whilst they may also reflect concentrations of stone or brick they are unlikely to represent structural remains.
- 4.11 Very small high resistance anomalies in both areas could reflect the presence of grave slabs just beneath the present surface.

5. Conclusions

- 5.1 Two small electrical resistance surveys have been undertaken in the churchyard at Beltingham, to either side of an ancient yew tree.
- 5.2 The remains of an early structure on the north side of the church may be represented by a rectangular area of high resistance anomalies.
- 5.3 Small high resistance anomalies elsewhere could reflect buried grave slabs or tumbled headstones.

6. References

- David, A (1995) *Geophysical survey in archaeological field evaluation*, Research and Professional Services Guideline **1**, English Heritage
- Gaffney, C, Gater, J & Ovenden, S (2002) *The use of geophysical techniques in archaeological evaluations*, Technical Paper **6**, Institute of Field Archaeologists
- Schmidt, A (2001) *Geophysical Data in Archaeology: A Guide to Good Practice*, Archaeology Data Service, Arts and Humanities Data Service



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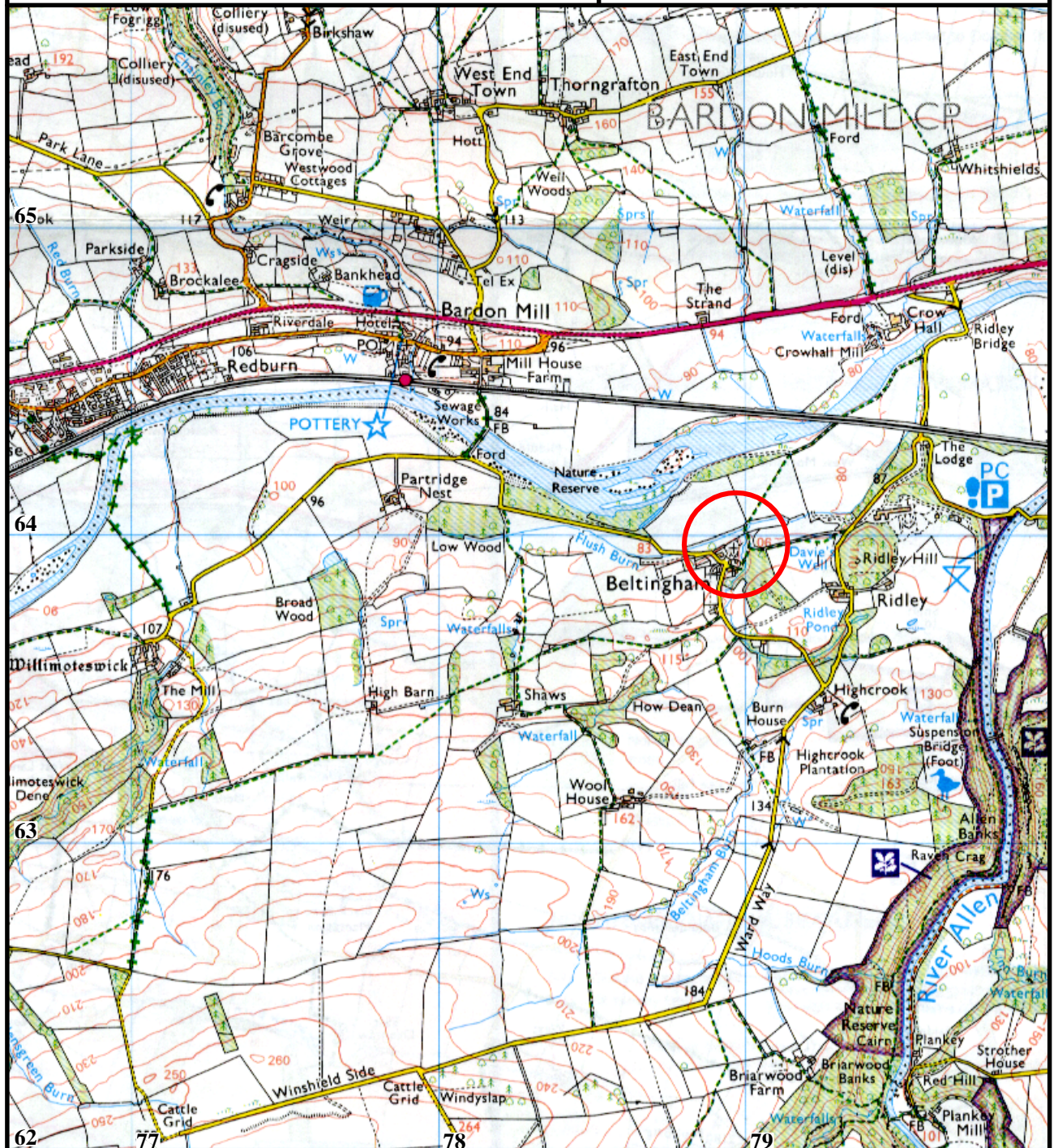
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Figure 1

Location map

on behalf of
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0 1km

scale 1:20 000 - for A3 plot





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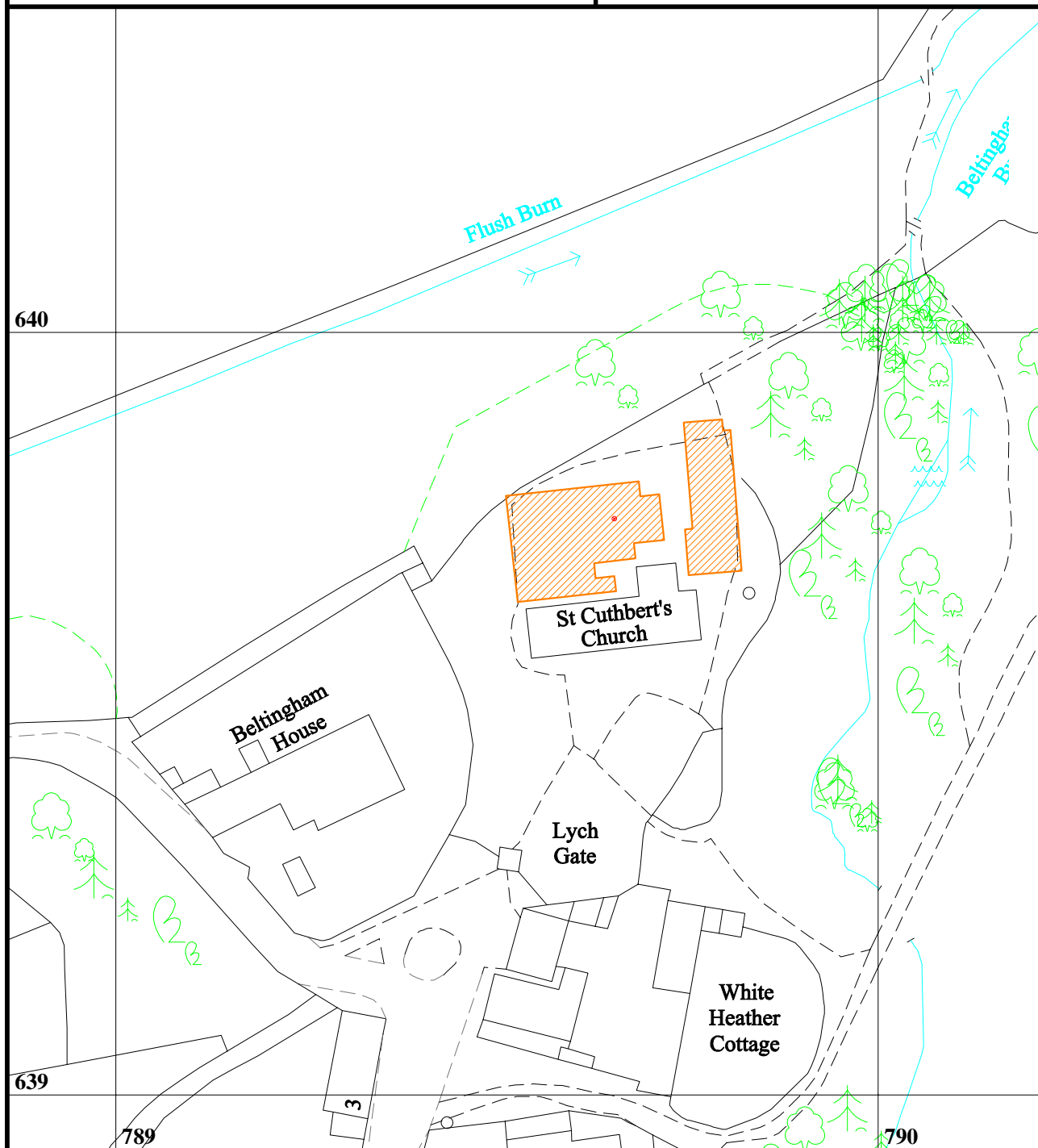
Figure 2

Location of geophysical surveys

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0 40m

scale 1:800 - for A4 plot



area of geophysical surveys



Yew tree



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Figure 3

Geophysical survey results

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0 5m
scale 1:125 - for A3 plot

 outline of survey area
 Yew tree

350.00
325.83
301.67
277.50
253.33
229.17
205.00 ohm
180.83
156.67
132.50
108.33
84.17
60.00

6398

6397

6396

7895

7896

7897

7898

path

St Cuthbert's
Church

path



CROSS

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Figure 4

Survey interpretation

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0 5m
scale 1:125 - for A3 plot

- outline of survey area
- Yew tree
- high electrical resistance /
stone concentration
- very high electrical resistance /
stone concentration

