An Integrated Archaeological Survey of Cuckney Churchyard, Castle, and surroundings. Cuckney, Nottinghamshire, 2016.
(SK 565713).

Integrated Archaeological Survey Report

Andy Gaunt & Sean Crossley
Mercian Archaeological Services CIC
07/06/2016
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Report MAS021

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Integrated Archaeological Survey Report

1. Summary

In 1951 during underpinning works at Cuckney Church a large number of burials, all stated to be male, were found in a series of pits beneath the northern part of the parish church (Barley 1951). The bodies were dug up, and subsequently re-buried somewhere in the churchyard. Professor Barley inferred that these burials pre-dated the church and probably dated to the 12th century anarchy, associated with a possible skirmish around the Motte and Bailey Castle that is believed to occupy the site.

In 1977 Stanley Revel proposed a theory based on place name evidence that the burials may instead be from the Battle of Hatfield fought in 632/633AD by the forces of King Edwin of Northumbria, against an alliance between Cadwallon of Gwynedd, and King Penda of Mercia (Revill 1975).

As part of a Heritage Lottery Funded project: *Does the Heritage of the Welbeck Estate Include A King Killed At Cuckney?* The Battle of Hatfield Investigation Society employed Mercian Archaeological Services CIC to lead an archaeological investigation to locate the possible burial pits, locate the possible reinterments from 1951, and to further interpret the site, earthworks and landscape; which includes the above-mentioned medieval castle of Cuckney. This report contains the results of the integrated archaeological survey overseen by Mercian Archaeological Services CIC, which included a geophysical magnetometer survey and a topographic earthwork survey by Mercian, and a ground penetrating radar survey by RSK Geophysics. The Ground Penetrating Radar survey detected anomalies under the church which could represent burial pits, and also found anomalies in the eastern part of the churchyard which could represent the re-interments from the 1950s. Magnetometer survey and topographic survey detected banks ditches throughout the survey area, increasing the knowledge of the scheduled area and surroundings.

During the surveys two late Saxon pottery sherds were recovered from the site, one just to the east of the present church and the other approximately directly 215m west of the first, within the valley of the Poulter. These sherds represent the first archaeological evidence for late Saxon activity in

Cuckney.

The project was designed and undertaken as a community archaeology project with volunteers receiving training and experience in archaeological techniques, learning about local heritage, and helping with the survey.

2. Project location, topography and geology

2.1. **Site Location:** The site is located (SK565713), in the parish of Cuckney, Nottinghamshire, Cuckney Church yard is to the north of the village of Cuckney. Cuckney village is located approximately half way between Mansfield and Worksop.

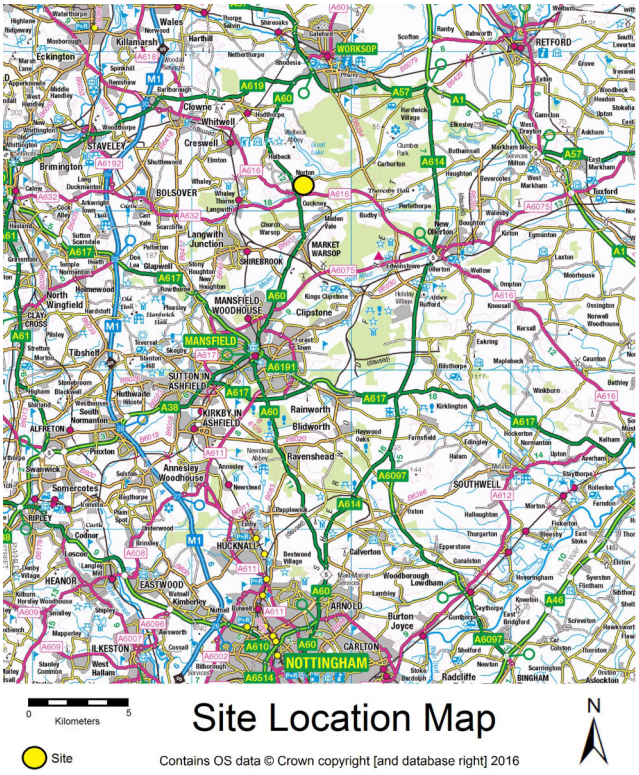

Figure 1: Site Location regional map.
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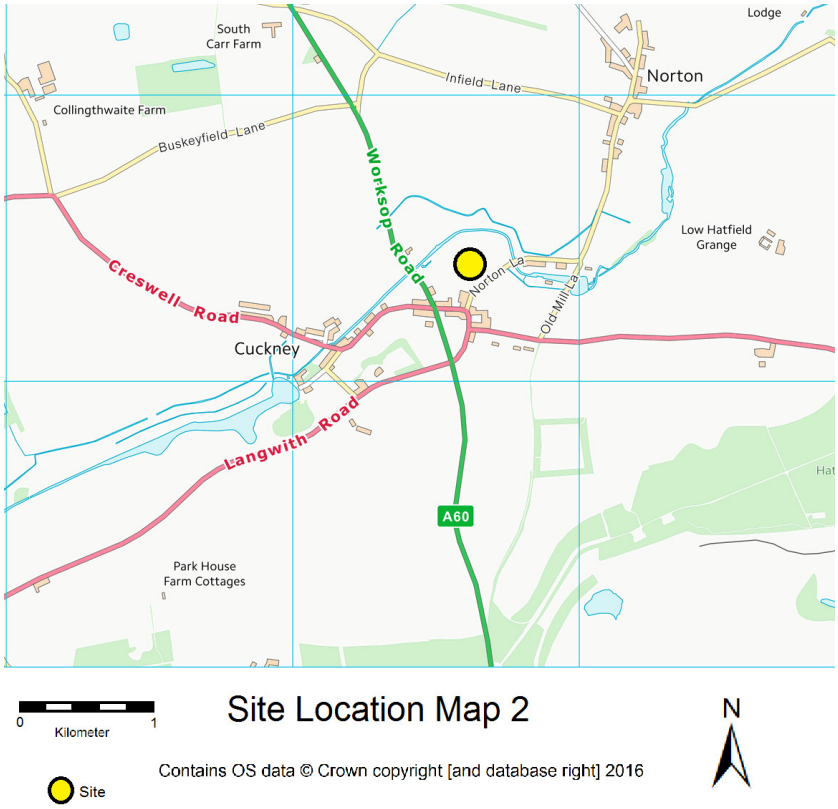

Figure 2: Site location from local map.
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2.2 **Topography:** The site is located in the valley of the River Poulter. The Church of Cuckney sits on a raised location at the northern end of the village of Cuckney above the flood plain of the river. The River Poulter forms the northern extent of the site, which is enclosed to the east north and west by a meander. The river's course has been canalised as part of a historic water meadow system. A number of earthworks occupy the lower ground between the churchyard and the river on this northern side. The site sits to the west side of a historic north-south route way from Mansfield to Worksop. Earthworks protected as a Scheduled Monument are extant in the western part of the churchyard, and to the north.

2.3 **Geology:** The 1:50,000 scale bedrock geology description for the site is as follows: Lenton Sandstone Formation - Sandstone. Sedimentary Bedrock formed approximately 246 to 271 million years ago in the Triassic and Permian Periods. Local environment previously dominated by rivers. These rocks were formed from rivers depositing mainly sand and gravel detrital

material in channels to form river terrace deposits, with fine silt and clay from overbank floods forming floodplain alluvium, and some bogs depositing peat; includes estuarine and coastal plain deposits mapped as alluvium. The site is enclosed to the north by the river channel of the River Poulter where the 1:50,000 scale superficial deposits description is as follows: Alluvium - Clay, Silt, Sand And Gravel. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by rivers. These rocks were formed from rivers depositing mainly sand and gravel detrital material in channels to form river terrace deposits, with fine silt and clay from overbank floods forming floodplain alluvium, and some bogs depositing peat; includes estuarine and coastal plain deposits mapped as alluvium. (www.BGS.ac.co.uk- accessed 29/03/2016).

3. Archaeological and Historical Background

3.1. **Place name:** The English Place Names Society volume for Nottinghamshire published in 1940 gives the derivation of Cuckney as "The second element is e.g. 'island of marshy land.' The first is probably... The personal name *Cuca* or *Cwica,* a pet form of such a name as [old english] *Cwichelm* (Glover et al 1940 p75). It lists the earliest appearances in the forms: Cuchenai 1086 Domesday Book, Cucheneia c 1150, Cuckeneya 1159-81, Cuckeneie c 1179, "and frequently in Inquisitions Post Mortem to 1295 with variant spellings *Kuk-* and *-eye, eia, -aie, -aye, -ee." Chugeneia 1185, Chugeneia 1187, Quikenea 1195, Kuyekeney c 1245, Cokeneye 1221, Cokkene 1393, Cokkenaye 1548, Coknay 1510, Cookney 1542, Cowkenay 1548, Cuckney 1684* (ibid).

3.2 **The Domesday Book of 1086**:

"The Land of Roger de Bully.
Bassetlaw Wapentake
In CUCKNEY Alric and Wulfsige had 1 carucate of lands to geld. [There is] land for 2 ploughs. There Geoffrey, Roger's man, has 1 plough, and 9 villains having 3 ploughs. [There is] woodland pasture 2 furlongs long and 2 broad. TRE* worth 20s; now 2s less." (Williams & Martin Eds. 2003. Pp 764-766)

“The Land of Hugh fitzBaldric.
In Cuckney Swein had 2 carucates of land to the geld. [There is] land for 4 ploughs. Richard holds it of Hugh, and has there 2 ploughs in demense; and 3 sokeman on 2 bovates of land and 10 villains and 5 bordars having 2 ploughs. There is a priest and a church, and 2 mills [rendering] 8s [and] woodland pasture 4 furlongs long and 4 furlongs broad. TRE, as now, worth 30s.” (Williams & Martin Eds. 2003. P779).

*TRE - Tempore Regis Edwardi (Time of King Edward the Confessor). Refers to the value of the holdings at the time of the Norman Conquest, 1066. The second value relates to the value at the time of the Domesday survey 1086.

3.3 **Prehistoric and Roman**

3.3.1. The Historic Environment Record (HER) is the repository for archaeological knowledge and information for the county. A 2km wide search of the database, centred on Cuckney church brings up a list of 54 Monuments and Elements.
The records listed on the HER include a number of undated linear earthworks, and undated cropmark enclosures; one in both Norton and Cuckney, an undated banked enclosure, and undated irregular earthworks.
The earliest dateable object is a Roman coin dating from 268- 273AD.

3.3.2. This Roman coin is the only artefact registered on the HER for Cuckney with a confirmed date prior to the medieval period (see Appendix IV).

3.4. **Medieval**

3.4.1**. Church.**

3.4.1.1. The earliest reference to a church in Cuckney comes from

the Domesday entry listed above, where a church and priest are recorded in 1086.

3.4.1.2. Nikolaus Pevsner describes the church in Cuckney in the following entry: “St, Mary. An unusually long nave of c. 1200 with a N aisle, in the W with circular piers, then two of quatrefoil plan, finally the others octagonal... The arches are all semi-circular and double chamfered. In date the arcade seems to stand between the lower stages of the broad short W tower and the S door (two orders without columns, one zig-zag, the other a thick angular rope motif) on the one hand and the upper stage of the tower (ashlar with mid-C13 two-light windows) and the S porch on the other. The S porch in any case seems EE [Early English] throughout (see its door with stiff-leaf capitals and its corbel table). The Piscina has dogtooth and nailhead ornament, - SCREEN now in the tower arch: only very small remains of Perp [Perpendicular] panel tracery” (Pevsner. 1951. p58).

3.4.2. **Motte and Bailey Castle.**

3.4.2.1. The Motte and Bailey Castle at Cuckney has been a Scheduled Monument since 28-Apr-1953. Scheduled Monument Number 1010909, Legacy Scheduled Monument Number 13393 (https://historicengland.org.uk/listing/the-list/list-entry/1010909, accessed 31/03/2016).

3.4.2.2. According to the Historic England website “Cuckney Motte and bailey castle is a reasonably well-preserved example of an adulterine fort built to command a river valley. Although the Motte and inner bailey are partially disturbed by modern burials, a sufficient amount remains intact for the structure of the Motte to be preserved and also the relationship between these areas and the outer bailey. The outer bailey itself has suffered little disturbance and so will retain the archaeological remains of ancillary features such as garrison buildings and corrals for stock and horses. The defensive earthworks associated with both the inner and outer baileys also survive well” (https://historicengland.org.uk/listing/the-list/list-entry/1010909, accessed 31/03/2016).

3.4.2.3. The Historic England website contains the following

detailed entry about the Scheduled area of the Motte and Bailey Castle:

“The monument includes the Motte, outer bailey and part of the inner bailey of the twelfth century Motte and bailey castle at Cuckney. Originally, the inner bailey extended further east into the area now occupied by the parish church of St Mary and the churchyard to the south. Although archaeological remains will survive here, these areas are not included in the scheduling as they are in current ecclesiastical use. The outer bailey may also have extended further south into the built-up area southwest of the church. This area is not included in the scheduling as the extent and state of preservation of the remains is not sufficiently understood. The inner bailey is a sub-rectangular platform orientated east to west. It measures 90m from north to south and 150m east to west. Only the western 80m are included in the scheduling. The Motte occupies the northwest corner of the inner bailey and consists of a flat-topped oval mound, 4m high and measuring 45m from north to south by 20m east to west. Both the Motte and the scheduled part of the inner bailey are occupied by the now disused graveyard associated with the church. The perimeter wall of the graveyard occupies the inner edge of a 10m wide ditch that encircles the west side of the Motte and encloses the inner bailey on the north side. Originally, it would also have enclosed the south side of the bailey but has been filled-in to the south of the church so that, on this side, only the area south of the Motte remains open. The remainder will survive as a buried feature in the unscheduled part of the inner bailey. The ditch does not appear to have extended along the east side of the inner bailey, which also lies in the unscheduled area. This indicates that the original entrance would have occupied this side. Encircling the inner bailey on the north and west sides is a 40m wide ribbon of open ground which functioned as an outer bailey. This is partially encircled by a double bank and ditch which lies roughly parallel with the River Poulter and is approximately 15m wide. The river would have formed another line of defence on this side and, in addition, could be commanded from the castle. The castle was built by Thomas de Cuckney during the reign of King Stephen (1135-54), which was a time of civil strife between Stephen's supporters and those of the Empress Matilda (Maud), daughter of his predecessor Henry I. The castle may therefore have been an adulterine fort; that is, one built without the king's permission. During the underpinning of the church in 1951, up to 200 burials were found which antedate the

building of the church in c.1200. They occupied three or four communal graves; that is, trenches dug north to south so that the bodies could be laid with their feet to the east. No associated finds have been recorded; neither have the remains undergone scientific analysis. However, it is assumed that the bodies were casualties from a skirmish associated with the Maudian rebellion. After their discovery, the skeletons were reinterred in a fresh communal grave. Excluded from the scheduling are the boundary walls crossing the monument and the graves on the Motte and within the scheduled part of the inner bailey, although the ground beneath these exclusions is included." (https://historicengland.org.uk/listing/the-list/list-entry/1010909, accessed 31/03/2016).

3.5. **Post Medieval**

3.5.1 The HER search (see Appendix IV) shows large amounts of building in the parish in the post medieval period, including a series of mills and workers cottages. The list also includes a number of sluices. These survive in the fields to the north of the River Poulter.

3.5.2. **Water Meadows system.** The River Poulter was the subject of a water meadow improvement scheme by the Duke of Portland during the 18th and 19th century (Gaunt 2009: 2010) this presumably resulted in canalisation of the water channel of the meander surrounding the site to the East, North and West.

3.6 **Mass Burials under the Church.**

3.6.1. As stated on the Historic England website, in relation to the entry for the Motte and Bailey Castle Scheduling, during underpinning works, undertaken in 1951 in advance of potential coal mining operations in the area, builders discovered a large number of skeletons. Maurice Barley reported the find in the transactions of the Thoroton Society, but his interpretations and descriptions were not based on first hand evidence, but on the testimonies of the workmen and others. It was estimated that burial pits under the church could hold up to 200 burials. These burials were believed to have pre-dated the building of the church in the later 12th century and early 13th century (Barley 1951).

3.6.2. The burials occupied three or four trenches dug north to south so that the bodies could be laid with their feet to the east.

3.6.3. No finds were recorded to date the bones, no photographs survive, if they were taken, no drawings were made, and no scientific analysis was undertaken. No primary evidence of the burials is known.

3.6.4. Professor Barley assumed that the bodies were casualties from a skirmish or battle dating from the period of the Anarchy of Stephen and Matilda in the middle part of the 12th century.

3.6.5. This suggestion ties in with the building of the possible adulterine Motte and Bailey Castle, and is the preferred date for the origin of the burials according to Historic England.

3.6.6. The skeletons that were dug up in the 1951 works were reinterred in a new location in the graveyard.

3.7. **The Battle of Hatfield**

3.7.1. In 1975 Stanley Revill reassessed the evidence for the burials, and using place name evidence among other arguments, he suggested that the burials might have dated from the 633AD Battle of Hatfield, where Edwin of Northumbria was defeated and killed by the combined forces of Penda of Mercia and Cadwallon of Gwynedd. Revill referenced the existence of Hatfield Grange, High Hatfield Farm, the location of Cuckney in the District of Hatfield, the western part of the Wapentake of Bassetlaw, Edwinstowe, and St Edwin's chapel in Clipstone, all as indicators of the possible memory of the battle and death of King Edwin in the area (Revill, 1975).

3.7.2.Revill was not the first to suggest the Battle of Hatfield was fought local to Cuckney. In 1890 Stapleton in his "*History of the Lordship of King's Clipstone or Clipstone in Sherwood, Nottinghamshire"* speculated that St Edwin's Chapel in Clipstone parish was likely named after King Edwin and the Battle.

3.7.3. John Chapman's map of Nottinghamshire from 1774 depicts Hatfield District covering the western half of Bassetlaw Wapentake.

3.8. **Historic Mapping** (see Appendix IX)

4. Research Aims and Objectives

4.1. As part of the Heritage Lottery Funded Project; There were a number of research aims, relating firstly to the 1950s discovery of potential burial pits and re-interments and secondly to the location and form of the medieval castle.

4.2. The first aim was to investigate if any evidence could be found underneath within the vicinity of the church, of the burials mentioned by Maurice Barley in his article.

4.3. The project aimed to search for evidence of the re-interment of bones within the cemetery as reported from the 1950s following their removal for works in the 1950s.

4.4. The project aimed to further understand through non-invasive methods; the earthworks in and around the churchyard that have historically become associated with the Scheduled area of Cuckney Castle. This would be undertaken using a mixture of Topographic survey and Geophysical survey techniques.

4.5. The project was designed with the aim of potentially addressing the following updated research agenda questions highlighted in the recent publication: (Knight, Vyner and Allen 2012). *East Midlands Heritage- An Updated Research Agenda and Strategy for the Historic Environment of the East Midlands:*

4.5.1. Research Objective 3F: Identify monument complexes and prioritise for curatorial action.

4.5.1.1. This is an urgent requirement due to burials in the churchyard. Mercian Archaeological Services CIC have identified potential risk to the re-interments from the 1951 under-pinning work, due to their

location being unknown. If the reburials fall outside the scheduled area, and within the area being used for modern burials, they are under potentially imminent threat. It is vital therefore that these burials, if they are in the graveyard, can be located as a high priority to prevent potential loss of or damage to the buried remains by modern burial activity.

4.5.2. Research objective 6F: Identify cultural boundaries in the Early Medieval period.

4.5.3. Research objective 7G: Estates, architecture and power: investigate the relationship between castles and great houses and their estates.

4.6. The project forms part of Mercian Archaeological Services CIC's research into the historic development of the landscape of Sherwood Forest.

4.7 The project forms part of Mercian Archaeological Services CIC's research into settlement development in Sherwood Forest.

5. Methodology

5.1. **Geophysical Survey** enables the non-invasive identification of buried or sub-surface features. These may include features of potential archaeological significance. Geophysical survey as employed in archaeology usually comes from one of three techniques: Magnetometry, Earth Electrical Resistance, or Ground Penetrating Radar (GPR). Techniques are chosen 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, but also more often than not choices are based on time, and therefore financial reasons. Best results are gained from an integrated survey where more than one technique is employed. For this integrated survey, two forms of Geophysical survey were chosen. Magnetometer survey was employed to cover as large an area as possible, and to search for anomalies such as ditches and pits associated with earthworks from the Castle and surrounding landscape. Ground Penetrating Radar was chosen in order to search for the potential burials both under the church, and the possible re-

interments from the 1951 works. Mercian recruited RSK Geophysics to undertake the GPR survey due to their experience of working with burials. The methods of the geophysical surveys are outlined below.

5.1.1. **Standards**

5.1.1.1. The Magnetometer survey and reporting were conducted in accordance with Historic England guidelines, *Geophysical survey in archaeological field evaluation* (David, Linford & Linford 2008); the Institute for Archaeologists (IfA) *Draft Standard and Guidance for archaeological geophysical survey* (2010); 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* (draft 2nd edition, Schmidt & Ernenwein 2010).

5.1.1.2. The survey was undertaken using a Bartington Grag6012 fluxgate gradiometer. 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; archaeological features can cause such anomalies. The gradiometer works by measuring the earth magnetic field at two separate sensors; one positioned 1 metre above the other. The lower of the two sensors is place nearer to the ground surface and so is affected by magnetic variations in the soil. The signal is either higher or lower than the top sensors. This 'gradient' is recorded.

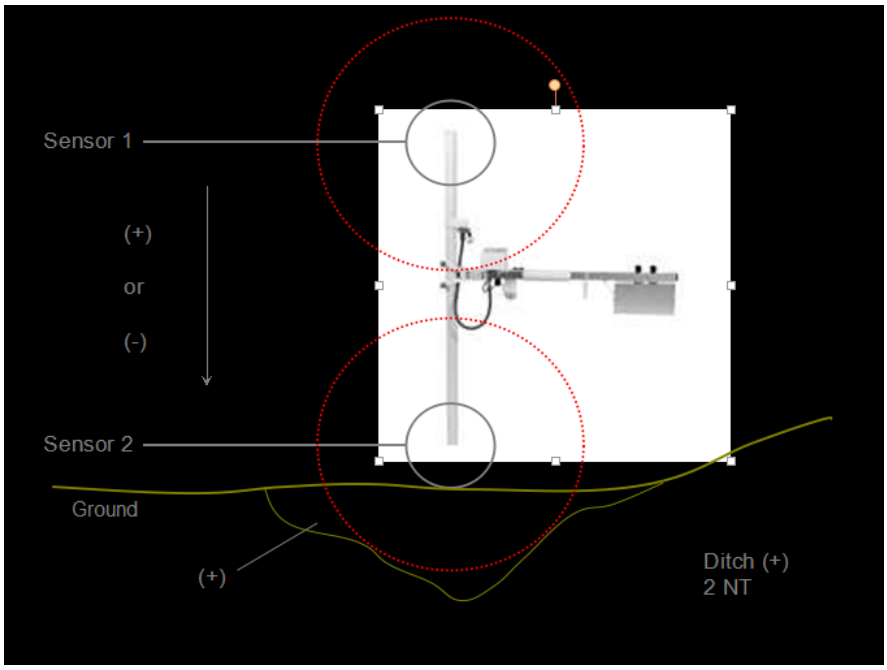

Figure 3: Theory of Fluxgate Gradiometer recording anomaly.
A. Gaunt © Mercian Archaeological Services CIC, 2015.

5.1.1.3 **Fieldwork Methods**

5.1.1.3.1. A 20m grid was established across the survey area using tape measures and pegs. This grid was then recorded using the Total Stations to give accurate Ordnance Survey data locations for the grid. Three separate areas were surveyed (see figure 5).

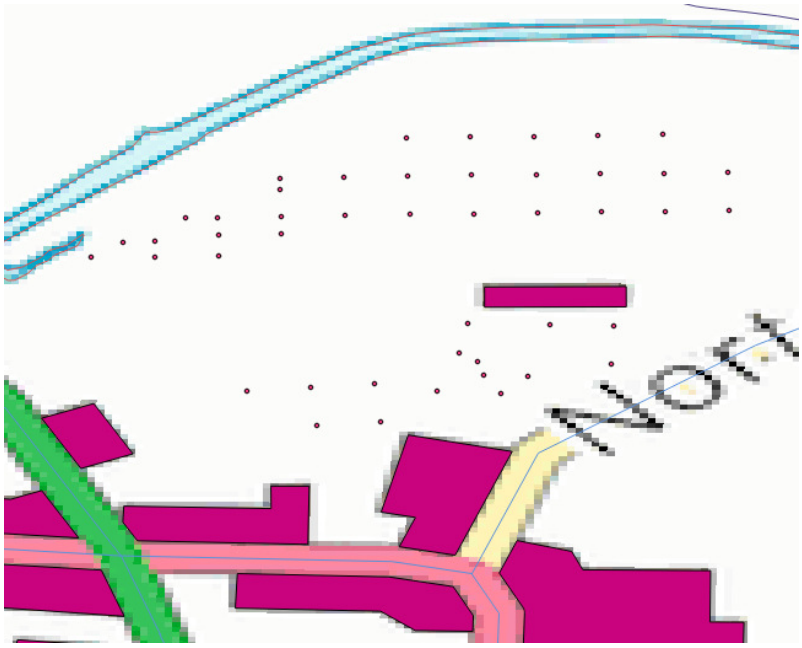

Figure 4: Points recording the geophysical survey grid.
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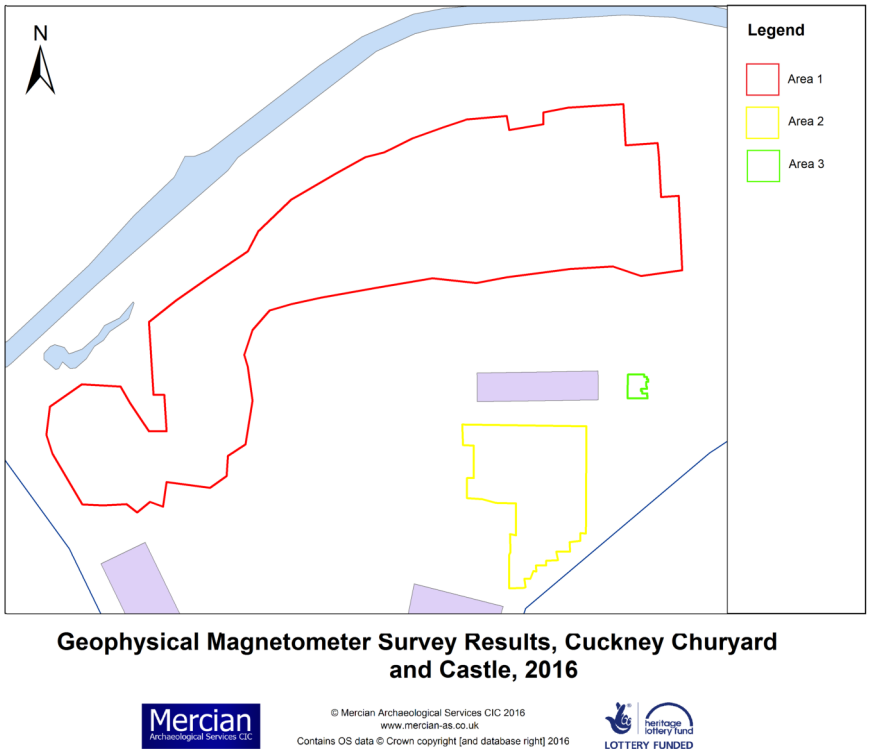

Figure 5: Magnetometer Survey Areas.
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5.1.1.3.2. Measurements of vertical geomagnetic field gradient were determined using Bartington Grad601-2 dual fluxgate gradiometers. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was nominally 0.03nT, the sample interval was 0.25m and the traverse interval was 1m.

5.1.1.3.3. Data were downloaded on site onto a laptop for initial processing and storage. The data was backed up onto Mercian's data network, with copies made of the data for processing.

5.1.1.4. I**nterpretation and Archiving.**

5.1.1.4.1. **Data processing**

5.1.1.4.1.1. Grids collected in the field were downloaded and processed in a combination of Snuffler version 1.14, and Geoplot v.3 software. Grids were meshed together into a composite map of the survey. Snuffler 1.14 and Geoplot v.3 were used to process the geophysical data and to produce both a continuous tone greyscale image and a trace plot of the raw (minimally processed) data. A plot of filtered data is also provided. The greyscale images are presented in Figures 11, 12, 13, 15, 16, 18, and 19. Trace plots provided in Figures 14, 17, and 20. An interpretation plot is provided in Figure 21. In the greyscale images, positive magnetic anomalies are displayed as light grey and negative magnetic anomalies as dark grey. A key bar relates the greyscale intensities to anomaly values in NanoTesla.

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

5.1.1.4.1.3. **Clip:** This clips data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic.

5.1.1.4.1.4. **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.

5.1.1.4.1.5. **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

5.1.1.4.1.6. **Destripe:** used to remove error caused during data collection.

5.1.1.4.2. **Anomaly types:**

5.1.1.4.2.1. A colour-coded geophysical interpretation plan is provided. Three types of geomagnetic anomaly have been distinguished in the data:

5.1.1.4.2.2. **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 (in Purple in Figure 21).

5.1.1.4.2.3. **Negative magnetic** regions of anomalously low or negative magnetic field gradient, which may correspond to features of low magnetic susceptibility such as wall footings (Blue in Figure 21).

5.1.1.4.2.4. **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 (pink in Figure 21).

5.1.1.4.3. **Interpretation: features**

5.1.1.4.3.1. A colour-coded archaeological interpretation plan is provided. Except where stated otherwise in the text below, positive magnetic anomalies are taken to reflect relatively high magnetic susceptibility materials, typically sediments in cut archaeological features (such as ditches or pits). The fill of ditches is often magnetically enhanced by decomposed organic matter or by burning.

5.1.2. **Ground Penetrating Radar**

The following is Ground Penetrating Radar Survey Methodology is taken from the RSK report (see Appendix VII):

5.1.2.1. **Objective and Geophysical Approach**

“It is understood that the church dates from the 12th Century, although it

has been substantially altered and reconstructed several times since. During the last major phase of reconstruction works in 1950, which involved the excavation of six north-south orientated trenches across the nave to lay foundations to underpin the structure, skeletons were recovered from the trenches. Based on information from the client, the number of skeletons uncovered may have totalled as many as 200 in 3 or 4 (no.) separate areas from ~0.5m to 2.5m depth. The skeletons were all male and systematically buried. It is reported that the bones were then reinterred in several pits in the church grounds. Anecdotal evidence suggests that one such pit may be located in the north east corner of the grounds. It is not known how far the bones extended beneath the church away from the trenches. The objective of the survey was to survey areas around the Church, and inside the Church where access allows, in order to evaluate the geophysical response for anomalous areas that may relate to the burial pits, or the re-interned pits from the 1950s. It has been suggested that the mound may also relate to activity from this period, and again any anomalous features may indicate where further intrusive excavations could be targeted. The geophysical technique employed was Ground Penetrating Radar (GPR). The survey was undertaken between the 2nd and 5th November 2015" (RSK 2015, p4, Appendix VII).

5.1.2.2. **The Ground Penetrating Radar Technique:**

"In GPR surveys, electromagnetic waves of frequencies between 50MHz and 1.5GHz are transmitted into the ground or structure. This energy is reflected back to the surface when it encounters significant contrasts in dielectric properties" (RSK 2015, p4, Appendix VII).

5.1.2.2.1. **Theory**

"Both surface and borehole GPR techniques use electromagnetic waves of frequencies between 50MHz and 1.5GHz to probe the subsurface (Figure 3a). A radio wave transmitter (TX) is used to generate a short (<20ns) pulse of radio waves of specific frequency (depending on the antenna selected). These radio waves penetrate into the subsurface. Some of the energy carried by these waves is transmitted to greater and greater distances, while some of the energy is reflected back towards the receiver (RX) whenever a

contrast in electrical properties is encountered. The amount of energy reflected is dependent on the contrast in electrical properties encountered by the radio waves. The receiver measures the variation in strength of the reflected signals with time. The resulting profile is called a 'trace' and is a one-dimensional representation of the subsurface beneath the transmitter and receiver. To build up a two-dimensional section of the subsurface (a radargram), the transmitter and receiver are traversed across the surface at a controlled speed. The higher frequency antennas provide high-resolution data over shallow depths (<0.5m), and are mostly employed for near surface structural investigations (e.g., characterising rebar in concrete). The lower frequency antennas can probe to greater depths (up to 30m, depending on subsurface conditions) but exhibit a reduced degree of resolution. These antennas are typically employed in geological/hydrogeological investigations (e.g., locating cave systems and sinkholes). In order to present time sections as depth sections, some form of calibration is required through borehole or core information, or through an assessment of the electrical (dielectric) properties of the surveyed materials. The velocity of the EM pulse through the ground is directly related by the dielectric constant, (ξ) of the medium. As such the presence of moisture and voiding has a significant role in affecting the nature of the reflections encountered" (RSK 2015, pp4-5, Appendix VII).

5.1.2.2.2. **Application to Site**

"GPR can be used to detect responses associated with human burials in several ways. It may detect the disturbed soil of the grave shaft, or a break in the natural soil profile. It may also detect the coffin, bones or other articles in the burial. Reflections may be caused from air voids within the coffin or skull. These features within the otherwise homogeneous structure of the ground may constitute a contrast in dielectric (electrical) properties, and generate anomalous reflections within the radargrams. The nature and strength of these reflections will be dictated by the size/orientation of the objects, and to some extent, the respective contrast in dielectric properties with the surrounding ground. Decomposition of bones may also leach into the ground changing the electrical properties of the soil. Mass burials (in particular if positioned all in the same orientation) will provide a larger geometric response than of that expected from a single burial. For historic burials, features are likely to be much more subtle as the ground is likely to

have compacted and settled, voids compressed, and ground chemistry returned to near background levels, however if the burials have subsequently been reinterred to a new location, the more recently disturbed ground should still be evident." (RSK 2015, p5, Appendix VII).

Plate1: RSK Geophysics GPR data acquisition using the DF system in the eastern part of the churchyard (RSK 2016, p6. see Appendix VII)

5.1.2.2.3 **Equipment**

5.1.2.2.3.1. **Dual Frequency System**

"A dual frequency (DF) GPR system using the latest digital 300MHz and 800MHz antenna were deployed to site to provide the most appropriate depth penetration and resolution. The higher frequency antenna provided clearer information on shallow disturbed ground, and higher resolution features in the near surface, whilst the lower frequency antenna provided information on deeper features. The GPR equipment used was the SIR (Subsurface Interface Radar) Dual Frequency system manufactured by Geophysical Survey Systems Inc (Serial no 2261). See equipment specifications in Appendix A" (see this report Appendix II). "The scan rate was set to record 200 scans per meter and the depth range was set to 3m. A large odometer wheel was mounted to the antenna to ensure that the rough grass encountered at the site could be traversed" (RSK 2015, pp5-6. Appendix VII).

5.1.2.2.4. **Survey Design**

"Areas of interest subject to the survey were highlighted to RSK by the client. These included areas of the churchyard immediately north, east, south and west of the church, together with accessible parts of the nave within the church. Additional areas requested by the client included two parts of the castle mound in the west of the site (one in the cemetery and one further west near the A60). All accessible areas covered with the GPR survey are shown shaded blue in Figure 22 and covered as follows:

North, west, south, east surrounds of churchyard – 4,000 m2

Nave (interior) – 125 m2

Castle mound – 725 m2 (cemetery) and 490 m2 (far west)

Data were acquired in accordance with the 'Geophysical Survey in Archaeology Field Evaluation' guidelines produced by English Heritage, 2008. A survey grid with parallel lines generally spaced at 0.5m intervals in both north-south, and east-west orientations were used across the areas. In lower priority areas to the far west and south, an interline spacing of 1m was used". (RSK 2015, p6. Appendix VII).

5.1.2.2.5. **Data Processing and Presentation**

"GPR data have been imported into the specialist processing software RADAN. This allows the user to apply complex processing routines and algorithms, which help to improve signal to noise ratio and highlight reflections of interest. Data are interrogated in section view. Anomalous reflections can be 'picked' from the data set and exported to other software packages to be superimposed onto a site plan. Time slice data for the 1-2m depth range has been plotted in plan view to show amplitude data indicative of probable burials, together with ten example GPR radargrams from the site, which are presented in Figures 4-7. The colour scale represents signal amplitude, with deep red representing positive amplitudes. Raw data have been processed as described in Table 1 (redrawn from RSK 2015, p7, in this report Appendix VII):

Table 1: **Summary of GPR processing methods**

Method	Justification
Distance calibration	Horizontal measurement is undertaken using a wheel odometer mounted to the antenna and is calibrated daily and saved on the GPR console. An on-site check over 10m was conducted and found to be accurate.
Depth calibration	A dielectric constant of 14 for sandy moist soil has been used for the ground in order to give the most accurate indication of depth. Accuracies of ±20% are likely.
Zero-offset	To correct the signal to the actual ground surface level.
Gain control	Used an exponential attenuation factor to compensate for the signal attenuation with depth and enhance the signals from deeper reflectors to aid interpretation of features. Each profile was enhanced with the same gain parameters where possible.
Filtering	High and low pass filters were set at 150 MHz and 600 MHz for the 300GHz antenna, and 400 MHz and 1600 MHz for the 800GHz antenna to remove noise from the data, and to isolate “legitimate” signals from reflections of the pulse from the instrument.
Stacking	To increase the signal to noise ratio, a data enhancing acquisition stack (cumulative average) of 2 pulse repetitions was used for each data point.
Export	Apply appropriate colour scheme to combined grid and export dataset for presentation, with colour scale bar. High response anomalies are shaded red to indicate buried features within the ground.

5.1.2.2.6 **Data Interpretation**

5.1.3.5.1 **Data Quality**

"The radar data acquired gave clear reflections in the shallow sub-surface, the maximum depth from which reliable reflections were obtained being approximately 1.0m with the 800MHz antenna and 3.0m with the 300MHz antenna.

The effectiveness of the GPR is determined by the soil conditions. At this site, soil conditions were generally sandy (with high electrical resistance) which helps to improve signal penetration depth. Due to the numerous modern burials ground conditions are often heterogeneous which has contributed to signal scattering which can mask responses from features at deeper depth.

Numerous buried services have also been located across the site, leading from, and around the church. These have been drawn on the interpretation plan. In these areas the presence of the service may obscure responses from possible burials below. As a result of the underpinning works undertaken in the 1950's, the presence of the new foundations will obscure responses from burials directly below. Within the church nave the reinforced foundation beams are narrow at ~1m width therefore in the ~3m width of ground between the beams, the GPR is able to image into the ground unhindered. Exterior to the church, there is a 2-3m wide strip of disturbed ground all around the church outer wall which is likely the result of trenchwork which was dug in the 1950's as part of the underpinning works. Due to this interference it is difficult to image through the 'noise clutter' generated, however changes in response are still visible and show additional features below this area" (RSK 2015, p8. Appendix VII).

5.2. **Topographic Survey Methodology**

The Topographic earthwork survey was undertaken to record and interpret the earthworks in and around Cuckney churchyard, including those that are designated as the Scheduled monument of Cuckney Castle. The survey was also designed to provide a 3 dimensional and 2 dimensional framework for the Geophysical radar and Magnetometer surveys. The survey was undertaken to produce a 2D hachure plan of the earthworks using subjective survey techniques, and to produce 3D Digital terrain models (DTM) of the earthworks by combining the data from subjective survey with

data from objective surveys.

5.2.1. **Equipment**

5.2.1.1. The survey was undertaken using survey grade Global Positioning System (GPS), Electronic Distance Measuring (EDM) Total Station, and Robotic EDM Total Station with 360° prism. The GPS system used was a Leica GPS Viva; enabled to use Smartnet technology. This GPS system operates using Differential GPS (DGPS), where corrections are given to improve the information received from satellite location data. A rover station controlled by the operator recorded points operating in Real-time Kinematic mode, receiving data from a remote system of control stations. This Smartnet system, corrects the rover station, allowing points to be recorded 'on the fly' to subcentimetre accuracy levels, via a mobile SIMM card connection. The GPS rover was set to record either continuously or to take static points, depending on requirements as recommended in Ainsworth, S. & Thomason, B. 2003. The GPS was used to set up accurate control points which could form the 'Control of Survey' for the optical survey techniques (see below).

5.2.1.2 EDM Total Station combines a Theodolite to record vertical and horizontal angles, and an Electronic distance measurement device, to enable the acquisition of 3-Dimentional coordinate data. Total stations reflect infrared laser beams against a reflective prism. Two different Total Stations were utilised during the Cuckney survey to provide the different aspect of the survey. The first Total Station, a Leica TS06, requires two operators, one to operate the device and the other to position the prism pole in the required location for surveying. The second Total Station was a Leica TS15 Robotic 360° prism station. This device enables an operator to gather points automatically at a set increment while the total station 'locks on' and automatically follow the user around the site. This method allows a large volume of data points to be recorded quickly.

5.2.1.3. EDM Total Stations also provide subcentimetre relative accuracy for recordings (http://totalstation.org/total-stationfunctionality.php). The stations are orientated by coordinate or re-sectioning from known coordinates which are taken from control points (see below) provided by the Differential GPS. All points recorded are therefore accurate to, and recorded in Ordnance Survey Datum.

5.2.2 **Control of survey**

5.2.2.1 Control of survey is the accurate framework of carefully measured points within which the rest of the survey is fitted' (Ainsworth, et al. 2007). Section 2.1 *Control of Survey in Metric Survey Specifications for English Heritage* states that metric survey 'must provide reliable and repeatable control capable of generating the required coordinates within the tolerances stated' (Lutton.2003).

5.2.2.2 The prescribed tolerance level is to a precision of ±10mm (Lutton. 2003). This level of control was achieved by using the Differential GPS Leica Viva system mentioned above. The GPS device was set to take readings within ±10mm accuracy levels, and then used to stakeout station points using 99 epochs per location. The points were chosen to provide inter-visibility across the site for optical survey using Total Stations. Total stations were set up above these station points when required and orientated by the other survey control points to provide control between GPS and optical survey. The control points were also used to configure the Total Stations by re-sectioning techniques. Further control points and Temporary Bench Marks (TBM) were set up around the site using the GPS as required. As well as falling within the accepted tolerance levels, this technique also fulfils the requirement that the control must be repeatable. The site can easily be re-occupied using GPS devices in the future without the need to leave permanent site pegs on a Scheduled Site.

5.2.3. **Objective and Subjective survey methodology**

The survey was undertaken using a combination of objective and subjective survey techniques.

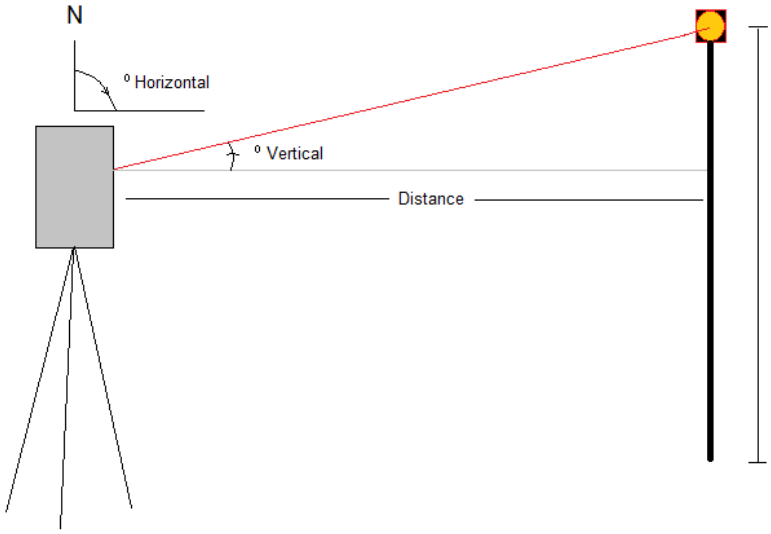


Figure 6: Using a Total Station and prism pole to record points, showing how device records angles and distance (infrared light beam shown in red).
© Mercian Archaeological Services 2016.

5.2.3.1 **Objective Survey**

5.2.3.1.1. The objective, systematic part of the survey was carried out using the GPS Viva system described above, but due to tree cover a robotic TS15 Total Station was also used. 1m transects were surveyed across the site walked at right angles to give regular and objective coverage. Transect increments were controlled by volunteers at the ends of the transects acting as markers for the surveyor carrying the robotic total station 360° prism pole. Surveyors walked these transects, and recordings were automatically taken every 0.25 metres.

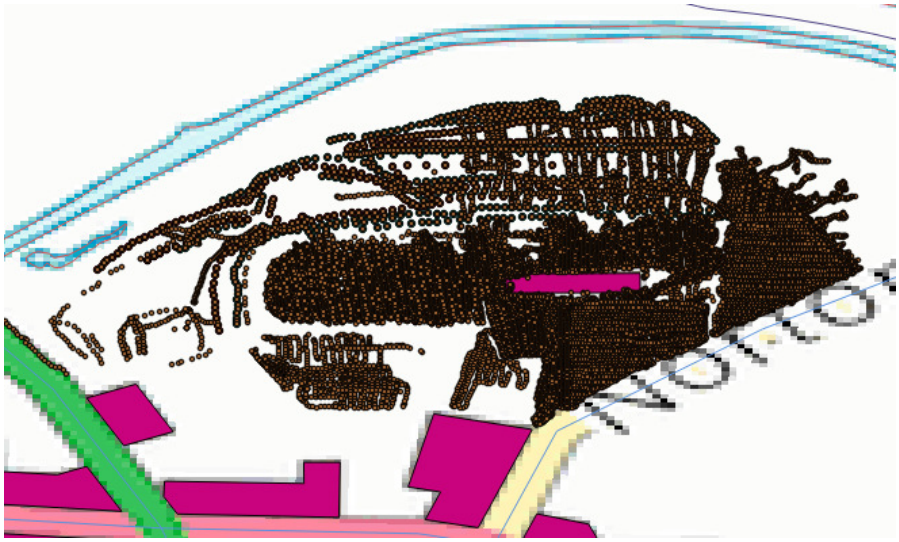


Figure 7: Screen grab from working data combining subjective and objective surveys, to show coverage. Collected during survey (not all data points displayed). Contains OS data © Crown copyright [and database right] 2016.

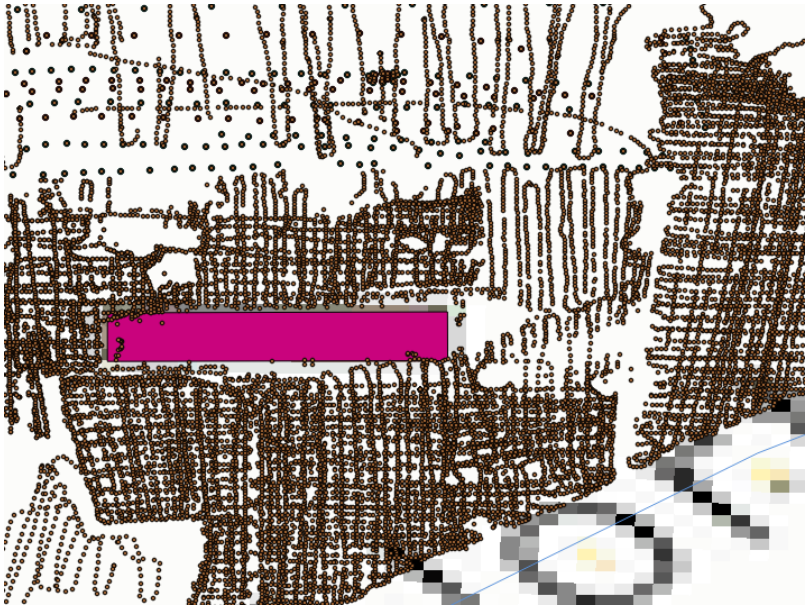


Figure 8: Screen grab from working data combining subjective and objective surveys, to show coverage. Collected during survey (not all data points displayed). Contains OS data © Crown copyright [and database right] 2016.

5.2.3.2 **Subjective Survey**

5.2.3.2.1 Subjective survey was used as a means to record features in more detail. It relies on the expertise of the surveyor to analyse the earthworks and to record them. For this procedure, EDM Total Stations were used to record the tops and bottoms of slopes. These recordings were highlighted in the survey data using different point Identification codes. The tops and bottoms of slopes were mapped and joined together in Geographic

Information Systems software, and then the subjective survey data was employed to produce a hachure plan of the site as recommended by Historic England (Bowden 2006).

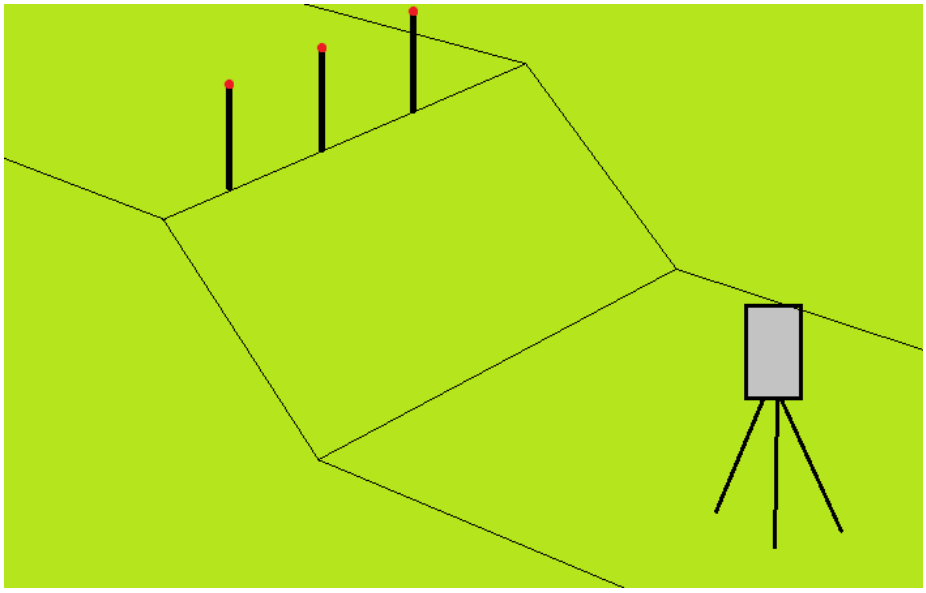


Figure 9: Total Station measuring tops of slope.

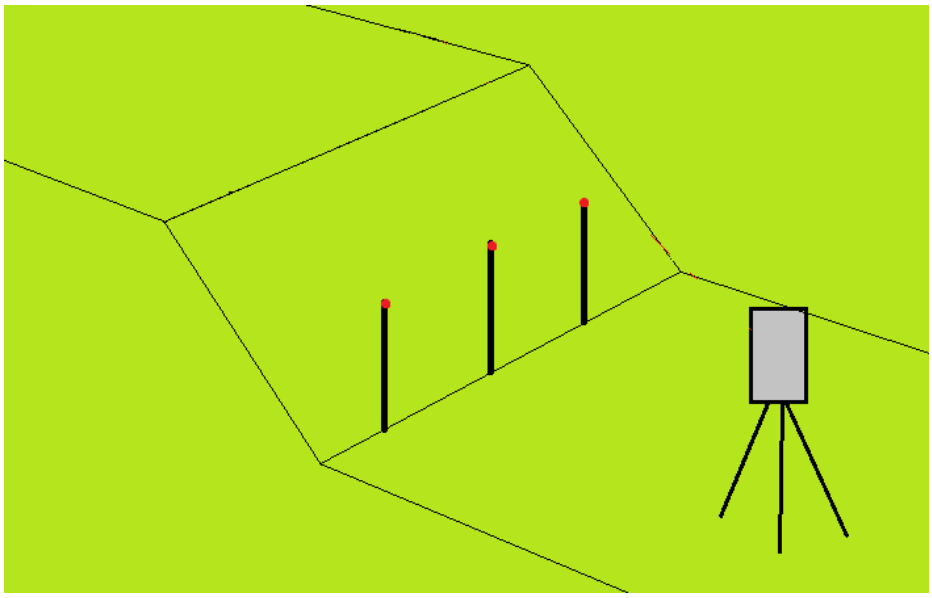


Figure 10: Total Station measuring bottom of slope.

6. Results

6.1. Magnetometer Survey

6.1.1. Survey Results Map

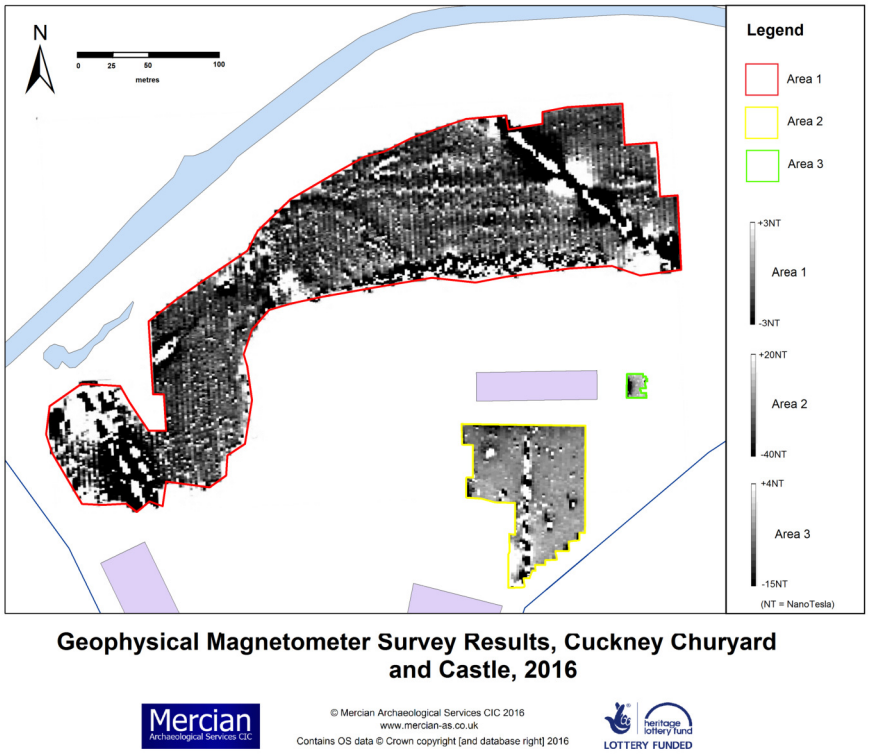


Figure 11: Geophysical Magnetometer Survey Results, 2016. Contains OS data © Crown copyright [and database right] 2016.

6.1.2. **Area 1 Plots**

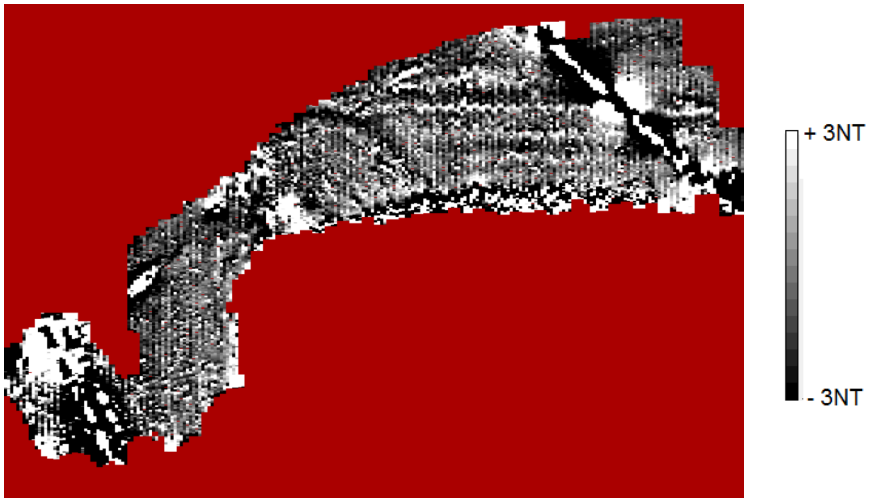


Figure 12: Unprocessed Magnetometer data greyscale image area 1.

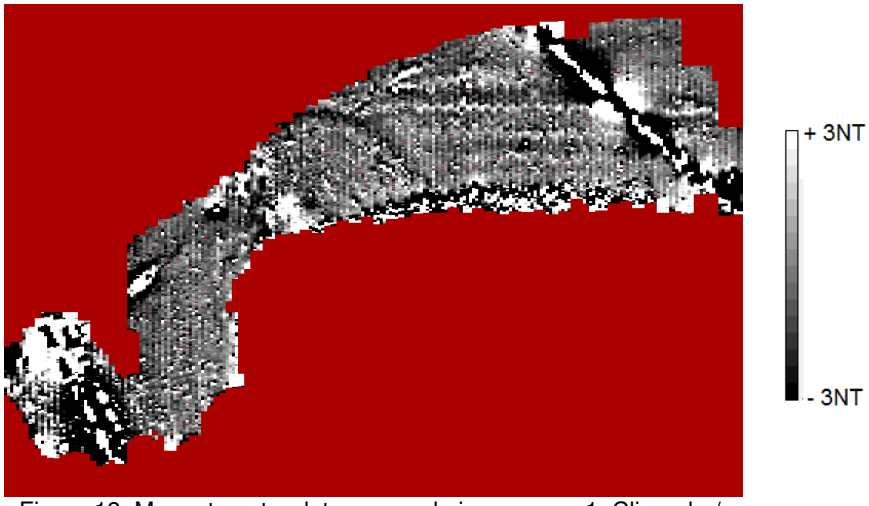


Figure 13: Magnetometer data greyscale image area 1, Clipped +/- 3NT, Destriped, De-Spiked (Threshold 1.0), Interpolated Vertical.

Figure 14: Trace plot area 1, produced in TerraSurveyor

6.1.3. **Area 2 Plots**

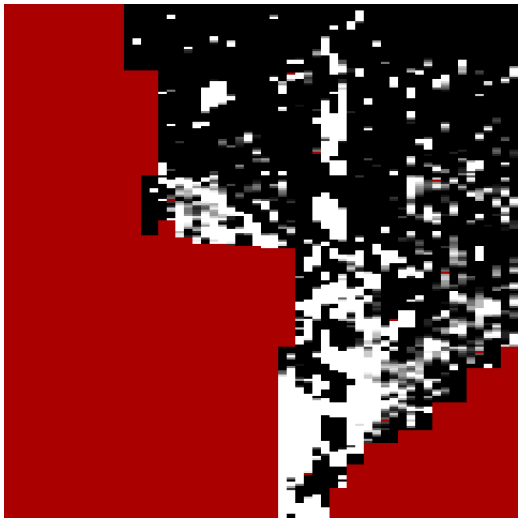


Figure 15: Unprocessed Magnetometer data greyscale image area 2.

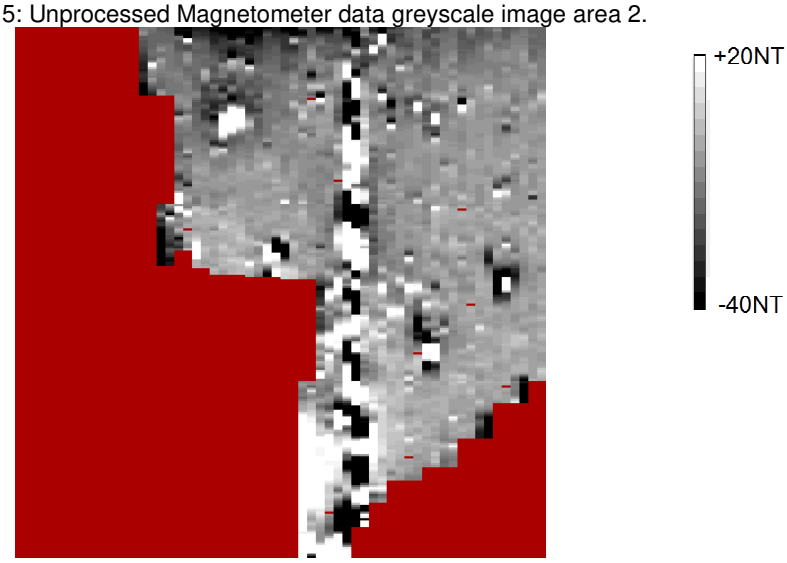


Figure 16: Magnetometer data greyscale image area 2, Clipped +20NT/ - 40NT, Destriped, De-Spiked (Threshold 1.0), Interpolated Vertical.

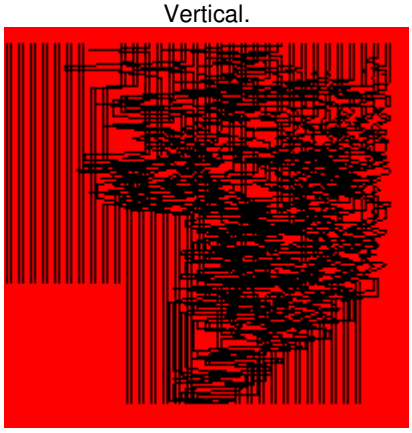


Figure 17: Trace plot Area 2, produced in TerraSurveyor

6.1.4. **Area 3 Plots**

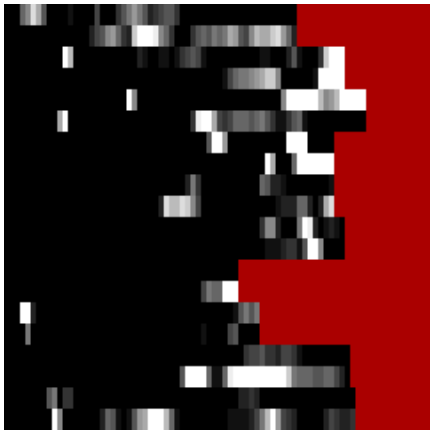


Figure 18: Unprocessed Magnetometer data greyscale image area 3.

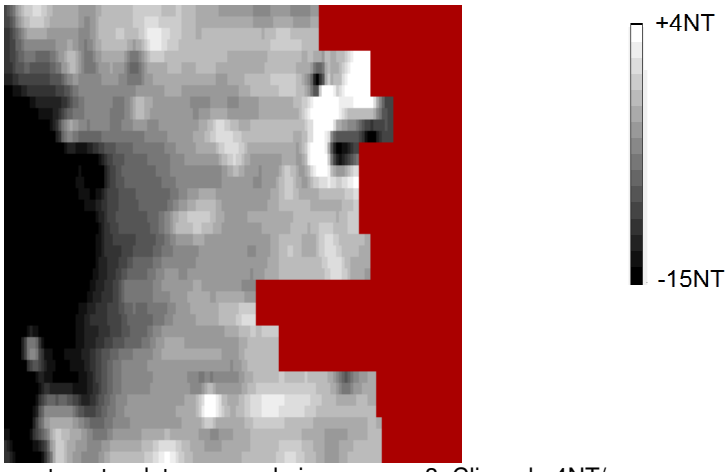


Figure 19: Magnetometer data greyscale image area 3, Clipped +4NT/ - 15NT, Destriped, De-Spiked (Threshold 1.0), Interpolated Vertical

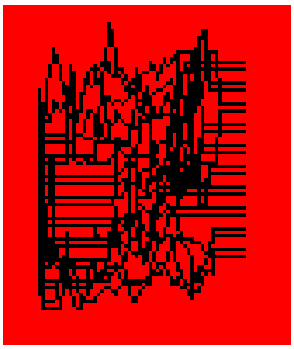
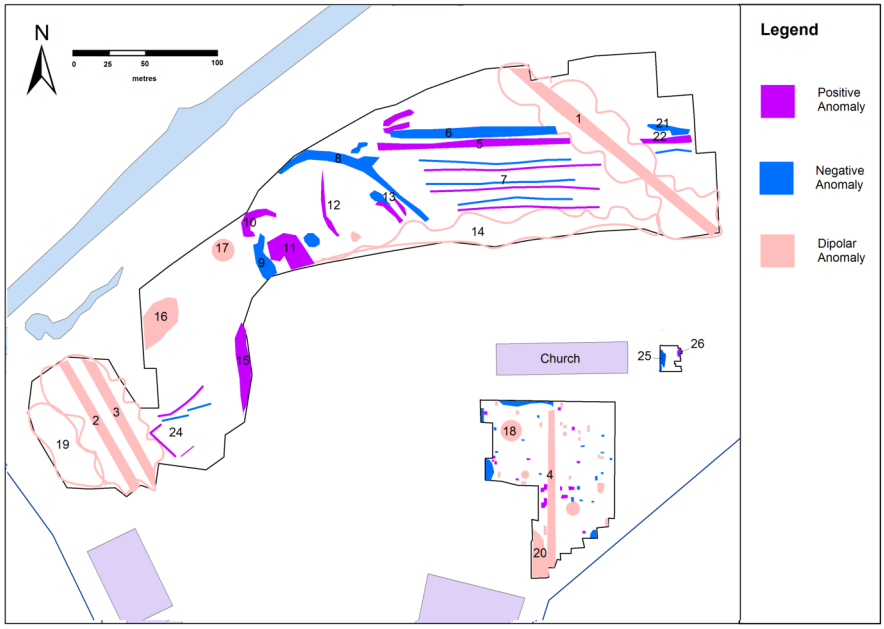


Figure 20: Trace plot Area 3, produced in TerraSurveyor

6.1.5. **Interpretation Plot**



Geophysical Magnetometer Survey Interpretation Plot, Cuckney Churchyard and Castle, 2016

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heritage lottery fund LOTTERY FUNDED

Figure 21: Geophysical Magnetometer Survey Interpretation Plot.
Contains OS data © Crown copyright [and database right] 2016.

6.1.6. The above plots and figures 11 to 2o are the processed and unprocessed results and trace plots of the Geophysical Magnetometer survey undertaken at Cuckney in November 2015. Figure 21 is an interpretation plot of the survey data.

6.1.7. Area 1 contains a number of high and low magnetic anomalies; collection was affected in the field by the varying topography, which resulted in some striping of the data. However a good number of anomalies have been recorded.

6.1.8. Within the churchyard, large amounts of historic disturbance and metalwork affected the quality of the survey data. In order to display the results for area two the data was clipped at very high values, this means that any small variations caused by archaeological remains may be difficult to discern. Area 3 was also clipped at high values, but feature 25 and particularly 26 may be of interest.

6.1.9. A number of linear dipolar anomalies run across the surveyed area. In area 1 a linear dipolar anomaly cuts across the eastern end of the survey running northwest to southeast, marked 1 on interpretation plot in figure 21. Area 1 is also crossed in the western end by two further linear dipolar anomalies labeled 2 and 3. Area 2 is crossed north to south by a linear dipolar anomaly labeled 4. There are large areas of dipolar signals to the north of the churchyard labeled 14, and on the far western edge of area 1 labeled 19. Large individual dipolar signals were detected labeled 16, 17 and 18.

6.1.10. A large linear high magnetic anomaly labeled 5 runs approximately 120 metres east to west across the northern part of area 1. It is truncated at the eastern end by the dipolar linear feature 1. To the east of feature 1 a high magnetic linear feature 22 (possibly a continuation of feature 5); runs to the eastern edge of the survey. To the north of feature 5 a low magnetic linear feature runs parallel to 5; labeled 6. It may continue to the eastern edge of the survey where feature 21 continues on the same alignment.

6.1.11. To the south of feature 5 a series of alternating low, high, low, high, low, high linear anomalies run east to west in the ground between feature 5 and the area of dipolar anomalous readings labeled 14; close to the northern churchyard wall.

6.1.12. A curvilinear negative anomaly labeled 8 was detected in the central part of area 1, where there are a number of positive and negative anomalies.

6.1.13. In the western part of the survey an area of positive magnetic signal forms a reasonably wide linear orientated north to south, labeled 15. To the west of this a small number of discreet thin linear positive and negative anomalies can be discerned in the various plots. These are labeled 24.

6.2. Ground Penetrating Radar Survey (GPR)

The following GPR survey result section is taken from the RSK Geophysics Report in Appendix VII:

6.2.1 GPR Results

6.2.1.1. “Modern burials are located at 1-2m depth, have a consistent size (typically 1x2m) and orientation (burials evenly spaced in parallel, linear rows). Sometimes burials can be double stacked in the same plot, or include smaller containment vessels at shallower depth. At this site, many features from discrete modern burials have been detected. These are classified as ‘false positives’ for this survey (as the objective is for larger mass burials). For the purposes of interpretation and identification, the GPR inferred modern graves together with the location of gravestones have been marked on the interpretation drawing” in figures 23, 24, 25, 27, 32, and 35 below (RSK 2015, Appendix VII)

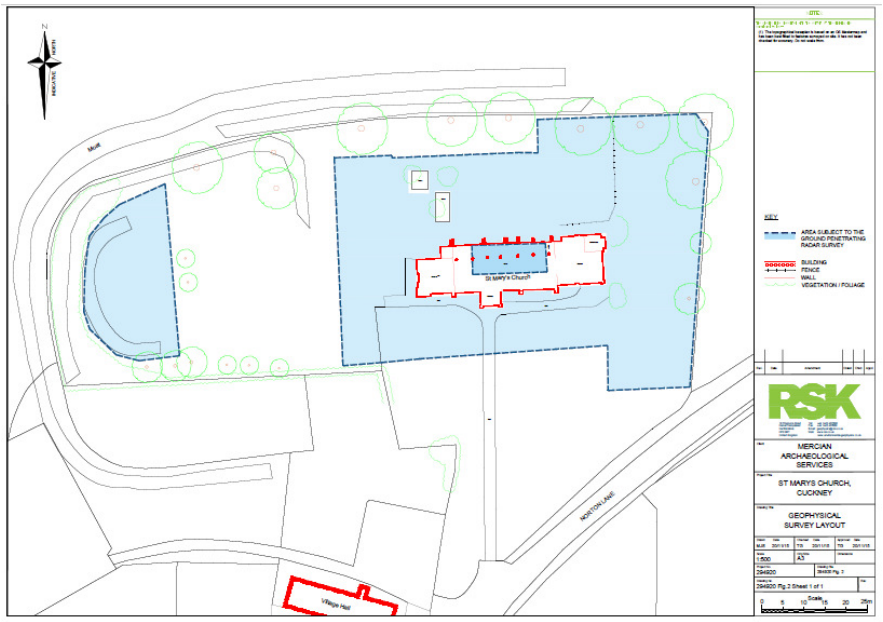


Figure 22: Location of Radar Survey. © RSK Environment Ltd.

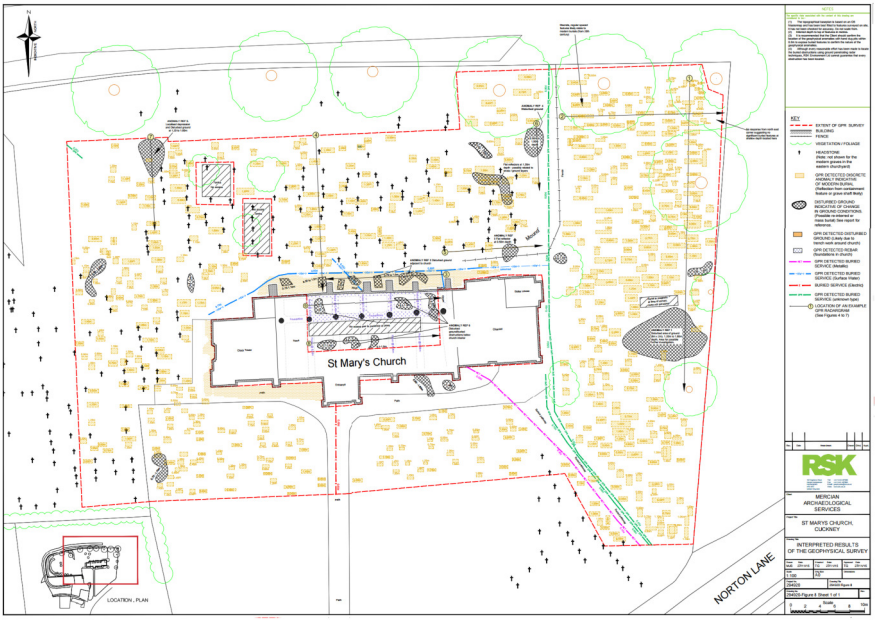


Figure 23: Eastern half of Interpreted results of the Ground penetrating Radar Survey. © RSK Environment Ltd.

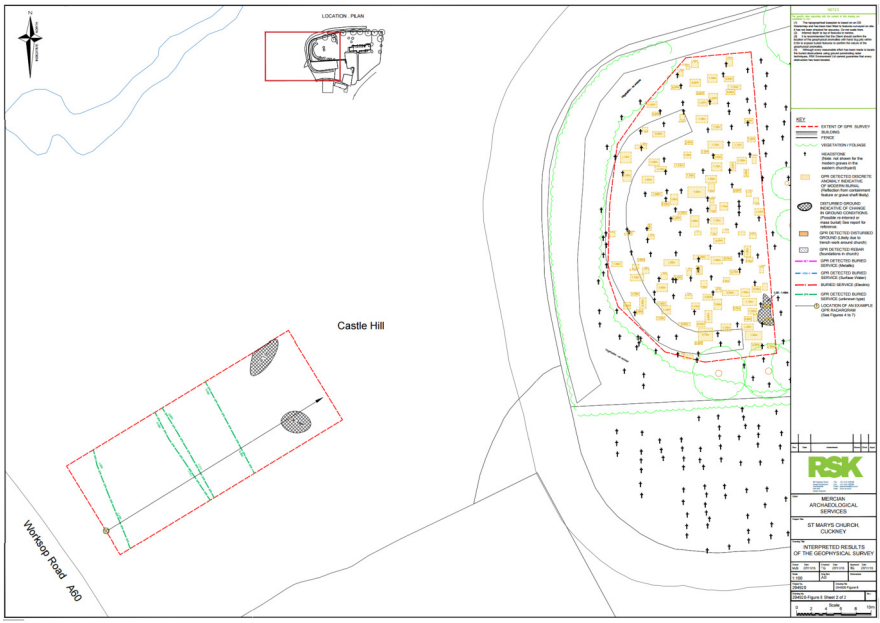


Figure 24: Western half of Interpreted results of the Ground penetrating Radar Survey. © RSK Environment Ltd.

"There are a number of anomalies which differ from the singular discrete features which suggests that in a number of locations, the ground conditions differ than the remainder of the site. A detailed description of the findings of the GPR survey for each area is presented in the Table 2" below adapted from The RSK report in Appendix III (RSK 2015, pp 11-13, in this report Appendix VII) .

Table 2: **Findings of the GPR survey**

Anomaly Reference In Figs 22, 23 & 24	GPR Description	Interpretation
Eastern graveyard	Characterised by regular spaced, hyperbolic reflections parallel lines in the northern half. These likely relate to recent burials from the 20th century. Reflections show the likely presence of coffins/air filled cavities. Older graves in the southern part of this area are more subtle in the dataset. No significant features are imaged in the northeast corner of the area (near the wall) – see Appendix III. This is one of the areas where re-interment of the mass burial may be located. It should be noted that the ground conditions next to the wall were saturated and boggy which has caused poorer data quality from this area.	
Ref 1	High amplitude, discontinuous reflections at 1.20-2.00m depth. 8m x 2m in extent.	This area is located in the centre of the eastern cemetery and to the immediate south of the most recent burials as shown highlighted in Figure 25 (plan view) and labelled 3 in Figure 26. The strong reflections indicate a change in ground conditions. This could be the result of ground disturbance from a possible burial pit (such as a re-interment of the 1950s bodies). It should be noted that the strong reflections could also be a result of higher conductivity in the ground. This may be due to leaching from the recent nearby burials to the north into the soil. However, as the site is sloped down to the north, any leaching would more likely flow to the north away from this anomalous area. Although this area does not contain any gravestones, it is noted that historically the area contained gravestones hence the presence of modern burials in this area cannot be discounted. This should be taken into consideration in the event the area is investigated further. (see figures 25 and 26 for details of anomaly reference 1).
Northern graveyard	See plan view in Figure 27. Characterised by some clear modern burials, and other subtle features (older burials). Some more disturbed areas (see below). In a 2-3m zone around the perimeter of the church, the ground is very disturbed – likely due to the trench works as part of the underpinning.	
Ref 2	High amplitude, discontinuous reflections next to the church. Some features flat in nature, and some occur isolated at depth.	Within the disturbed zone around the church perimeter, lie additional high amplitude features (see labelled 4 in Figure 31). These probably relate to buried obstructions – either as part of the structure of the church, or possible burials. Is it understood some burials under the church were shallow (from 0.5 to 2m depth). The GPR detected

Anomaly Reference In Figs 22, 23 & 24	GPR Description	Interpretation
	Occurs in 6 no. areas immediately north of the church	features are within this range. It is noted that the disturbed ground does not extend more than ~3m northwards of the church. The client should be aware that the disturbed nature of the ground will likely mask responses from more subtle features such as older bones in this area. (see figures 27, 28 and 29 for details of anomaly reference 2).
Ref 3	Horizontal high amplitude feature on the small mound north east of the church. (see Appendix VII)	The mound was one of the locations marked as a possible burial area. The nature of this feature suggests a flat obstruction in the ground. Given its small size, it is unlikely to represent a large burial pit, but a probably obstruction nonetheless.
Ref 4	Discontinuous high amplitude feature near the northern boundary. (see Figure 27 and 30)	Data suggests an area (2.5 x3.5m) of disturbed ground or change in ground conditions at shallow (0.5m) depth. A dipping reflector present may indicate the edge of a burial pit or similar.
Ref 5	Discontinuous high amplitude feature near the northern boundary. (see Figure 27 and 31)	Data suggests an area (3 x4m) of disturbed ground or change in ground conditions at depth (~1.5m). It is noted that the surrounding ground surface contains a small depression which suggests some ground settlement has occurred.
Church Interior	All accessible parts of the nave were surveyed (where pews could be moved). The GPR survey clearly reveals the 1950s reinforced ground beams at ~0.30 depth as a series of linear, high amplitude features (see Figure 30). Between the beams lie a number of discrete features (see below)	
Ref 6	Moderate amplitude features at depths between 0.5m and 2.0m located between the beams in six areas.	The features indicate the presence of possible buried obstructions in the ground below the church floor. These may relate to the structure of the church or other possible burial feature. As multiple skeletons were encountered in these areas previously, the presence of additional skeleton features cannot be discounted. Some of the features identified line up with features identified outside the church immediately to the north which suggests the features may extend below the north church wall. (see figures 33, 34 and 35 for details of anomaly reference 6).
West of Church	No significant anomalies were detected in this area other than discrete and disturbed reflections expected of modern graves.	
South of Church	No significant anomalies were detected in this area other than discrete and disturbed reflections expected of modern graves. It is noted that although this area does not contain any gravestones, the stones have likely been moved in recent times, hence many unmarked burials likely exist in this area.	

Anomaly Reference In Figs 22, 23 & 24	GPR Description	Interpretation
Castle Mound in west of Church ground	No significant anomalies were detected in this area other than discrete and disturbed reflections expected of modern graves. As the burials in this area of the site are older, the features detected are more subtle. No features indicative of buried structures from the former castle were recorded in the data.	
Castle Mound in far west field beyond church yard next to A60	No features indicative of discrete buried were detected in the GPR data. However, two areas of disturbed ground (see Figure 35 and labelled '3' in Figure 36) have been detected which may indicate the presence of buried obstructions or a possible burial pit. 4 (no.) linear features indicate of buried services are also shown in the data crossing the survey area orientated running parallel to the road.	

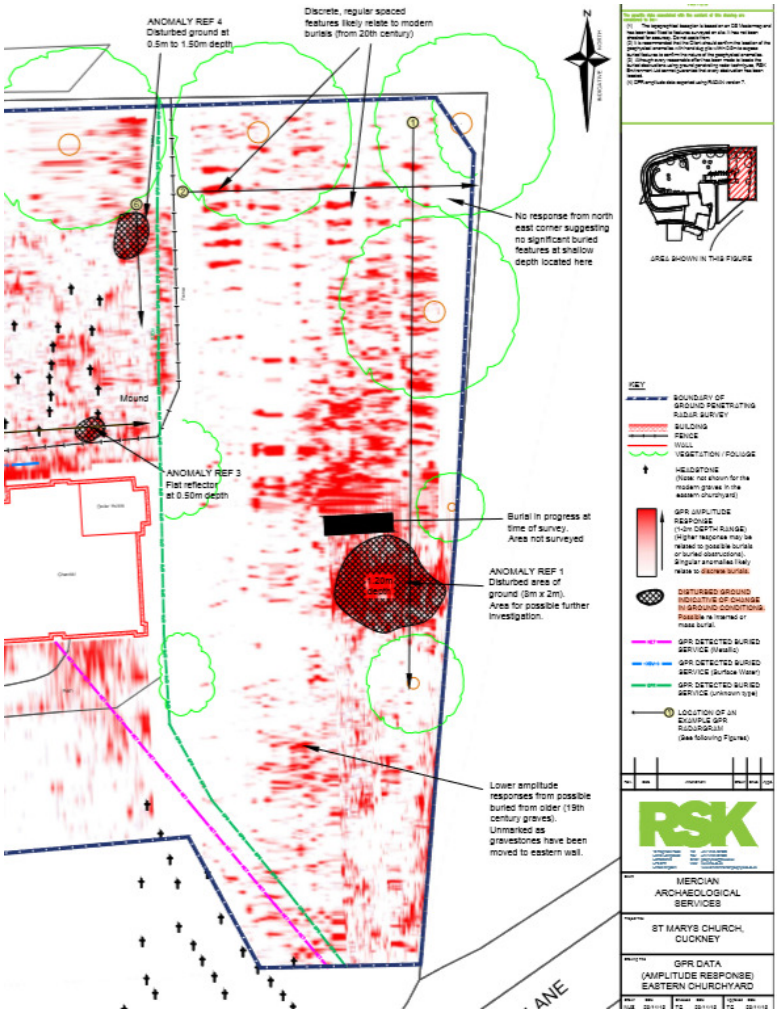


Figure 25: GPR results Eastern side of churchyard, showing location of anomaly reference 1, and radargram line 1. © RSK Environment Ltd.

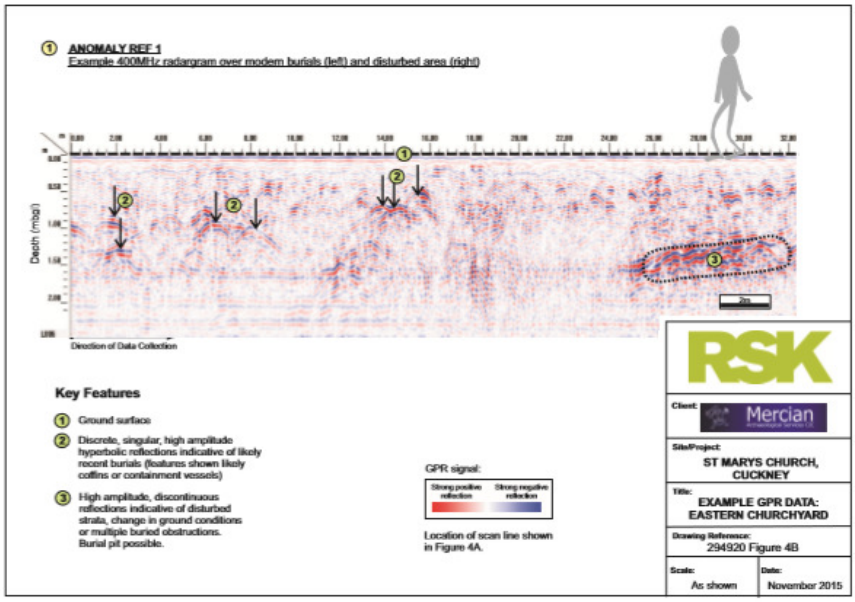


Figure 26: Anomaly Reference 1 on radargram line 1 from figure 25. © RSK Environment Ltd.

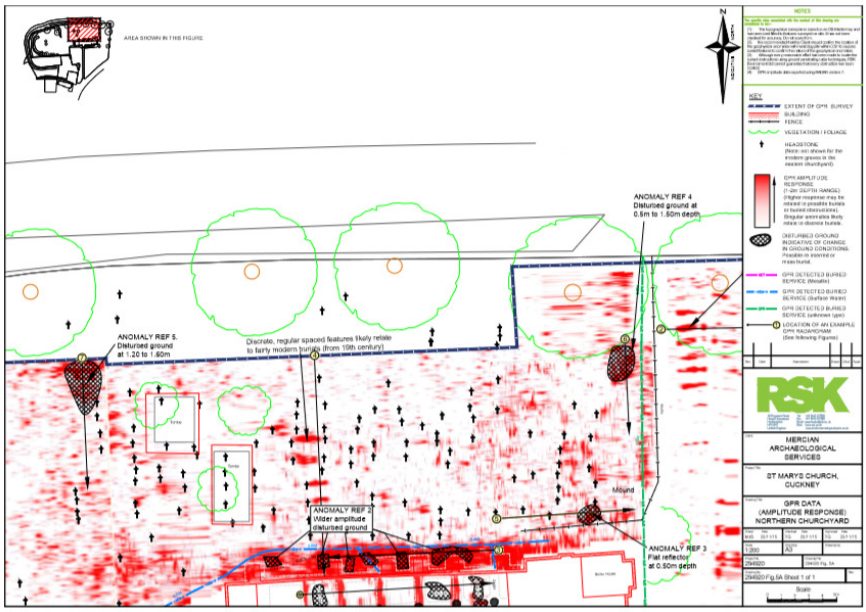


Figure 27: GPR results from northern side of churchyard, showing location of anomaly reference 2, and radargram lines 3 and 4, anomaly reference 4 and radargram line 6, and anomaly reference 5 and radargram line 7 © RSK Environment Ltd.

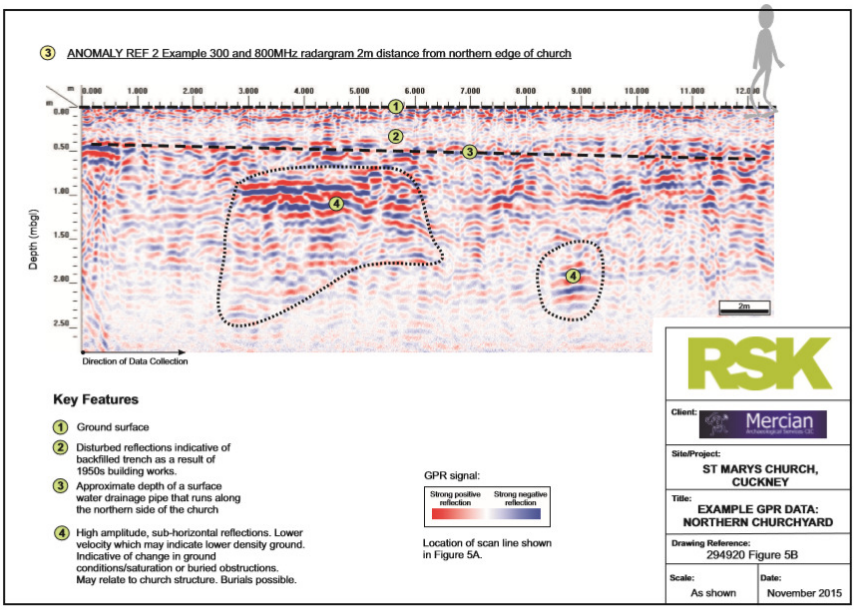


Figure 28: Anomaly Reference 2, on radargram line 3 from figure 27. © RSK Environment Ltd.

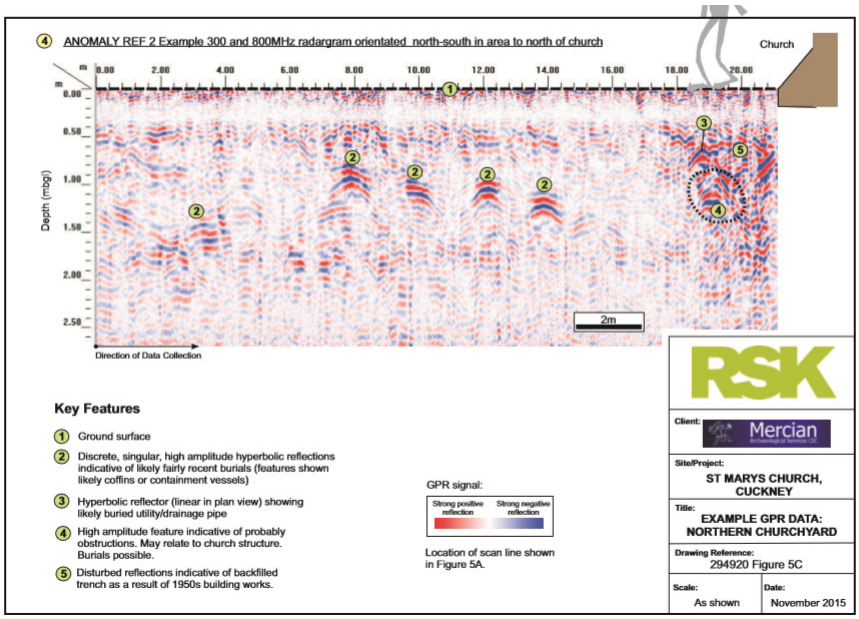


Figure 29: Anomaly Reference 2, on radargram line 4 from figure 27. © RSK Environment Ltd.

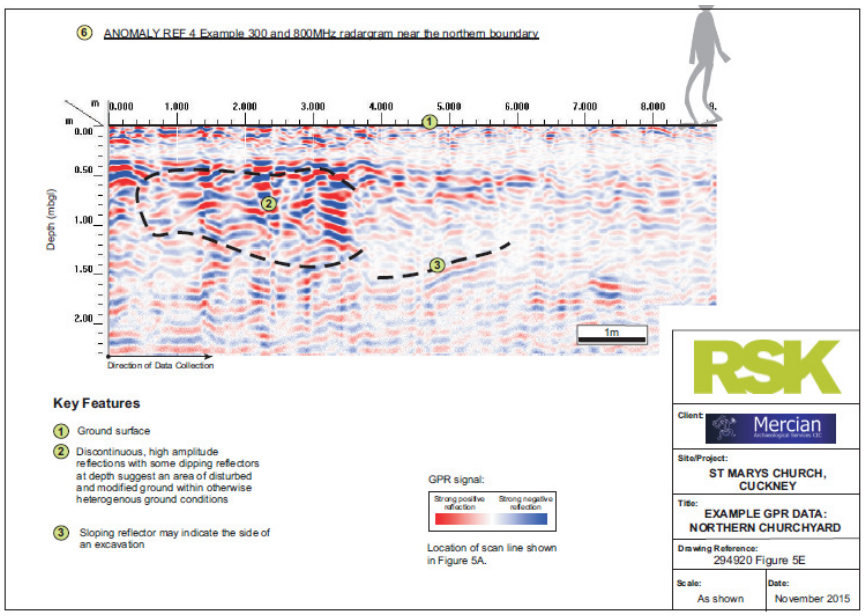


Figure 30: Anomaly Reference 4, on radargram line 6 from figure 27. © RSK Environment Ltd.

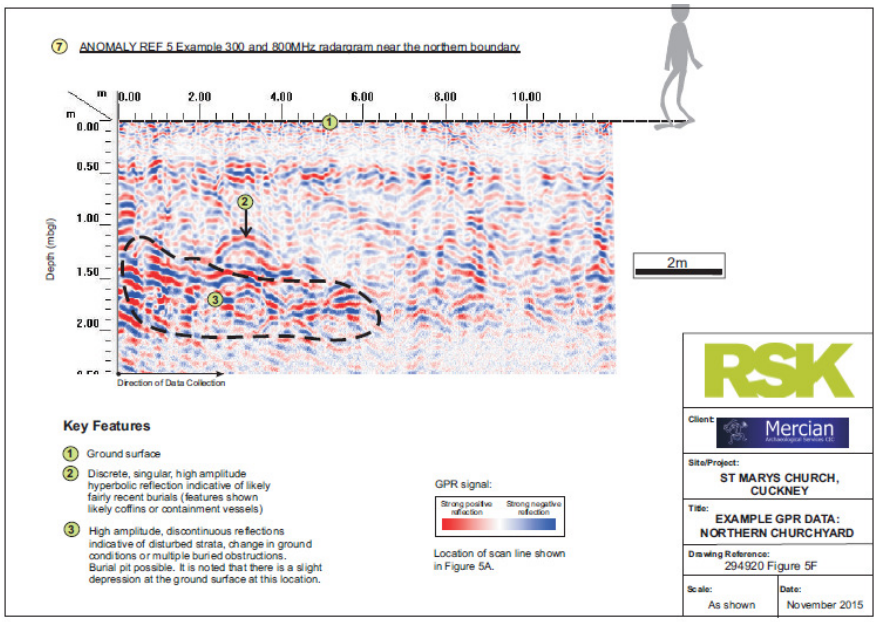


Figure 31: Anomaly Reference 5, on radargram line 7 from figure 27. © RSK Environment Ltd.

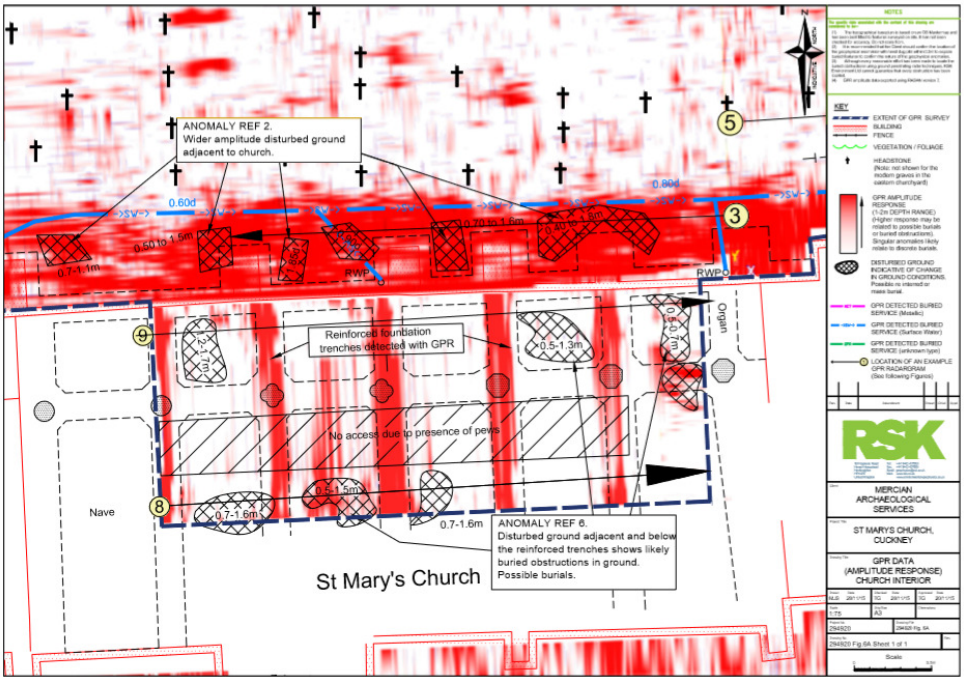


Figure 32: GPR results inside church, showing location of anomaly reference 6, and radargram lines 8 and 9. © RSK Environment Ltd.

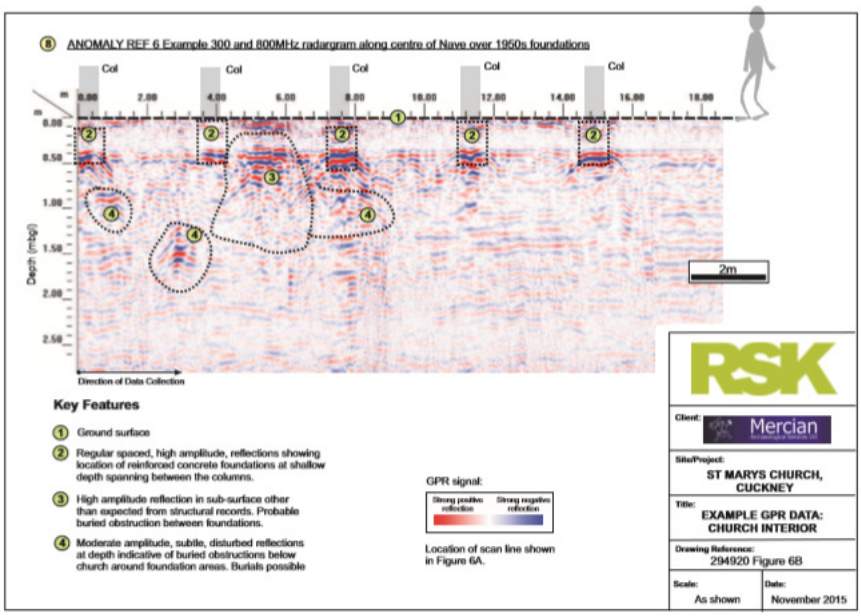


Figure 33: Anomaly Reference 6, on radargram line 8 from figure 32. © RSK Environment Ltd

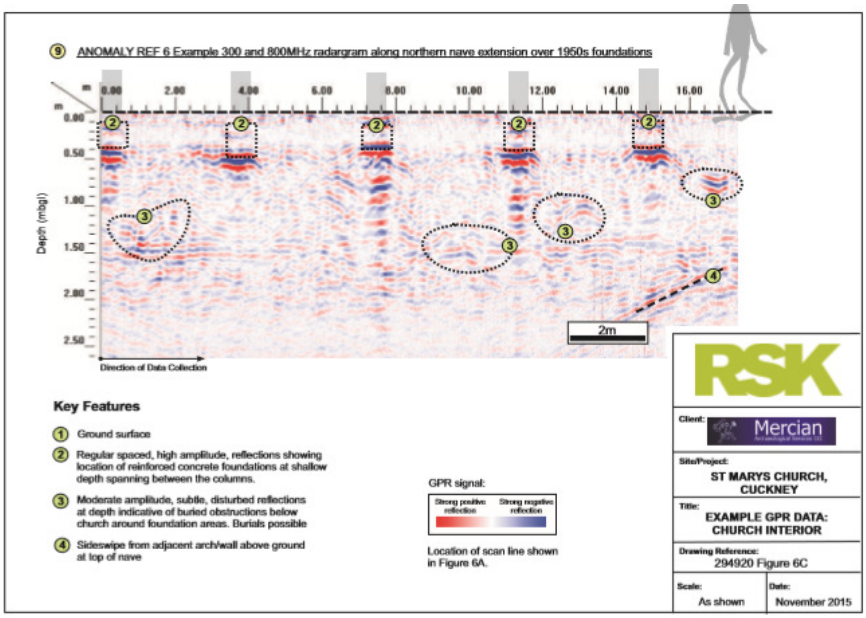


Figure 34: Anomaly Reference 6, on radargram line 9 from figure 32. © RSK Environment Ltd

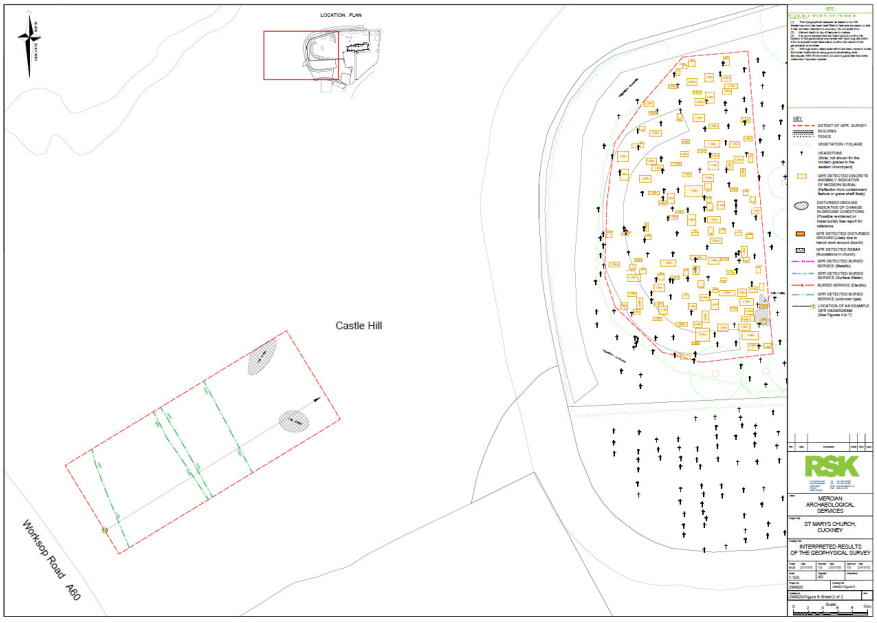


Figure 35: GPR results mound to west of churchyard showing location of anomalies listed in table 2, and location of radargram line 10. © RSK Environment Ltd

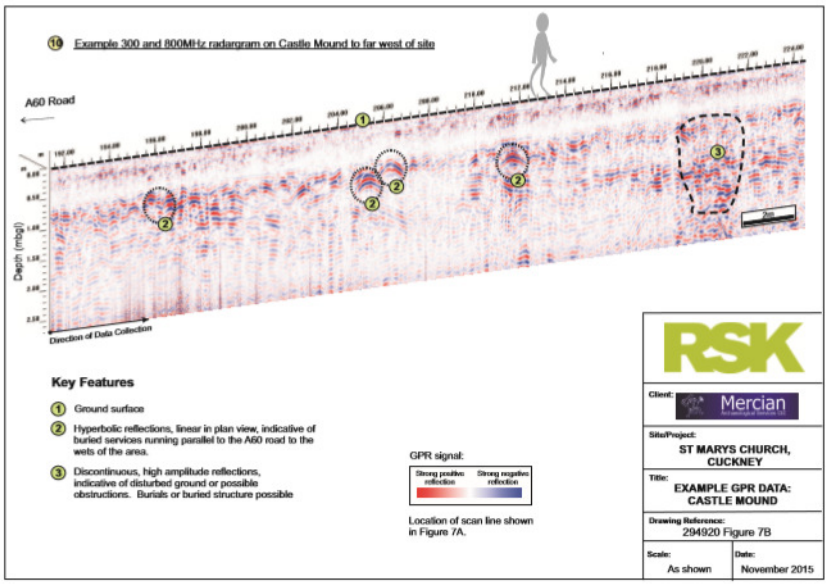
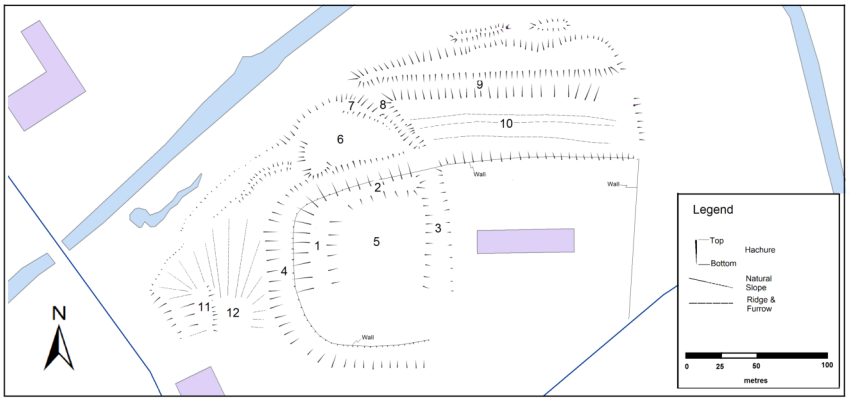


Figure 36: Radargram line 10 from figure 35 showing anomalies detected on mound to west of churchyard (see table 2). © RSK Environment Ltd

6.3 Topographic Survey

6.3.1 **Hachure Plan**



Hachure plan of earthworks, Cuckney Churchyard and Castle, 2016

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heritage lottery fund LOTTERY FUNDED

Figure 37: Hachure plan of earthworks.
Contains OS data © Crown copyright [and database right] 2016.

6.3.2. **Topographic Survey Results**

6.3.2.1. The Topographic earthwork survey recorded a number of features which have been mapped on the Hachure plan in figure 37 above. These features can also be seen in the Digital Terrain Models (DTM) in figures 38- 42. For a larger version of the Hachure plan please see Appendix I. To the west end of the churchyard the ground rises to a linear bank running 30 metres north to south by 10 metres east to west, labeled 1 in figure 37. The DTM models below show this raised area continues to the south and curves around to the east. Here it forms a raised bank 50 metres east to west by 20 metres north to south. This area forms a discreet section of the churchyard with burials from the 20th century. To the north the bank forming feature 1 drops to form a lower east to west orientated ridge on the north side of the churchyard; feature 2 on figure 37. The features so far described enclose to the west north and south an area of lower flatter ground marked 5 on the plot in figure 37. To the east feature 2 drops in to a shallow ditch running 45 metres north to south, and up to 20 metres wide, labeled 3 on the plot. Together these earthworks form the western half of Cuckney churchyard. The combined curved bank of features 1 and 2 are surrounded to the north, west and south by a large ditch which falls away steeply. The Hachure plan depicts with a line and triangle (tops of hachures) where the bank to ditch profile is vertical due to the insertion of a stone wall. This forms a Ha Ha on the southern and western sides with the wall forming one whole side of the ditch (the internal side) and being entirely below the surrounding ground levels to the south and west of the ditch. To the north of the churchyard the ditch levels out to form a wide semi-circular plateau; feature 6, with a low bank; 7 forming its northeastern edge. Feature 6 is terminated on the eastern side by a metre deep ditch or hollow; marked 8 on the plot. Ditch or hollow 8 curves towards the southeast and lines up with the ditch inside the churchyard; feature 3. Feature 9 is a large linear east to west orientated ditch or hollow that runs 200m in length by 10 metres in width. Feature 9 is flanked to the north and south by higher flatter ground. To the north this drops into the river flood plain, but to the south is cut by a number of linear banks and ditches running east to west; marked as 10 on the plot in figure 37. To the west of the Churchyard the land rises out of ditch 4 to an area of high ground to the west marked 12 on the hachure plan. This high ground is equal in height to feature 1, and the area to the south of feature 1 in the DTMs. To the west of the summit of the hill marked 12, is a pronounced linear bank running north to south; marked

11 on the plot. The earthworks recorded fall both inside and outside of the area Scheduled as a Motte and Bailey Castle. The DTM's displayed below help to display the 3 Dimensional shape of the earthworks and their relationship to each other.

6.3.3. **3D models**

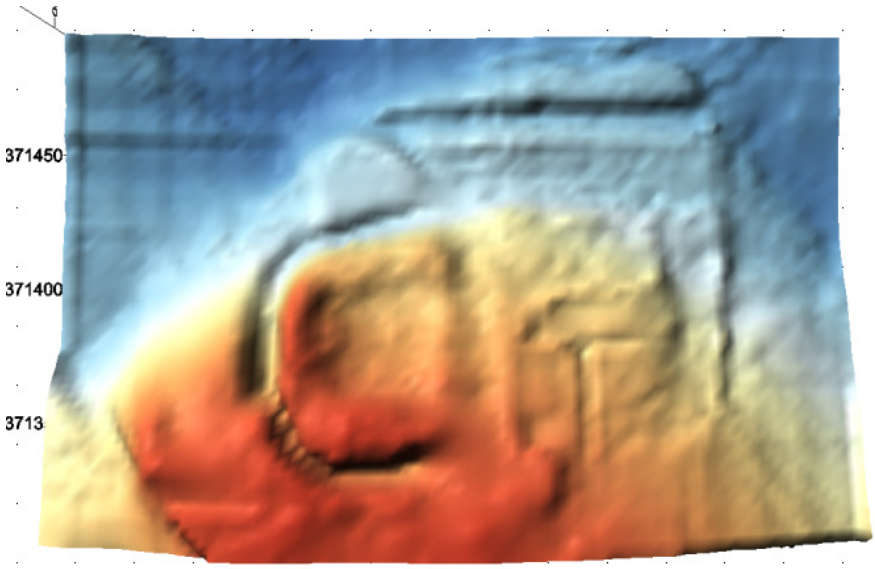

Figure 38: Digital Terrain Model (DTM) of earthwork survey data, North to top of image.

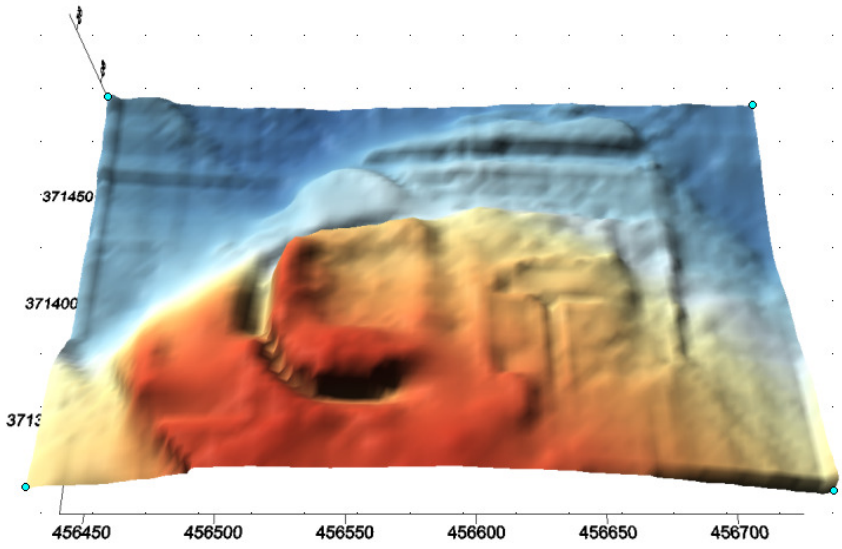

Figure 39: Digital Terrain Model (DTM) of earthwork survey data, oblique view. North to top of image.

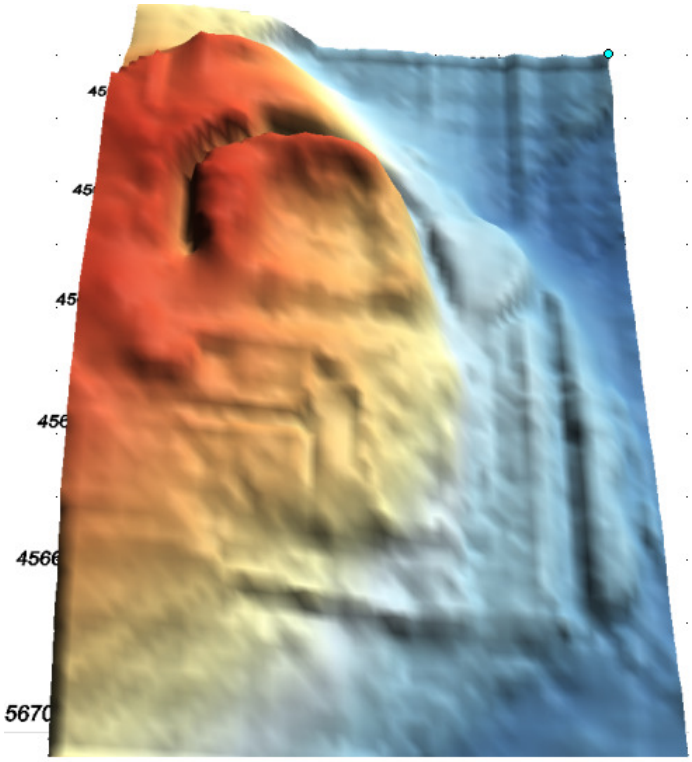

Figure 40: Digital Terrain Model (DTM) of earthwork survey data, oblique view. West to top of image.

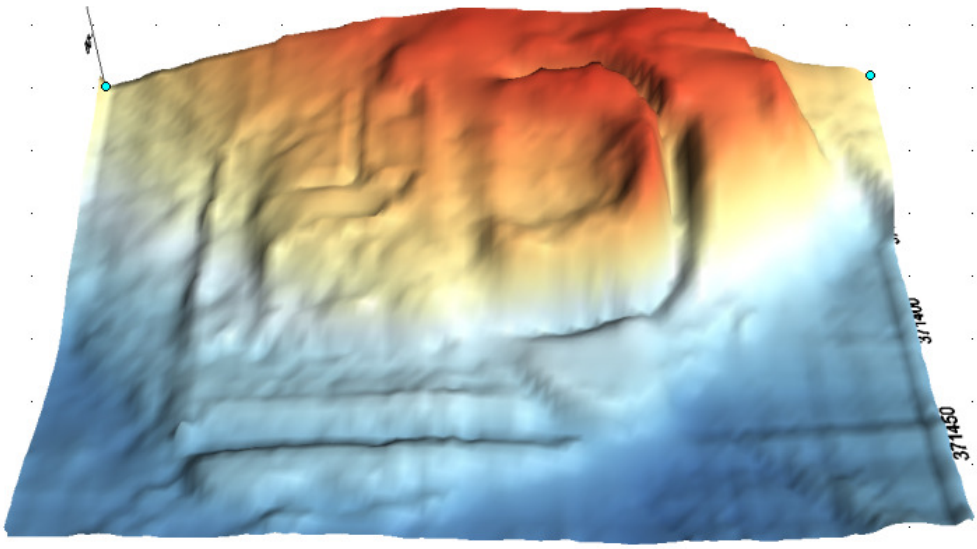

Figure 41: Digital Terrain Model (DTM) of earthwork survey data, oblique view. East to top of image.

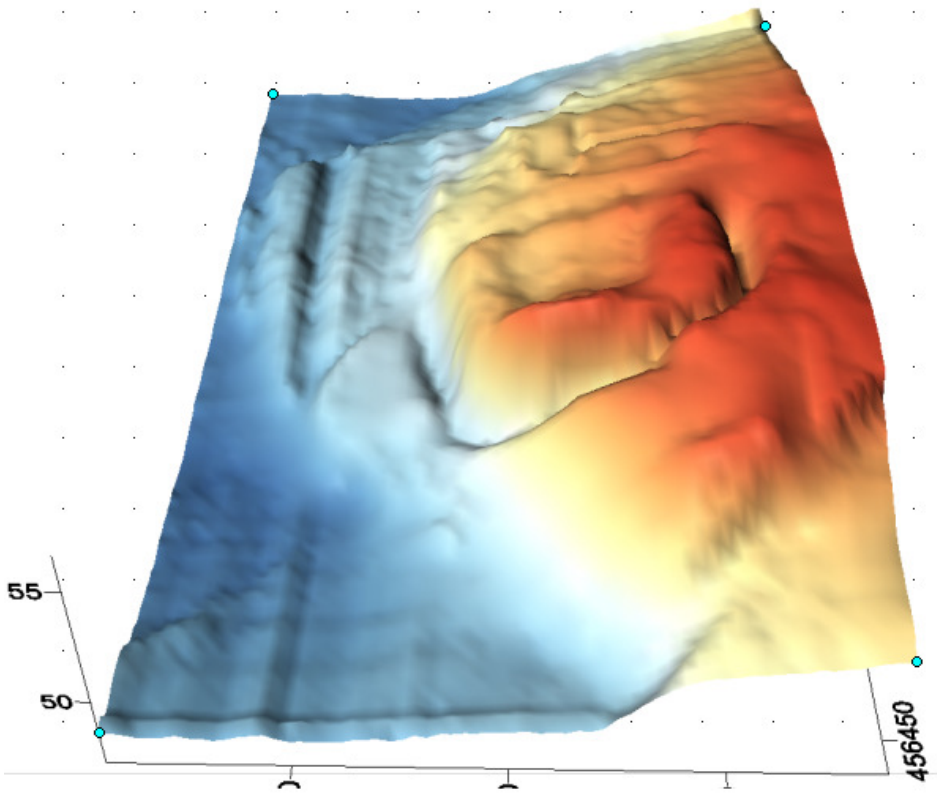

Figure 42: Digital Terrain Model (DTM) of earthwork survey data, low angle oblique view. East to top of image.

6.4 **Artefacts from the Church of St Mary and Motte and Bailey Castle, Cuckney.**

6.4.1. In total two sherds of late Saxon and one of medieval date along with one piece of modern pottery were recovered from the topographic survey site, while three sherds of post medieval pottery and one clay tobacco pipe stem were recorded but not collected. Two pot boiler stones were also recorded but not collected.

6.4.2. The pottery suggests that the area around the present church and nearby in the Poulter valley saw human activity in the late Saxon period and may tentatively be suggested as a location for pre-conquest activity. The medieval sherd may be contemporary either with the supposed period of occupation of the castle or the current church.

6.4.3. Notably, only post medieval and modern pottery was found within the earthworks to the north of the present churchyard. Whether this is, for example, merely a product of deeper disturbance in the churchyard or represents a genuine lack of medieval activity could not be determined, but perhaps may cast slight doubt on the nature and date of these remains.

6.4.4. The opportunity is also taken to record a fragment of burnt daub found previously in a mole hill to the north of the Poulter which appears to derive from an accidentally burned wattle and daub structure.

6.4.5. **Recovered pottery:**

6.4.5.1.Four sherds of pottery with a combined mass of 33g were recovered. The distribution of these sherds can be seen on figure 01. They are quantified in table 02 Appendix II.

6.4.5.2. The sherd coded AAA was the only sherd recovered from within the Scheduled Monument.

6.4.5.2.1.AAA - Early Medieval Hand Made Wares (EMHM). This sherd is the rim of a jar and has decorative thumbing to the outer edge of the rim. It displays a wear mark to its outside edge. Jane Young writes: "possibly produced within Nottinghamshire. Part of a widespread Eastern England tradition (Early Medieval Handmade), most vessels produced in East Anglia, but some vessels made at Bourne & [study of the] fabrics suggest several other places. 12th to mid 13th century".

6.4.5.3. AAB - Torksey-type Ware. Body sherd, jar or bowl. Found in spoil heap for new grave.

6.4.5.4. AAC - Torksey-type Ware. Body sherd, jar or bowl.

6.4.5.5. Of AAB and AAC, Jane Young notes that they are "Torksey-type but not main Torksey fabrics. Quartz indicates a Trent Valley source - Torksey-type ware was made at Newark & there are odd sherds from Marton & other places in Lincolnshire".

6.4.6. **Discussion:**

6.4.6.1. It should be stated that while attempts were made to examine the surfaces of all animal disturbed soil in the survey area this was not the primary purpose of the work being undertaken on site so was not done systematically. Further, the areas that could be examined depended entirely on the areas of animal burrowing, with a whole range of unquantifiable and unknown factors determining whether artefacts were revealed (some possible factors might include depth of archaeological deposits, depth of burial of archaeological deposits, depth of burrowing of animals, depth of grave digging). While it is therefore clearly impossible on present evidence to suggest how representative of below ground densities the artefacts recovered are, or how representative of the distribution of past activities the spread of artefacts revealed by this work actually were, there are some results from the exercise that appear worthy of note.

6.4.6.2. For a start, the spoil produced by the many rabbit burrows in the western slopes of the 'Motte' seemed, on subjective assessment, to represent by far the greatest volume of spoil on the site. Additionally this had been spread in debris fans stretching several metres down slope, thus also apparently exposing the largest surface area of spoil, and was in most cases well weathered. Consequently, the western slope of the 'Motte' could subjectively be considered the area most likely to reveal artefacts. Despite concerted search of the surface of this spoil not a single artefact was encountered. It was also notable that this rabbit burrow spoil (and indeed the walls of the burrows as far as could be seen going into the mound) consisted of reddish sand that was almost devoid of stones. This was in stark contrast to the evidence seen elsewhere in the survey area that seemed to suggest the underlying deposits contained significant quantities of gravel, most notably the grave spoil to the east of the church and in the mole hills to the north of the church yard.

6.4.6.3. The sides of the recently dug grave east of the church (where TORKT sherd designated AAB was found) were unfortunately not available for study; the section here may have clarified aspects of the geology. The common human skeletal remains evident in the spoil heap if nothing else indicated the presence of earlier burials here, despite the lack of headstones pre-dating the second half of the 20th century in this area.

Human remains were not collected or otherwise recorded.

6.4.6.4. While the sections of the grave cut could not be examined the surfaces of the spoil heap provided opportunity to assess the substratum in this part of the site. It appeared to consist of sand and gravel with rounded, up to cobble sized, gravel predominating. This presumably represents a component of the clay / silt / sand / gravel superficial alluvium recorded by the BGS as masking the bedrock Lenton Formation sandstone in the valley bottom (BGS Geology of Britain Viewer, accessed 31/03/2016). Other molehills displayed significant quantities of gravel and pebbles, including those east of the mound within the churchyard and particularly those outside and to the north and west of the churchyard, suggesting similar gravely deposits are also present in these locations. However, the BGS mapping does not appear to record superficial alluvium deposits within the churchyard, only to the north and west in close proximity to the river Poulter. It should, however, be noted that the BGS have typically ignored deposits with a thickness of under 1m (e.g. see Garton et al, in press (2016)) and thus the actual spatial extent of alluvium may be considerably greater than that indicated by the published BGS mapping.

6.4.6.5. It is notable, though perhaps not significant (due to the uncertainties relating to the factors determining artefact visibility), that no artefacts were encountered in the extensive rabbit spoil on the western slope of the Motte. If there was human activity in the area prior to the posited 12th century construction of the supposed castle (as appears to be suggested by finds AAB and AAC) it might be anticipated that such artefacts would be incorporated into or be buried by the Motte deposits, if it is also assumed that the Motte would be raised as a consequence of human endeavour from material dug in the immediate vicinity.

6.4.6.6. Should this be the case it might also be anticipated that the Motte should have a similar composition to the material it was dug from (i.e., be likely to consist of sand and gravel rather than just sand, unless the deposits to the south, which did not display extensive animal activity and could therefore not be commented on in this note, were notably different (recorded by BGS as Lenton Sandstone formation) and were exclusively quarried to raise the mound.

6.4.6.7. Though these unquantified observations of the apparent

nature of the mound based on examination of limited excavation by rabbits cannot be considered to provide evidence of the true structure of the mound and, as the discussion has not sufficiently detailed or explored the likely scenarios or processes (archaeological, ecological and geological), that might produce such evidence, it is suggested that, at the least, the possibility that the mound may be geological in origin rather than a man-made Motte raised from the surrounding deposits should perhaps be considered by any future work (though such an origin would in no way preclude human use or modification of the feature).

6.4.6.8. It is presumed that the pot boiler stones represent water heating activity close to the Poulter. It is impossible to determine the date of this activity. Similarly, the burnt daub could not be dated. It is not even possible to be sure if it derives from an accidentally burnt structure such as a house or formed part of a deliberately fired wattle and daub construction such as an oven or kiln. The areas of probable incompletely combusted carbonaceous material (notably in the parts of this artefact furthest from the wattle channels) might however suggest a short firing time, a scenario perhaps more likely to occur in an accidental burning rather than the more long term or repeated activity associated with the deliberate firing of an oven or kiln. Either way, it does provide intriguing evidence for some kind of structure in the vicinity at some point in history.

6.4.6.9. The presence of the two late Saxon sherds, one just to the east of the present church and the other approximately directly 215m west of the first, within the valley of the Poulter, is significant. These sherds represent the first archaeological evidence for late Saxon activity in Cuckney. Though a settlement is recorded at Cuckney in the Domesday Book it does not necessarily follow that the present village occupies the same location as its Domesday predecessor.

6.4.6.10. It would likely be stretching the evidence too far to suggest that this pottery indicates the site of the Domesday settlement (it could alternatively represent manuring of fields in proximity to the settlement, for example, though the presence of the river seems to make this an unlikely location for a village field, or derive from other waste disposal practices, or even be the result of later earth moving activities, particularly in the case of AAC which is in an area potentially subject to

disturbance during the construction of the water meadows). A number of factors, including the proximity of a water source in the form of the Poulter and the presence of the later church, containing 12th century fabric, in this location, does rather invite the suggestion though that this part of the settlement of Cuckney, rather on the margins of the present village, might be a good candidate for the location of the late Saxon / Domesday settlement of Cuckney, or at least a part of it.

6.4.6.11. The dating of the Early Medieval Hand Made sherd is unfortunately not sufficiently tight to associate it with any particular phase of activity, it could be associated with pre-castle settlement activity, with the construction and use of the castle (if such it be) or with the post castle (church construction or use) use of the churchyard.

6.4.6.12. The lack of medieval sherds in the supposed outer bailey of the castle, to the north of the present church yard, may be due to a whole range of factors. As earlier and later finds were seen in this area though it is possible that the lack of medieval artefacts represents a true absence, at least of medieval activity associated with the presently visible earthworks. A slight question mark is therefore raised over whether these outer earthworks truly represent part of a medieval castle or whether they could perhaps relate to other, probably later activity, perhaps particularly something to do with the extensive modification of the Poulter valley to install the water meadows.

7. Interpretations, conclusions, and discussions

7.1 The integrated surveys revealed a large number of anomalies and features listed in the results above. The Magnetometer survey picked up a number of dipolar linear anomalies 1, 2,3 and 4 which represent buried services, with features 2 and 3 running parallel to the line of the road. Feature 1 is perhaps a buried metal water pipe, as a series of manholes are present in the river flood plain. Feature 4 is the detection of services entering the church underneath a pathway forming the southern approach to the church.

7.2. The large areas of dipolar anomalies 14 and 19 are close to site boundaries

where metal wire fencing has been dumped along with other material (19 is probably associated with material from the building of the road, and from dumped material, 14 is adjacent to the boundary wall of the churchyard, and probably also reflects dumped material and remnants of metal fencing). Dipolar anomalies 16 and 17 are caused by manhole covers, perhaps for brick or stone lined drains. The bipolar anomaly 18 may represent a buried metal object, the large number of weaker dipolar anomalies in area 2 along with similar sized and shaped positive and negative anomalies (unnumbered) probably represent human burials in the churchyard, where grave markers have been removed presumably in the later 20th century.

7.3. The alternating negative, positive, negative, positive, negative, positive, magnetic linear anomalies in feature 7 in figure 21 correspond with feature 10 in the hachure plan for the topographic survey, where they have been interpreted as ridge and furrow agricultural remains (figure 37).

7.4. To the north of these features is a long linear ditch marked 9 on the hachure plan, and detected as a positive anomaly in figure 21 marked 5. The bank to the north corresponds with a negative linear anomaly 6 on figure 21. This long linear channel cuts the shortest route across the meaner of the river, and may be a former 'leet' or water channel utilising the potential energy gradient of the water caused by the meander, perhaps to power a mill at the eastern, downstream end (beyond the survey area). The Historic England Scheduled Monument entry suggests that this feature is a double bank and ditch enclosing an outer bailey to the north, running parallel to the river which would have formed a further line of defence. This could also be a possibility. Although no ditch is seen to the east or west of the church (see below) to complete the outer bailey enclosure. The artefacts recovered and recorded in the survey are all of post medieval date from this northern part of the site. This could of course reflect deeper stratigraphy in this area.

7.5. To the west of this long linear ditch is a large flat semi-circular feature 6 on hachure plan, with a bank; 7 on the northeastern edge and a meter deep ditch; 8 on the north eastern and eastern sides. This may be an enclosure between the suggested Motte to the south, and the river to the north. The Magnetometer survey shows positive and negative anomalies in line with the bank and ditches of this feature (9, 10, 11, 12, 13 on figure 37). The ditch in feature 8 corresponds

with a ditch running north to south (feature 3 on figure 21) further to the south.

7.6. Feature 3 seems to form part of the remains of a series of banks (features 1 and 2 in figure 21, and seen to the south in the DTMs above) that enclose a circular area (feature 5 on the hachure plan). This area is interpreted as a possible Motte in the Scheduling. A sherd of mid 12th - mid 13th century pottery was recovered from with in this area, perhaps supporting the suggested dating for the feature as a Motte (see Appendix VII). However, animal burrows investigated along the western side of the raised bank of Feature 3 are surprisingly sterile for a potential castle. The absence of gravels, or finds in these animal deposits, does raise a question over this mound regarding its origins as a man made structure (see above and appendix VII).

7.7. The western and southern part of the graveyard is enclosed by a deep ditch to the west and south of feature 3 (shown on the western side as positive anomaly 15 in the magnetometer interpretation plot in figure 21). It is depicted as feature 4 on the hachure plan and the vertical line of the wall is also show. According to the Scheduling for the Castle by Historic England: “The perimeter wall of the graveyard occupies the inner edge of a 10m wide ditch that encircles the west side of the Motte and encloses the inner bailey on the north side. Originally, it would also have enclosed the south side of the bailey but has been filled-in to the south of the church so that, on this side, only the area south of the Motte remains open. The remainder will survive as a buried feature in the unscheduled part of the inner bailey”.

7.8. Although a slight depression can be discerned in the western part of the southern churchyard, there is no evidence in the magnetometer survey data in area 2 for a ditch extending through the churchyard to the south.

7.9. The Scheduling also suggests that having encircled the church to the south, the inner bailey ditch should continue to the east of the church, however: “The ditch does not appear to have extended along the east side of the inner bailey, which also lies in the unscheduled area. This indicates that the original entrance would have occupied this side”. No ditch was seen in area 3 of the magnetic survey. This could confirm the presence of an entrance here, but the apparent absence of the southern ditch calls this into question also.

7.10. To the west of the Scheduled site is a large area of high ground with a flattish summit (feature 12 on the hachure plan in figure 37). A wide linear bank runs along the western edge of this summit marked 13 on the hachure plan. This bank lines up with anomalies found here in the GPR results (feature 3 on radargram 10- possible buried structure).

7.11. Within feature 12 (on the hachure plan) are a number of discreet linear positive and negative magnetic anomalies that may represent occupation, possibly small trenches or building foundations. At the base of the western slope of this hill was found a sherd of 10th - mid 11th century Torksey type ware (see Appendix VII), which may indicate Saxon occupation in this area. A sherd of Torksey type ware of a similar Saxon period was also found at the eastern end of the churchyard (see appendix VII).

7.12. The Saxon Pottery finds may suggest that the Saxon settlement was located in the vicinity of the church, in closer proximity to the watercourse.

7.13**.** To the east side of the churchyard the GPR survey detected a large anomaly (reference 1) that could be a likely target for the reinterred bones from 1951.

7.14. Feature 26 in area 3 of the magnetometer survey (figure 21) is actually two positive and negative features, suggesting an area of disturbance that may corroborate the anomaly detected in the GPR survey anomaly reference 1.

7.15. Anomaly feature references 4, and 5 in the GPR survey are also listed as possible burial pits to the north of the churchyard. These could be further burial pits so far unaccounted for.

7.16. Anomaly reference 2 was detected underneath the church and may represent the first primary evidence scientifically record of the burial pits described by Maurice Barley in 1951.

7.17. The surveys have detected a number of features and anomalies that both support and challenge the current interpretations of the medieval Motte and Bailey castle. It is hoped that the results brought together through this integrated survey can be investigated by castles experts and academics so that a better

understanding of the complex of earth works in and around Cuckney church can be gained now that this report is available.

7.18. The GPR part of the survey has also provided primary evidence for burial pits underneath the church.

8. Outcomes

8.1. A major objective of the project was to search for primary evidence of the potential burial pits beneath the church, and possibly elsewhere in the churchyard, and also to search for the possible location of the reinterments from 1951.

8.2. The Ground Penetrating Radar Survey detected a number of likely anomalies both under and around the church which could represent the first primary evidence ever recorded of the burial pits described by Professor Barley.

8.3 Ground Penetrating Radar also found a large anomaly to the east of the churchyard which could be the reinterments. This anomaly is within 0.1 metres of the last active burial in the churchyard.

8.4 If the detected anomaly (anomaly reference 1) is the reinterments then the project has helped to identify this location, which is situated in the currently active part of the churchyard. The survey has therefore prevented this anomaly from being accidentally damaged through continued burials in that area of the churchyard.

8.5 Features recorded in the integrated survey may help in a possible reassessment of the Scheduled Monument and it's interpretation, although more work would be necessary.

8.6. The project has recorded the first Saxon artefacts in the village (according to HER; appendix V) and could indicate the location of a settlement from the Saxon period around the area of the church, near to the river.

9. Future Work

9.1. It is recommended that the cause of the anomalies references 1-6 in the GPR table 2 are investigated further by targeted intrusive methods in order to confirm the causative feature of the anomalies.

9.2. Targeted excavation may also enable a greater understanding of the nature and use of the features detected in the Magnetometer and topographic earthwork surveys.

9.3. If excavated; the anomaly interpreted as the possible interments from the 1951 works may offer an opportunity for the application of modern osteological methods to establish the number, sex, age and possible cause of death of those in the pit. Scientific methods of collection and sampling could help determine the levels of later contamination, and certainly suggests any dating trends that could point to the period of original interment. Modern scientific testing such as Strontium analysis, radiocarbon dating, and isotope analysis, with the aim of dating the bones. This could help towards proving if a battle did take place at this site, and in which century.

9.4. Geophysical Resistance survey over features on the semi-circular enclosure to the north of the 'Motte' and on the hill summit to the west would also be beneficial in determining the presence or absence of buried trenches and / or foundations possibly associated with the castle.

9.5 Geophysical Resistance survey in the south and east of the churchyard may help to confirm or deny the presence of a ditch.

10. Publication, archiving, reporting, and Dissemination

10.1. An OASIS entry pertaining to the work has been created. The OASIS identifier for the project is OASIS ID: merciana2-246688.

10.2. All reports including those in the appendices are available for download from the Mercian website: http://www.mercian-as.co.uk.

10.3. A summary of the work will be published in the Archaeological Short Reports section of the Transactions of the Thoroton Society.

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(https://historicengland.org.uk/listing/the-list/list-entry/1010909, accessed 31/03/2016).

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Meden Vale, and Cuckney Church of England Primary Schools

13. Disclaimer:

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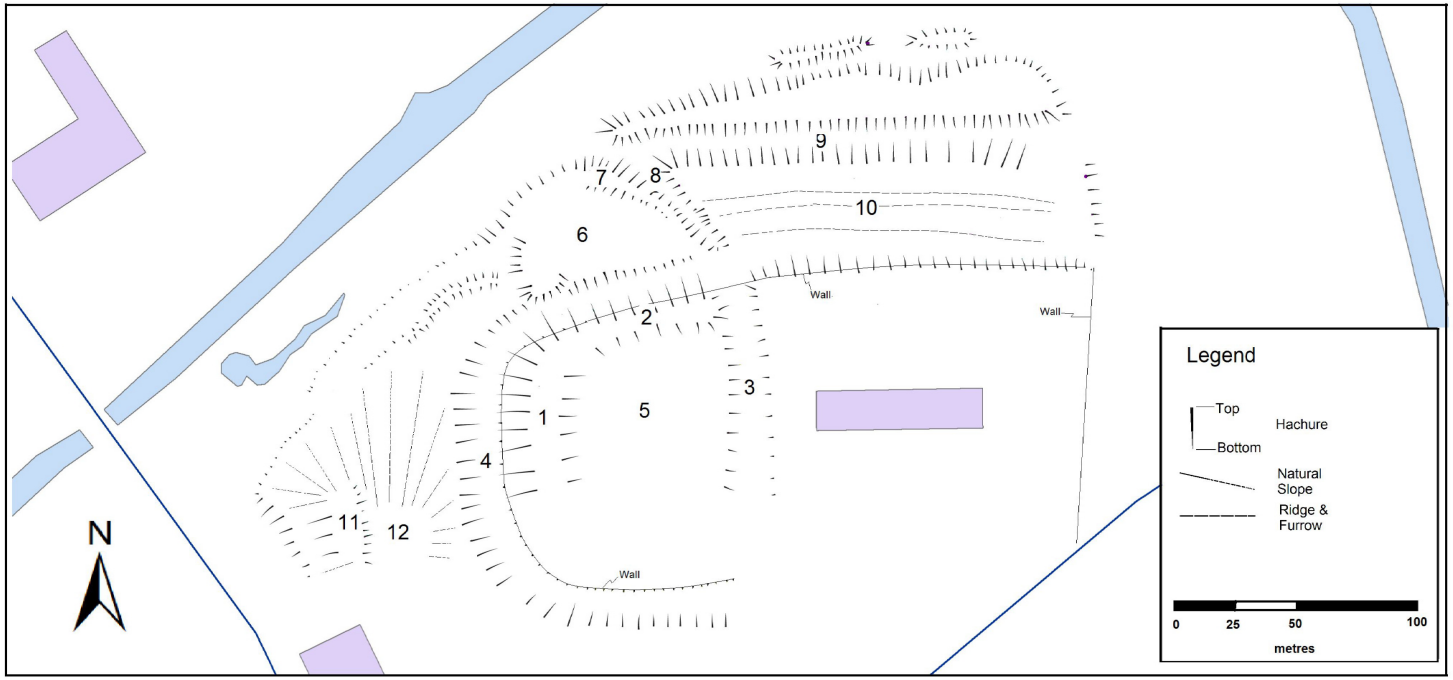
Geophysical techniques are not a map of the ground and are instead a direct measurement of subsurface properties. Detecting and mapping features requires that said features have properties that can be measured by the chosen

technique(s) and that these properties have sufficient contrast with the background to be identifiable. The interpretation of any identified anomalies is always subjective. While the scrutiny of the results is undertaken by qualified, experienced individuals and rigorously checked for quality and consistency it is often not possible to classify all anomaly sources; while there will be degrees of certainty for others. Where possible an anomaly source will be identified along with the certainty of the interpretation. The only way to improve the interpretation of results is through a process of comparing excavated results with the geophysical reports.

The results of the GPR survey can only provide locations of anomalies, which were identified based on changes from surrounding ground conditions. This includes areas with hyperbolic reflections, amplitude variations, and distinct planar reflections. It should be noted that these signals are not exclusive to archaeological features, and may represent other natural or contemporary features. Further, not all features of archaeological interest will produce a recognisable signal, in particular small-scale isolated remains (such as discrete bones) which are not in a formal burial context, and those features which do not vary significantly in physical and chemical characteristics from surrounding deposits.

The size of objects detected is limited by the antenna frequency to objects with dimensions larger than ~10 cm (with the 800MHz in the upper 0-1m) and ~20 cm (with the 300MHz in the depth range 1-3m). As such, this GPR survey is not expected to have identified all locations where human remains may be present.

Appendix I: Maps and Plans, 3D Models.



Hachure plan of earthworks, Cuckney Churchyard and Castle, 2016

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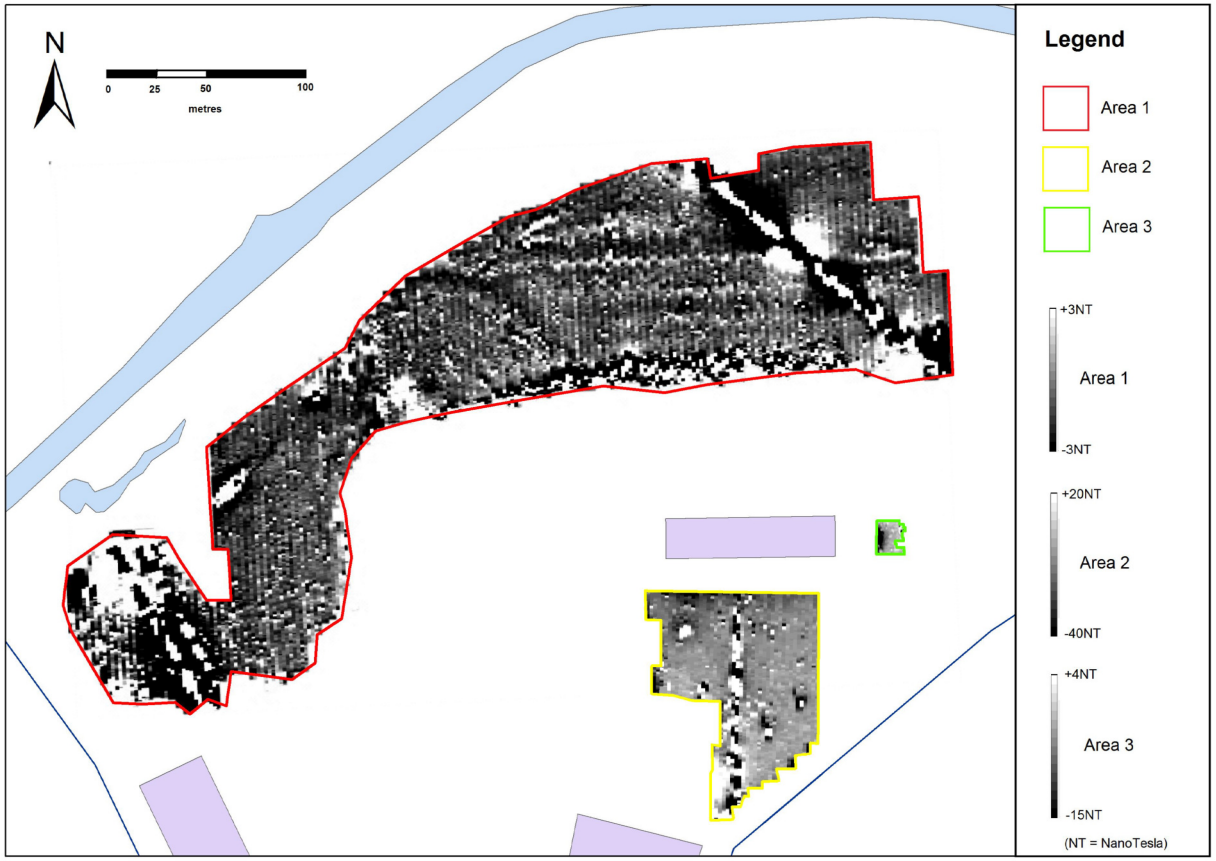
Figure 22: Western half of Interpreted results of the Ground penetrating Radar Survey. © RSK Environment Ltd.



Geophysical Magnetometer Survey Results, Cuckney Churyard and Castle, 2016

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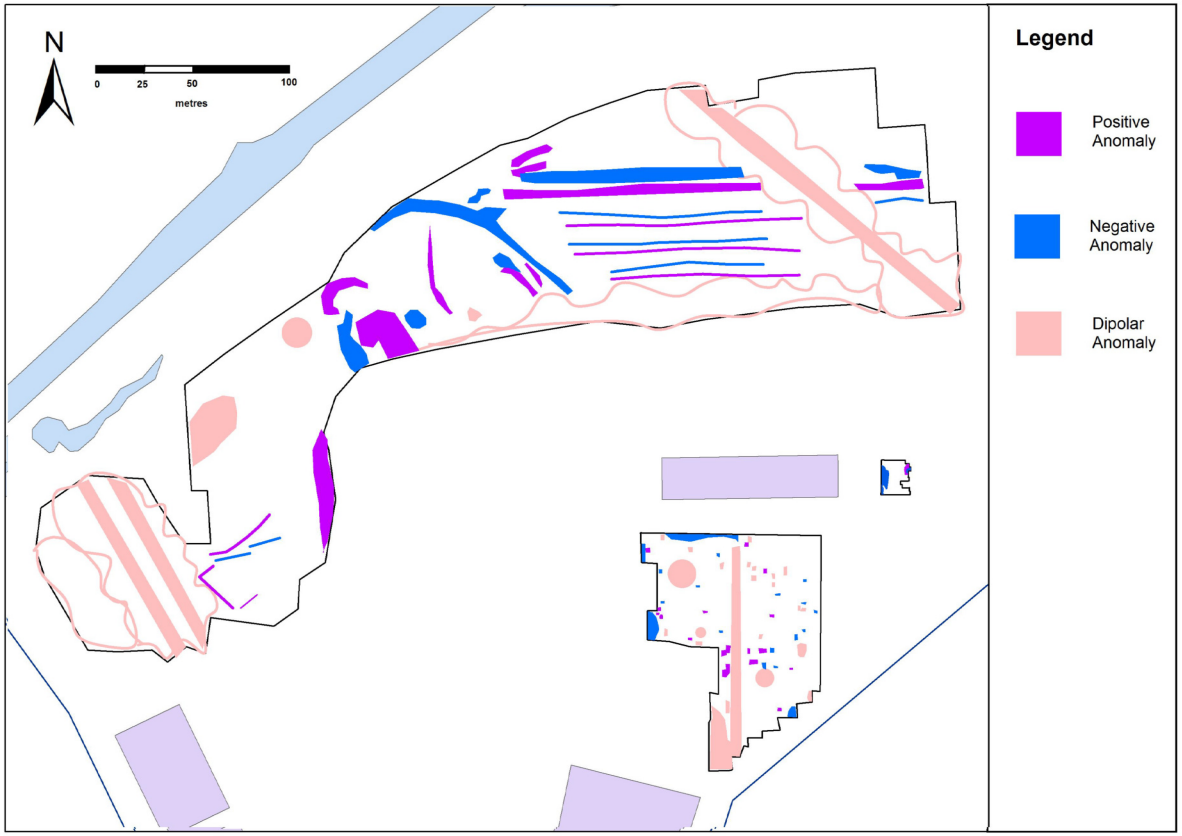
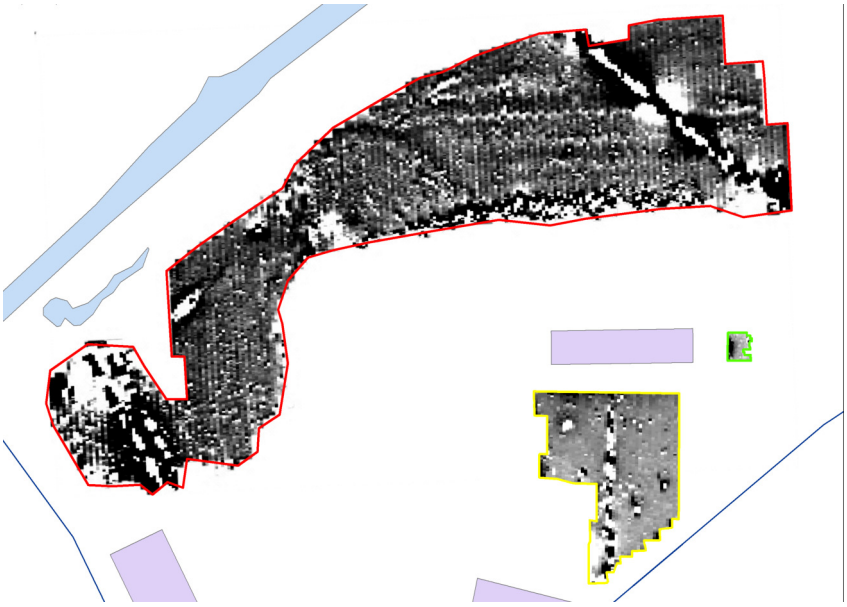


Geophysical Magnetometer Survey Interpretation Plot, Cuckney Churchyard and Castle, 2016

Appendix II: Magnetometer and Topographic Survey Report



Geophysical Magnetometer and Topographic Survey of Cuckney
Churchyard, Castle, and surroundings
Cuckney, Nottinghamshire, 2016
(SK 565713)

Geophysical Magnetometer and Topographic Survey Report

Andy Gaunt
Mercian Archaeological Services CIC
31/03/2016
Ref: Gaucuck1301
Report MAS020

LOTTERY FUNDED

Mercian
Archaeological Services CIC

Geophysical Magnetometer and Topographic Surveys of Cuckney Churchyard, Castle, and Surroundings

Cuckney, Nottinghamshire, 2016.

Geophysical Magnetometer and Topographic Survey Report

Cuckney (SK 565713).

Andy Gaunt
Mercian Archaeological Services CIC
MAS020

Title:	**Geophysical magnetometer and topographic surveys of Cuckney Churchyard, Castle, and Surroundings Cuckney, Nottinghamshire, 2016.**
Author:	Andy Gaunt
Derivation:	-
Date of Origin:	05/11/2015
Version Number:	1.1
Date of Last Revision:	
Revisers:	
Status:	Final
Summary of Changes:	Editorial changes
Mercian Project Identifier:	Gaucuck1301
Client:	The Battle of Hatfield Instigation Society, The Heritage Lottery Fund
Checked / Approved for Release by:	S.Crossley

Contents **Page**

1. **Project location, topography and geology**

1.1. **Site Location:** The site is located (SK565713), in the parish of Cuckney, Nottinghamshire, Cuckney Church yard is to the north of the village of Cuckney. Cuckney village is located approximately half way between Mansfield and Worksop.

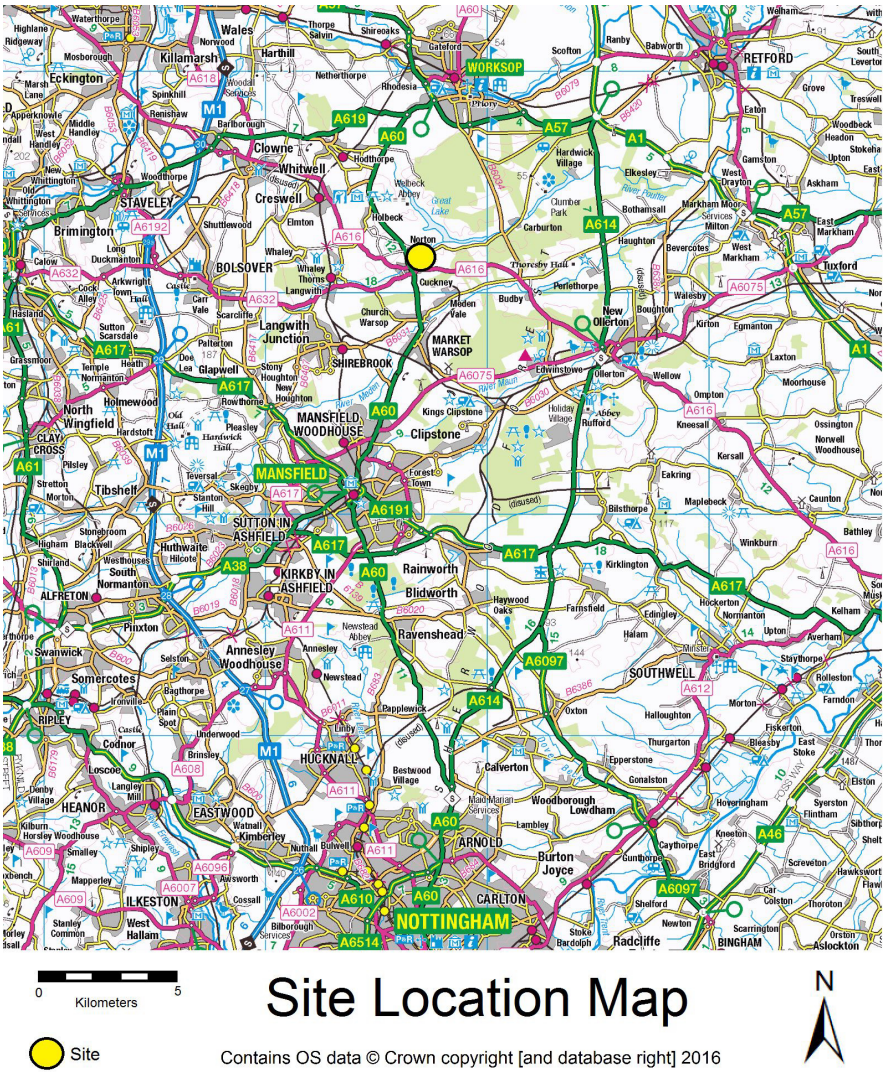


Figure 1: Site Location regional map.
Contains OS data © Crown copyright [and database right] 2016.

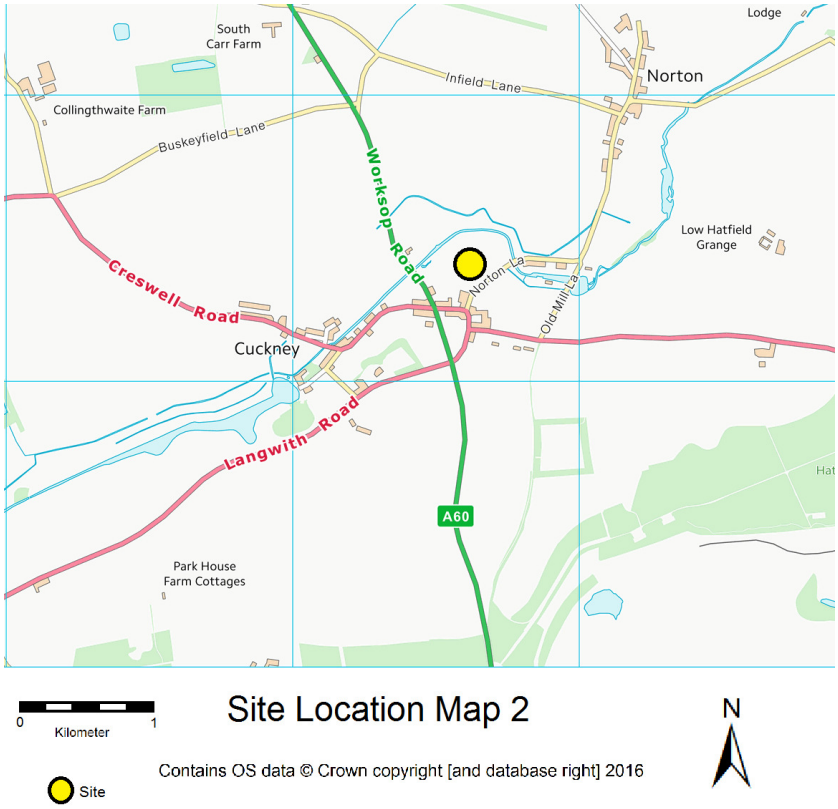


Figure 2: Site location from local map.
Contains OS data © Crown copyright [and database right] 2016.

1.2 **Topography:** The site is located in the valley of the River Poulter. The Church of Cuckney sits on a raised location at the northern end of the village of Cuckney above the flood plain of the river. The River Poulter forms the northern extent of the site, which is enclosed to the east north and west by a meander. The river's course has been canalised as part of a historic water meadow system. A number of earthworks occupy the lower ground between the churchyard and the river on this northern side. The site sits to the west side of a historic north-south routeway from Mansfield to Worksop. Earthworks protected as a Scheduled Monument are extant in the western part of the churchyard, and to the north.

1.3 **Geology:** The 1:50,000 scale bedrock geology description for the site is as follows: Lenton Sandstone Formation - Sandstone. Sedimentary Bedrock formed approximately 246 to 271 million years

ago in the Triassic and Permian Periods. Local environment previously dominated by rivers. These rocks were formed from rivers depositing mainly sand and gravel detrital material in channels to form river terrace deposits, with fine silt and clay from overbank floods forming floodplain alluvium, and some bogs depositing peat; includes estuarine and coastal plain deposits mapped as alluvium. The site is enclosed to the north by the river channel of the River Poulter where the 1:50,000 scale superficial deposits description is as follows: Alluvium - Clay, Silt, Sand And Gravel. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by rivers. These rocks were formed from rivers depositing mainly sand and gravel detrital material in channels to form river terrace deposits, with fine silt and clay from overbank floods forming floodplain alluvium, and some bogs depositing peat; includes estuarine and coastal plain deposits mapped as alluvium. (www.BGS.ac.co.uk- accessed 29/03/2016).

2. Archaeological and Historical Background

2.1. **Place name:** The English Place Names Society volume for Nottinghamshire published in 1940 gives the derivation of Cuckney as "The second element is e.g. 'island of marshy land.' The first is probably... The personal name *Cuca* or *Cwica,* a pet form of such a name as [old english] *Cwichelm* (Glover et al 1940 p75). It lists the earliest appearances in the forms: Cuchenai 1086 Domesday Book, Cucheneia c 1150, Cuckeneya 1159-81, Cuckeneie c 1179, "and frequently in Inquisitions Post Mortem to 1295 with variant spellings *Kuk-* and *-eye, eia, -aie, -aye, -ee." Chugeneia 1185, Chugeneia 1187, Quikenea 1195, Kuyekeney c 1245, Cokeneye 1221, Cokkene 1393, Cokkenaye 1548, Coknay 1510, Cookney 1542, Cowkenay 1548, Cuckney 1684* (ibid).

2.2 **The Domesday Book of 1086**:

"The Land of Roger de Bully.
Bassetlaw Wapentake

In CUCKNEY Alric and Wulfsige had 1 carucate of lands to geld. [There is] land for 2 ploughs. There Geoffrey, Roger's man, has 1 plough, and 9 villains having 3 ploughs. [There is] woodland pasture 2 furlongs long and 2 broad. TRE* worth 20s; now 2s less." (Williams & Martin Eds. 2003. Pp 764-766)

"The Land of Hugh fitzBaldric.
In Cuckney Swein had 2 carucates of land to the geld. [There is] land for 4 ploughs. Richard holds it of Hugh, and has there 2 ploughs in demense; and 3 sokeman on 2 bovates of land and 10 villains and 5 bordars having 2 ploughs. There is a priest and a church, and 2 mills [rendering] 8s [and] woodland pasture 4 furlongs long and 4 furlongs broad. TRE, as now, worth 30s." (Williams & Martin Eds. 2003. P779).

*TRE - Tempore Regis Edwardi (Time of King Edward the Confessor). Refers to the value of the holdings at the time of the Norman Conquest, 1066. The second value relates to the value at the time of the Domesday survey 1086.

2.3 **Prehistoric and Roman**

2.3.1. The Historic Environment Record (HER) is the repository for archaeological knowledge and information for the county. A 2km wide search of the database, centred on Cuckney church brings up a list of 54 Monuments and Elements.
The records listed on the HER include a number of undated linear earthworks, an undated cropmark enclosures; on in both Norton and Cuckney, an undated banked enclosure, and undated irregular earthworks.
The earliest dateable object is a Roman coin dating from 268-273AD.

2.3.2. This Roman coin is the only artefact registered on the HER for Cuckney with a confirmed date prior to the medieval period

(see Appendix V).

2.4. **Medieval**

2.4.1**. Church.**

2.4.1.1. The earliest reference to a church in Cuckney comes from the Domesday entry listed above, where a church and priest are recorded in 1086.

2.4.1.2. Nikolaus Pevsner describes the church in Cuckney in the following entry: “St, Mary. An unusually long nave of c. 1200 with a N aisle, in the W with circular piers, then two of quatrefoil plan, finally the others octagonal... The arches are all semi-circular and double chamfered. In date the arcade seems to stand between the lower stages of the broad short W tower and the S door (two orders without columns, one zig-zag, the other a thick angular rope motif) on the one hand and the upper stage of the tower (ashlar with mid-C13 two-light windows) and the S porch on the other. The S porch in any case seems EE [Early English] throughout (see its door with stiff-leaf capitals and its corbel table). The Piscina has dogtooth and nailhead ornament, - SCREEN now in the tower arch: only very small remains of Perp [Perpendicular] panel tracery” (Pevsner. 1951. p58).

2.4.2. **Motte and Bailey Castle.**

2.4.2.1. The Motte and Bailey Castle at Cuckney has been a Scheduled Monument since 28-Apr-1953. Scheduled Monument Number 1010909, Legacy Scheduled Monument Number 13393 (https://historicengland.org.uk/listing/the-list/list-entry/1010909, accessed 31/03/2016).

2.4.2.2. According to the Historic England website “Cuckney Motte and bailey castle is a reasonably well-preserved example of an adulterine fort built to command a river valley. Although the Motte and inner bailey are partially disturbed by

modern burials, a sufficient amount remains intact for the structure of the Motte to be preserved and also the relationship between these areas and the outer bailey. The outer bailey itself has suffered little disturbance and so will retain the archaeological remains of ancillary features such as garrison buildings and corrals for stock and horses. The defensive earthworks associated with both the inner and outer baileys also survive well" (https://historicengland.org.uk/listing/the-list/list-entry/1010909, accessed 31/03/2016).

2.4.2.3. The Historic England website contains the following detailed entry about the Scheduled area of the Motte and Bailey Castle:

"The monument includes the Motte, outer bailey and part of the inner bailey of the twelfth century Motte and bailey castle at Cuckney. Originally, the inner bailey extended further east into the area now occupied by the parish church of St Mary and the churchyard to the south. Although archaeological remains will survive here, these areas are not included in the scheduling as they are in current ecclesiastical use. The outer bailey may also have extended further south into the built-up area southwest of the church. This area is not included in the scheduling as the extent and state of preservation of the remains is not sufficiently understood. The inner bailey is a sub-rectangular platform orientated east to west. It measures 90m from north to south and 150m east to west. Only the western 80m are included in the scheduling. The Motte occupies the northwest corner of the inner bailey and consists of a flat-topped oval mound, 4m high and measuring 45m from north to south by 20m east to west. Both the Motte and the scheduled part of the inner bailey are occupied by the now disused graveyard associated with the church. The perimeter wall of the graveyard occupies the inner edge of a 10m wide ditch that encircles the west side of the Motte and encloses the inner bailey on the north side. Originally, it would also have enclosed the south side of the bailey but has been filled-in to the south of the church so that, on this side, only the area south of the Motte remains open. The remainder will survive as a buried feature in the unscheduled part of the inner bailey. The ditch does not appear to

have extended along the east side of the inner bailey, which also lies in the unscheduled area. This indicates that the original entrance would have occupied this side. Encircling the inner bailey on the north and west sides is a 40m wide ribbon of open ground which functioned as an outer bailey. This is partially encircled by a double bank and ditch which lies roughly parallel with the River Poulter and is approximately 15m wide. The river would have formed another line of defence on this side and, in addition, could be commanded from the castle. The castle was built by Thomas de Cuckney during the reign of King Stephen (1135-54), which was a time of civil strife between Stephen's supporters and those of the Empress Matilda (Maud), daughter of his predecessor Henry I. The castle may therefore have been an adulterine fort; that is, one built without the king's permission. During the underpinning of the church in 1951, up to 200 burials were found which antedate the building of the church in c.1200. They occupied three or four communal graves; that is, trenches dug north to south so that the bodies could be laid with their feet to the east. No associated finds have been recorded; neither have the remains undergone scientific analysis. However, it is assumed that the bodies were casualties from a skirmish associated with the Maudian rebellion. After their discovery, the skeletons were reinterred in a fresh communal grave. Excluded from the scheduling are the boundary walls crossing the monument and the graves on the Motte and within the scheduled part of the inner bailey, although the ground beneath these exclusions is included." (https://historicengland.org.uk/listing/the-list/list-entry/1010909, accessed 31/03/2016).

2.5. **Post Medieval**

2.5.1 The HER search (see Appendix V) shows large amounts of building in the parish in the post medieval period, including a series of mills and workers cottages. The list also includes a number of sluices. These survive in the fields to the north of the River Poulter.

2.5.2. **Water Meadows system.** The River Poulter was the

subject of a water meadow improvement scheme by the Duke of Portland during the 18th and 19th century (Gaunt 2009: 2010) this presumably resulted in canalisation of the water channel of the meander surrounding the site to the East, North and West.

2.6 **Mass Burials under the Church.**

2.6.1. As stated on the Historic England website, in relation to the entry for the Motte and Bailey Castle Scheduling, During underpinning works, undertaken in 1951 in advance of potential coal mining operations in the area, builders discovered a large number of skeletons. Maurice Barley reported the find in the transactions of the Thoroton Society, but his interpretations and descriptions were not based on first hand evidence, but on the testimonies of the workmen and others. It was estimated that burial pits under the church could hold up to 200 burials. These burials were believed to have pre-dated the building of the church in the later 12th century and early 13th century (Barley 1951).

2.6.2. The burials occupied three or four trenches dug north to south so that the bodies could be laid with their feet to the east.

2.6.3. No finds were recorded to date the bones, no photographs survive, if they were taken, no drawings were made, and no scientific analysis was undertaken. No primary evidence of the burials is known.

2.6.4. Professor Barley assumed that the bodies were casualties from a skirmish or battle dating from the period of the Anarchy of Stephen and Matilda in the middle part of the 12th century.

2.6.5. This suggestion ties in with the building of the possible adulterine Motte and Bailey Castle, and is the preferred date for the origin of the burials according to Historic England.

2.6.6. The skeletons that were dug up in the 1951 works were

reinterred in a new location in the graveyard.

2.7. **The Battle of Hatfield**

2.7.1. In 1975 Stanley Revill reassessed the evidence for the burials, and using place name evidence among other arguments, he suggested that the burials might have dated from the 633AD Battle of Hatfield, where Edwin of Northumbria was defeated and killed by the combine forces of Penda of Mercia and Cadwallon of Gwynedd. Revill referenced the existence of Hatfield Grange, High Hatfield Farm, the location of Cuckney in the District of Hatfield, the western part of the Wapentake of Bassetlaw, Edwinstowe, and St Edwin's chapel in Clipstone, all as indicators of the possible memory of the battle and death of King Edwin in the area (Revill, 1975).

2.7.2.Revill was not the first to suggest the Battle of Hatfield was fought local to Cuckney. In 1890 Stapleton in his: *History of the Lordship of King's Clipstone or Clipstone in Sherwood, Nottinghamshire,* speculated that St Edwin's Chapel in Clipstone parish was likely named after King Edwin and the Battle.

2.7.3. John Chapman's map of Nottinghamshire from 1774 depicts Hatfield District covering the western half of Bassetlaw Wapentake.

3. Methodology

3.1. **Geophysical Survey** enables the non-invasive identification of buried or sub-surface features. These may include features of potential archaeological significance. Geophysical survey as employed in archaeology usually comes from one of three techniques; Magnetometry, Earth Electrical Resistance, or Ground Penetrating Radar (GPR). Techniques are chosen 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, but also more often than not choices are based on time, and therefore financial reasons. Best results are gained from an integrated survey where more than one technique is employed. For this integrated survey, two forms of Geophysical survey were chosen. Magnetometer survey was employed to cover as large an area as possible, and to search for anomalies such as ditches and pits associated with earthworks from the Castle and surrounding landscape. The methods of the geophysical surveys are outlined below.

3.1.1. **Standards**

3.1.1.1. The Magnetometer survey and reporting were conducted in accordance with Historic England guidelines, *Geophysical survey in archaeological field evaluation* (David, Linford & Linford 2008); the Institute for Archaeologists (IfA) *Draft Standard and Guidance for archaeological geophysical survey* (2010); 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* (draft 2nd edition, Schmidt & Ernenwein 2010).

3.1.2.2 The survey was undertaken using a Bartington Grag6012 fluxgate Gradiometer. 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 be caused by archaeological features. The gradiometer works by measuring the earth magnetic field at two separate sensors; one positioned 1 metre above the other. The lower of the two sensors is place nearer to the ground surface and so is affected by magnetic variations in the soil. The signal is either higher or lower than the top sensors. This 'gradient' is recorded.

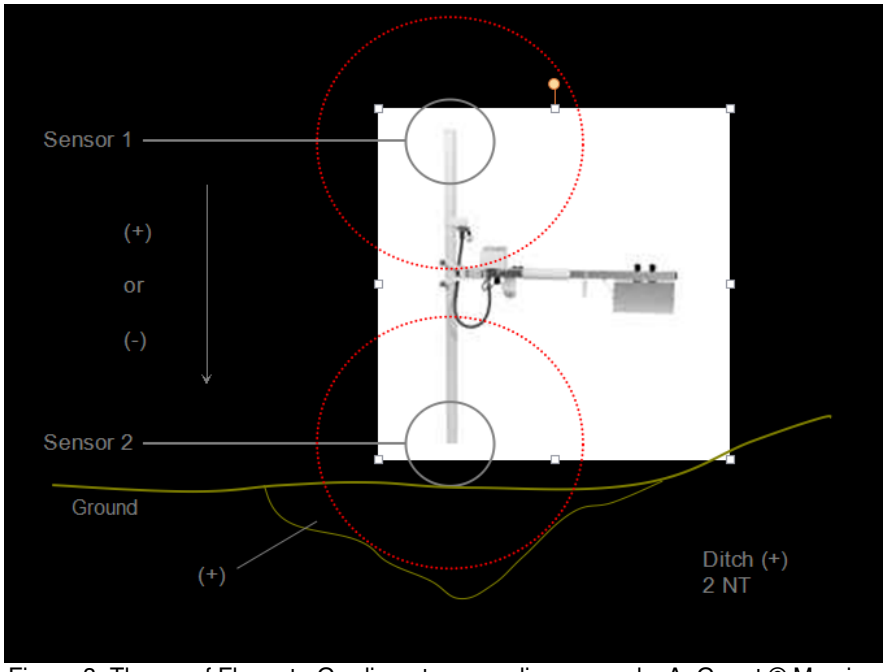


Figure 3: Theory of Fluxgate Gradiometer recording anomaly. A. Gaunt © Mercian Archaeological Services CIC, 2015.

3.1.2.4 **Fieldwork Methods**

3.1.2.4.1. A 20m grid was established across the survey area using tape measures and pegs. This grid was then recorded using the total stations to give accurate Ordnance Survey data locations for the grid. Three separate areas were surveyed (see figure 5).

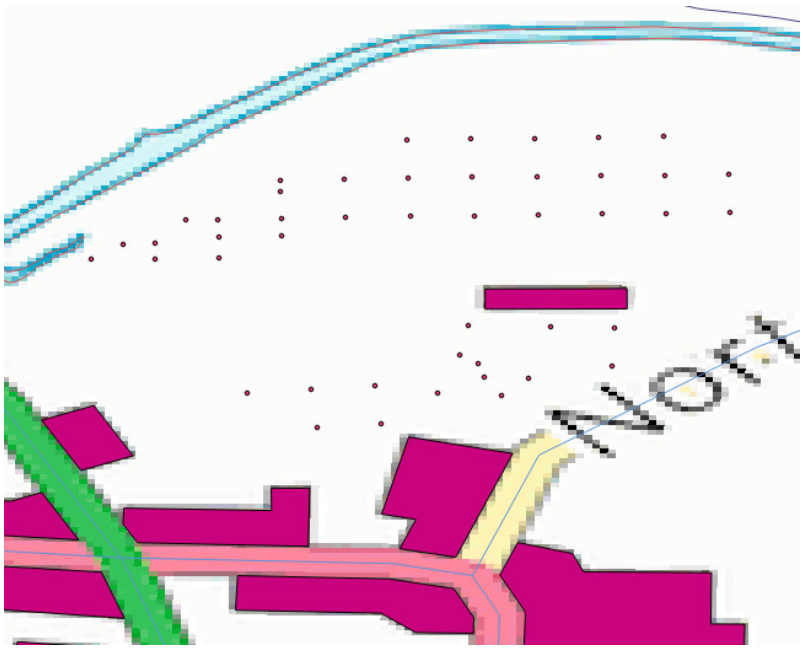
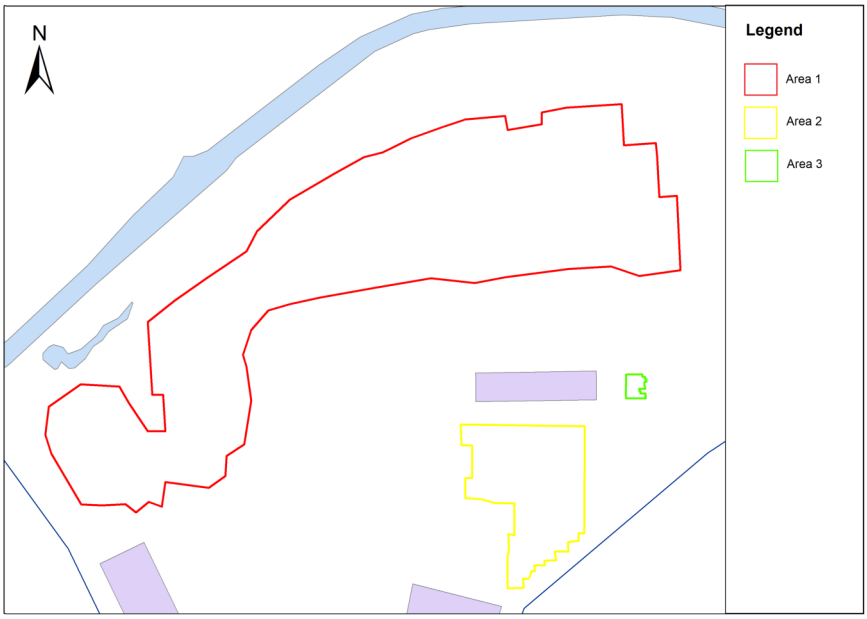


Figure 4: Points recording the geophysical survey grid. Contains OS data © Crown copyright [and database right] 2016.



Geophysical Magnetometer Survey Results, Cuckney Churyard and Castle, 2016

Figure 5: Magnetometer Survey Areas Contains OS data © Crown copyright [and database right] 2016.

3.1.2.4.2. 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.

3.1.2.4.3 Data were downloaded on site onto a laptop for initial processing and storage. The data was backed up onto Mercian's data network, with copies made of the data for processing.

3.1.2.5. **Interpretation and Archiving.**

3.1.2.5.1. **Data processing**

3.1.2.5.1.1. Grids collected in the field

were downloaded and processed in a combination of Snuffler version 1.14, and Geoplot v.3 software. Grids were meshed together into a composite map of the survey. Snuffler 1.14 and Geoplot v.3 were used to process the geophysical data and to produce both a continuous tone greyscale image and a trace plot of the raw (minimally processed) data. A plot of filtered data is also provided. The greyscale images are presented in Figures 11, 12, 13, 15, 16, 18, and 19. Trace plots provided in Figures 14, 17, and 20. An interpretation plot is provided in Figure 21. In the greyscale images, positive magnetic anomalies are displayed as light grey and negative magnetic anomalies as dark grey. A key bar relates the greyscale intensities to anomaly values in NanoTesla.

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

3.1.2.5.1.3 C**lip:** This clips data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic.

3.1.2.5.1.4. **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.

3.1.2.5.1.5. **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

3.1.2.1.5. **Destripe:** used to remove error caused during data collection.

3.1.2.1.2. **Anomaly types:**

3.1.2.1.2.1. A colour-coded geophysical interpretation plan is provided. Three types of geomagnetic anomaly

have been distinguished in the data:

3.1.2.1.2.2. **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 (in Purple in Figure 21).

3.1.2.1.2.3. **Negative magnetic** regions of anomalously low or negative magnetic field gradient, which may correspond to features of low magnetic susceptibility such as wall footings (Blue in Figure 21).

4.1.2.1.2.4. **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 (pink in Figure 21).

3.1.2.1.3. **Interpretation: features**

3.1.2.1.3.1. A colour-coded archaeological interpretation plan is provided. Except where stated otherwise in the text below, positive magnetic anomalies are taken to reflect relatively high magnetic susceptibility materials, typically sediments in cut archaeological features (such as ditches or pits) The fill of ditches is often magnetically enhanced by decomposed organic matter or by burning.

3.2. **Topographic Survey Methodology**

The Topographic earthwork survey was undertaken to record and interpret the earthworks in and around Cuckney churchyard, including those that are designated as the Scheduled monument of Cuckney Castle. The survey was also designed to provide a 3 dimensional and 2 dimensional framework for the Geophysical radar and Magnetometer surveys. The survey was undertaken to produce a 2D hachure plan of the earthworks using subjective survey techniques, and to produce 3D Digital terrain models (DTM) of the earthworks by combining the data from subjective survey with data

from objective surveys.

3.2.1. **Equipment**

3.2.1.1. The survey was undertaken using survey grade Global Positioning System (GPS), Electronic Distance Measuring (EDM) Total Station, and Robotic EDM Total Station with 360° prism. The GPS system used was a Leica GPS Viva; enabled to use Smartnet technology. This GPS system operates using Differential GPS (DGPS), where corrections are given to improve the information received from satellite location data. A rover station controlled by the operator recorded points operating in Real-time Kinematic mode, receiving data from a remote system of control stations. This Smartnet system, corrects the rover station, allowing points to be recorded 'on the fly' to subcentimetre accuracy levels, via a mobile SIMM card connection. The GPS rover was set to record either continuously or to take static points, depending on requirements as recommended in Ainsworth, S. & Thomason, B. 2003. The GPS was used to set up accurate control points which could form the 'Control of Survey' for the optical survey techniques (see below).

3.2.1.2 EDM Total Station combines a Theodolite to record vertical and horizontal angles, and an Electronic distance measurement device, to enable the acquisition of 3-Dimentional coordinate data. Total stations reflect infrared laser beams against a reflective prism. Two different Total Stations were utilised during the Cuckney survey to provide the different aspect of the survey. The first Total Station, a Leica TS06, requires two operators, one to operate the device and the other to position the prism pole in the required location for surveying. The second Total Station was a Leica TS15 Robotic 360° prism station. This device enables an operator to gather points automatically at a set increment while the total station 'locks on' and automatically follow the user around the site. This method allows a large volume of data points to be recorded quickly.

3.2.1.3. EDM Total Stations also provide subcentimetre relative accuracy for recordings (http://totalstation.org/total-

stationfunctionality.php). The stations are orientated by coordinate or re-sectioning from known coordinates which are taken from control points (see below) provided by the Differential GPS. All points recorded are therefore accurate to, and recorded in Ordnance Survey Datum.

3.2.2 **Control of survey**

3.2.2.1 Control of survey is the accurate framework of carefully measured points within which the rest of the survey is fitted' (Ainsworth, et al. 2007). Section 2.1 *Control of Survey in Metric Survey Specifications for English Heritage* states that metric survey 'must provide reliable and repeatable control capable of generating the required coordinates within the tolerances stated' (Lutton.2003).

3.2.2.2 The prescribed tolerance level is to a precision of ±10mm (Lutton. 2003). This level of control was achieved by using the Differential GPS Leica Viva system mentioned above. The GPS device was set to take readings within ±10mm accuracy levels, and then used to stake-out station points using 99 epochs per location. The points were chosen to provide inter-visibility across the site for optical survey using Total Stations. Total stations were set up above these station points when required and orientated by the other survey control points to provide control between GPS and optical survey. The control points were also used to configure the Total Stations by re-sectioning techniques. Further control points and Temporary Bench Marks (TBM) were set up around the site using the GPS as required. As well as falling within the accepted tolerance levels, this technique also fulfils the requirement that the control must be repeatable. The site can easily be re-occupied using GPS devices in the future without the need to leave permanent site pegs on a Scheduled Site.

3.2.3. **Objective and Subjective survey methodology**

The survey was undertaken using a combination of objective and subjective survey techniques.

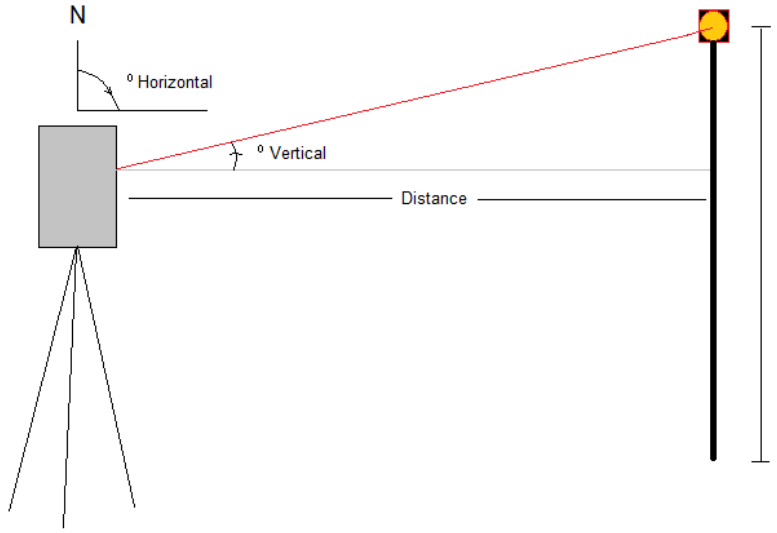


Figure 6: Using a Total Station and prism pole to record points, showing how device records angles and distance (infrared light beam shown in red). © Mercian Archaeological Services 2016.

3.2.3.1 **Objective Survey**

3.2.3.1.1. The objective, systematic part of the survey was carried out using the GPS Viva system described above, but due to tree cover a robotic TS15 Total Station was also used. 1m transects were surveyed across the site walked at right angles to give regular and objective coverage. Transects increments were controlled by volunteers at the ends of the transects acting as markers for the surveyor carrying the robotic total station 360° prism pole. Surveyors walked these transects, and recordings were automatically taken every 0.25 metres.

Figure 7: Screen grab from working data combining subjective and objective surveys, to show coverage. Collected during survey (not all data points displayed). Contains OS data © Crown copyright [and database right] 2016.

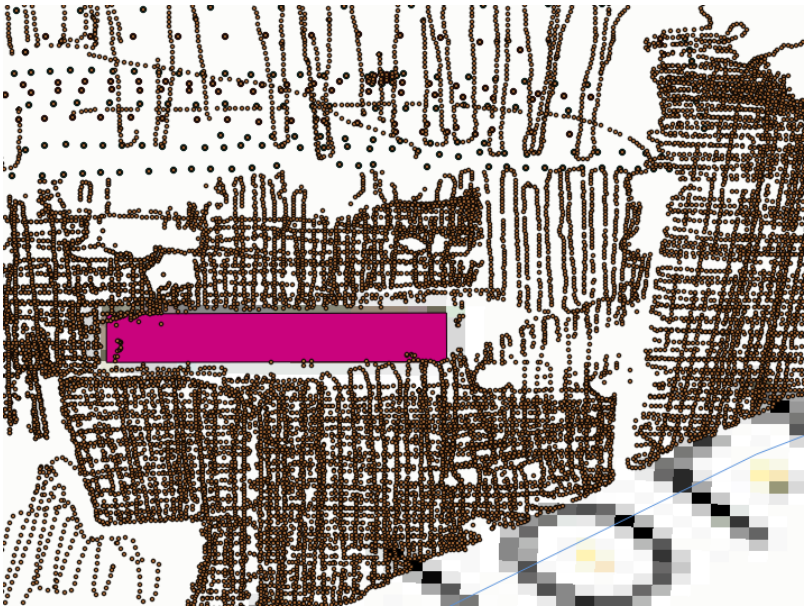


Figure 8: Screen grab from working data combining subjective and objective surveys to show coverage. Collected during survey (not all data points displayed). Contains OS data © Crown copyright [and database right] 2016.

3.2.3.2 **Subjective Survey**

3.2.3.2.1 Subjective survey was used as a means to record features in more detail. It relies on the expertise of the surveyor to analyse the earthworks and to record them. For this procedure, EDM Total Stations were used to record the tops and

bottoms of slopes. These recordings were highlighted in the survey data using different point Identification codes. The tops and bottoms of slopes were mapped and joined together in Geographic Information Systems software, and then the subjective survey data was employed to produce a hachure plan of the site as recommended by Historic England (Bowden 2006).

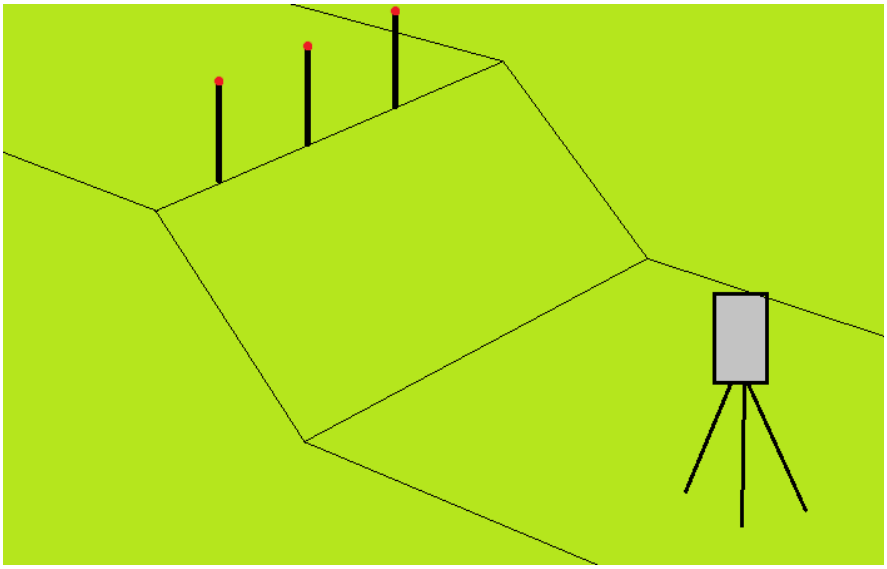


Figure 9: Total Station measuring tops of slope.

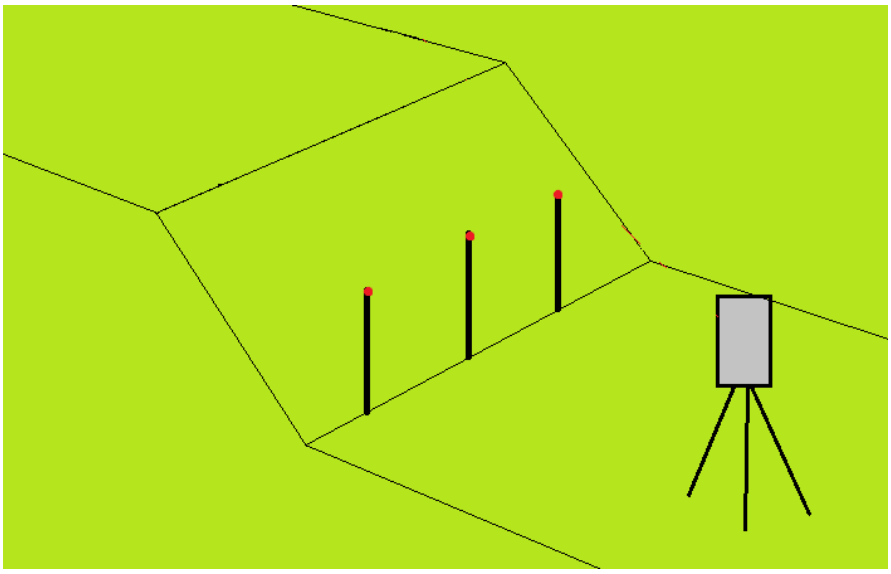


Figure 10: Total Station measuring bottom of slope.

4. Results

4.1. Magnetometer Survey

4.1.1. Survey Results Map

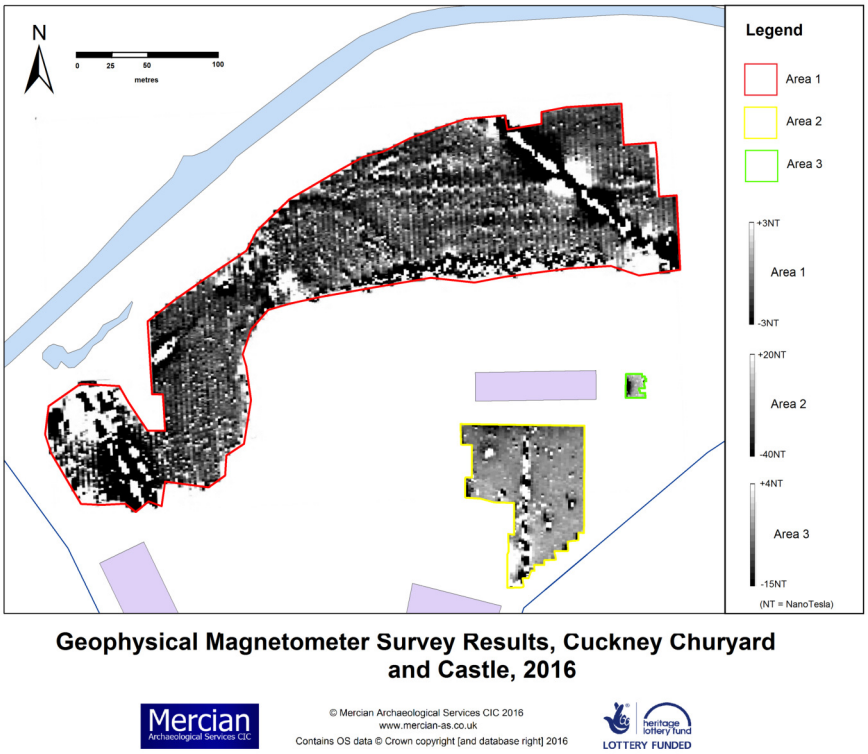


Figure 11: Geophysical Magnetometer Survey Results, 2016. Contains OS data © Crown copyright [and database right] 2016.

4.1.2. **Area 1 Plots**

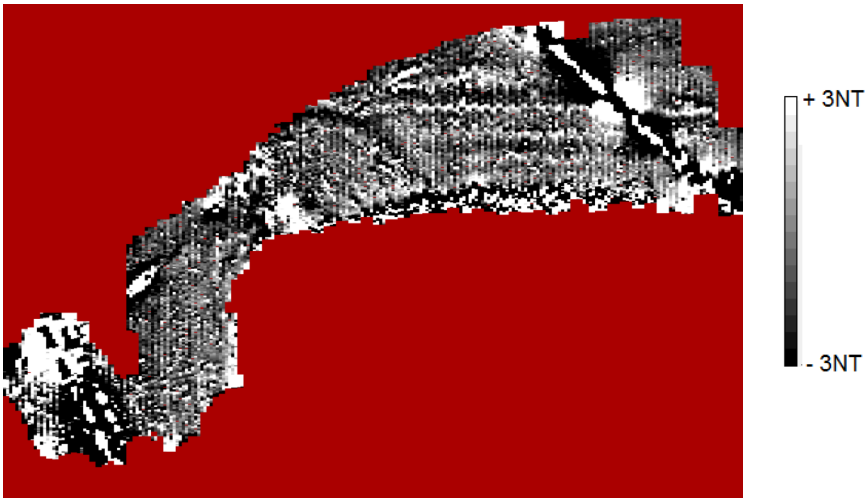


Figure 12: Unprocessed Magnetometer data greyscale image area 1.

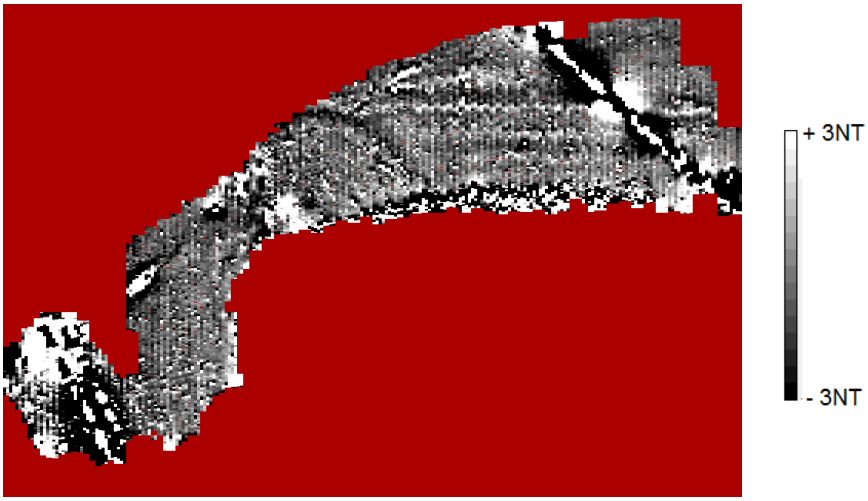


Figure 13: Magnetometer data greyscale image area 1, Clipped +/- 3NT, Destriped, De-Spiked (Threshold 1.0), Interpolated Vertical.

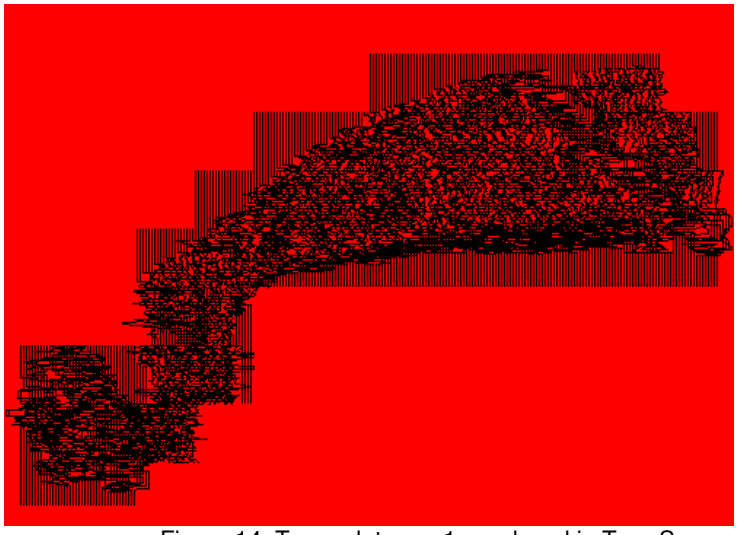


Figure 14: Trace plot area 1, produced in TerraSurveyor

4.1.3. **Area 2 Plots**

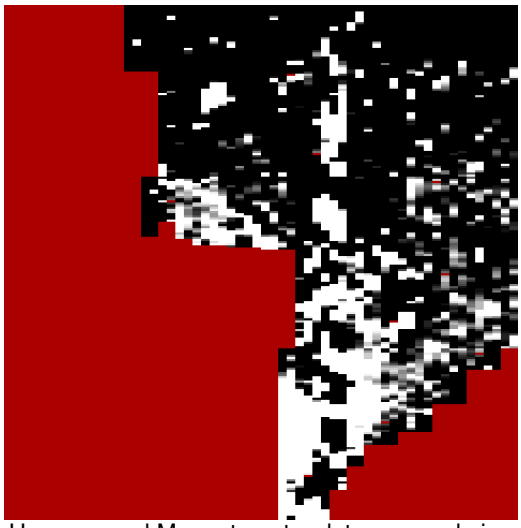


Figure 15: Unprocessed Magnetometer data greyscale image area 2.

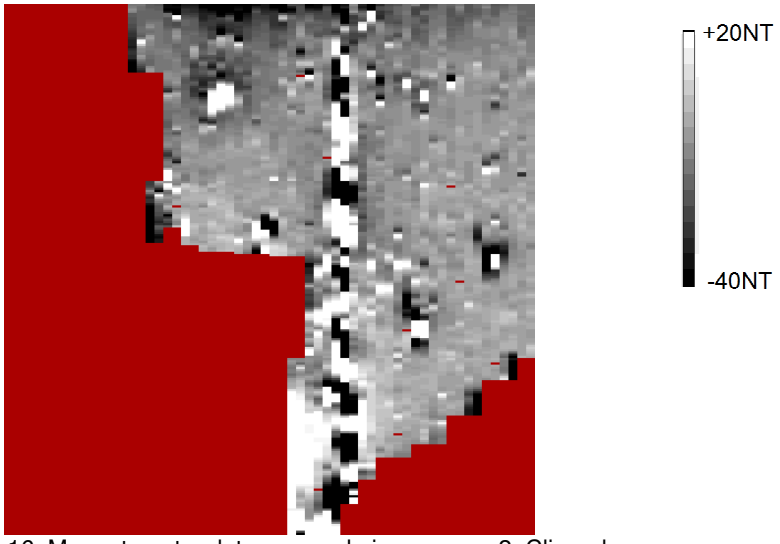


Figure 16: Magnetometer data greyscale image area 2, Clipped +20NT/ - 40NT, Destriped, De-Spiked (Threshold 1.0), Interpolated Vertical.

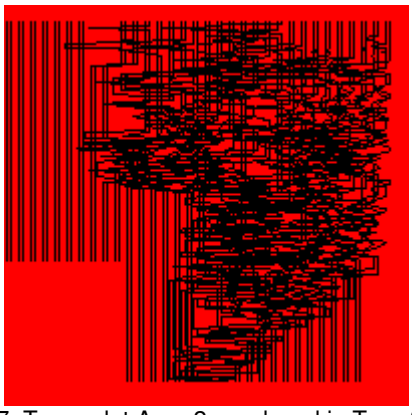


Figure 17: Trace plot Area 2, produced in TerraSurveyor

4.1.4. **Area 3 Plots**

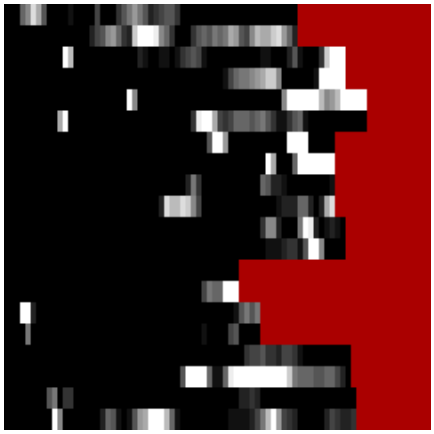


Figure 18: Unprocessed Magnetometer data greyscale image area 3.

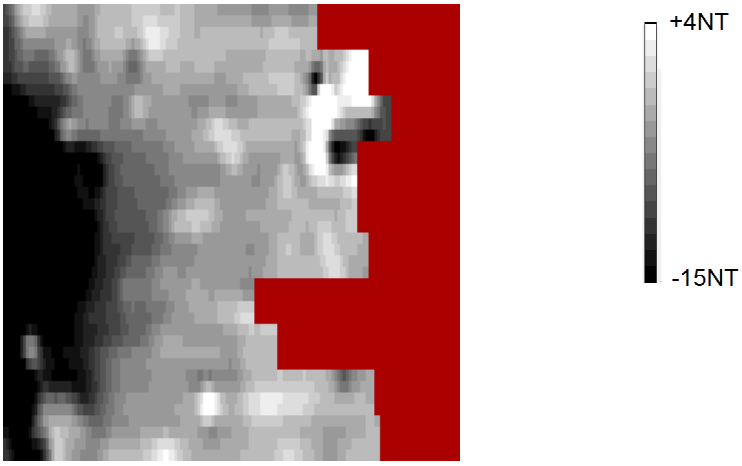


Figure 19: Magnetometer data greyscale image area 3, Clipped +4NT/ - 15NT, Destriped, De-Spiked (Threshold 1.0), Interpolated Vertical

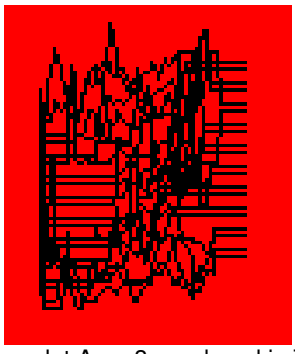
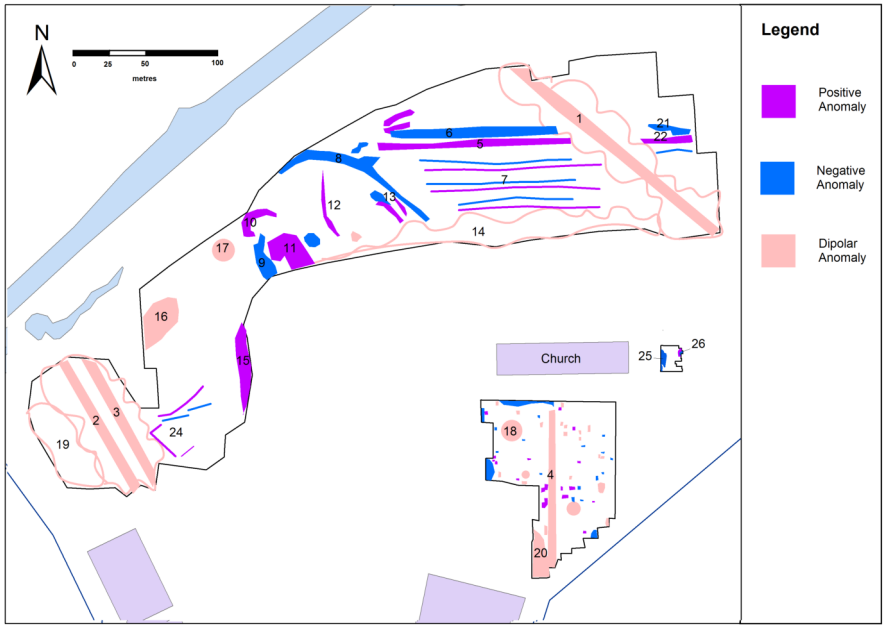


Figure 20: Trace plot Area 3, produced in TerraSurveyor

4.1.5. **Interpretation Plot**



Geophysical Magnetometer Survey Interpretation Plot, Cuckney Churchyard and Castle, 2016

Mercian Archaeological Services CIC

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heritage lottery fund
LOTTERY FUNDED

Figure 21: Geophysical Magnetometer Survey Interpretation Plot. Contains OS data © Crown copyright [and database right] 2016.

4.1.6. The above plots and figures 11 to 21 are the processed and unprocessed results and trace plots of the Geophysical Magnetometer survey undertaken at Cuckney in November 2015. Figure 21 is an interpretation plot of the survey data.

4.1.7. Area 1 contains a number of high and low magnetic anomalies; collection was affected in the field by the varying topography, which resulted in some striping of the data. However a good number of anomalies have been recorded.

4.1.8. Within the churchyard, large amounts of historic disturbance and metalwork affected the quality of the survey data. In order to display the results for area two the data was clipped at very high values, this means that any small variations caused by archaeological remains may be difficult to discern. Area 3 was also clipped at high values, but feature 25 and particularly 26 may be of interest.

4.1.9. A number of linear dipolar anomalies run across the surveyed area. In area 1 a linear dipolar anomaly cuts across the eastern end of the survey running northwest to southeast, marked 1 on interpretation plot in figure 21. Area 1 is also crossed in the western end by two further linear dipolar anomalies labeled 2 and 3. Area 2 is crossed north to south by a linear dipolar anomaly labeled 4. There are large areas of dipolar signals to the north of the churchyard labeled 14, and on the far western edge of area 1 labeled 19. Large individual dipolar signals were detected labeled 16, 17 and 18.

4.1.10. A large linear high magnetic anomaly labeled 5 runs approximately 120 metres east to west across the northern part of area 1. It is truncated at the eastern end by the dipolar linear feature 1. To the east of feature 1 a high magnetic linear feature 22 (possibly a continuation of feature 5); runs to the eastern edge of the survey. To the north of feature 5 a low magnetic linear feature runs parallel to 5; labeled 6. It may continue to the eastern edge of the survey where feature 21 continues on the same alignment.

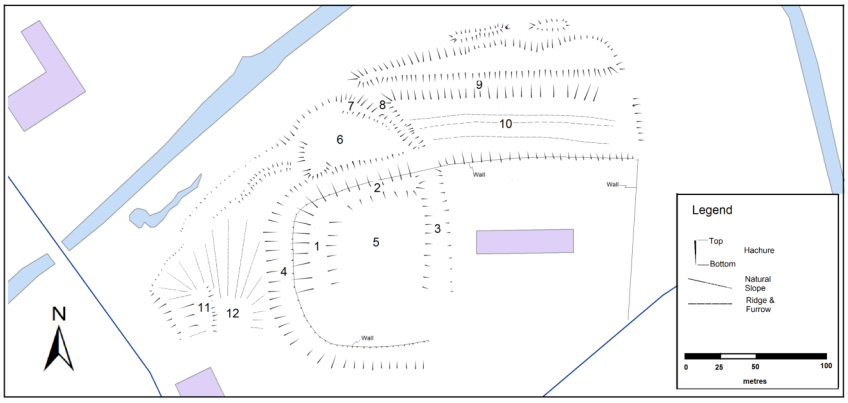
4.1.11. To the south of feature 5 a series of alternating low, high, low, high, low, high linear anomalies run east to west in the ground between feature 5 and the area of dipolar anomalous readings labeled 14; close to the northern churchyard wall.

4.1.12. A curvilinear negative anomaly labeled 8 was detected in the central part of area 1, where there are a number of positive and negative anomalies.

4.1.13. In the western part of the survey an area of positive magnetic signal forms a reasonably wide linear orientated north to south, labeled 15. TO the west of this a small number of discreet thin linear positive and negative anomalies can be discerned in the various plots. These are labeled 24.

4.2 **Topographic Survey**

4.2.1 **Hachure Plan**



Hachure plan of earthworks, Cuckney Churchyard and Castle, 2016

Figure 22: Hachure plan of earthworks Contains OS data © Crown copyright [and database right] 2016.

4.2.2. **Topographic Survey Results**

4.2.2.1. The Topographic earthwork survey recorded a number of features which have been mapped on the Hachure plan in figure 22 above. These features can also be seen in the Digital Terrain Models (DTM) in figures 23- 27. To the west end of the churchyard the ground rises to a linear bank running 30 metres north to south by 10 metres east to west, labeled 1 in figure 22. The DTM models below show this raised area continues to the south and curves around to the east. Here it forms a raised bank 50 metres east to west by 20 metres north to south. This area forms a discreet section of the churchyard with burials from the 20th century. To the north the bank forming feature 1 drops to form a lower east to west orientated ridge on the north side of the churchyard; feature 2 on figure 22. The features so far described enclose to the west north and south an area of lower flatter ground marked 5 on the plot in figure 22. To the east feature 2 drops in to a shallow ditch running 45 metres north to south, and up to 20 metres wide, labeled 3 on the plot. Together these earthworks form the western half of Cuckney churchyard. The combined curved bank of features 1 and 2 are surrounded to the north, west and south by a large ditch which falls away steeply. The Hachure plan depicts with a line and triangle (tops of hachures) where the bank to

ditch profile is vertical due to the insertion of a stone wall. This forms a Ha Ha on the southern and western sides with the wall forming one whole side of the ditch (the internal side) and being entirely below the surrounding ground levels to the south and west of the ditch. To the north of the churchyard the ditch levels out to form a wide semi-circular plateau; feature 6, with a low bank; 7 forming its northeastern edge. Feature 6 is terminated on the eastern side by a metre deep ditch or hollow, marked 8 on the plot. Ditch or hollow 8 curves towards the southeast and lines up with the ditch inside the churchyard; feature 3. Feature 9 is a large linear east to west orientated ditch or hollow that runs 200m in length by 10 metres in width. Feature 9 is flanked to the north and south by higher flatter ground. To the north this drops into the river flood plain, but to the south is cut by a number of linear banks and ditches running east to west; marked as 10 on the plot in figure 37. To the west of the Churchyard the land rises out of ditch 4 to an area of high ground to the west marked 12 on the hachure plan. This high ground is equal in height to feature 1, and the area to the south of feature 1 in the DTMs. To the west of the summit of the hill marked 12, is a pronounced linear bank running north to south; marked 11 on the plot. The earthworks recorded fall both inside and outside of the area Scheduled as a Motte and Bailey Castle. The DTM's displayed below help to display the 3 Dimensional shape of the earthworks and their relationship to each other.

4.2.3. **3D models**

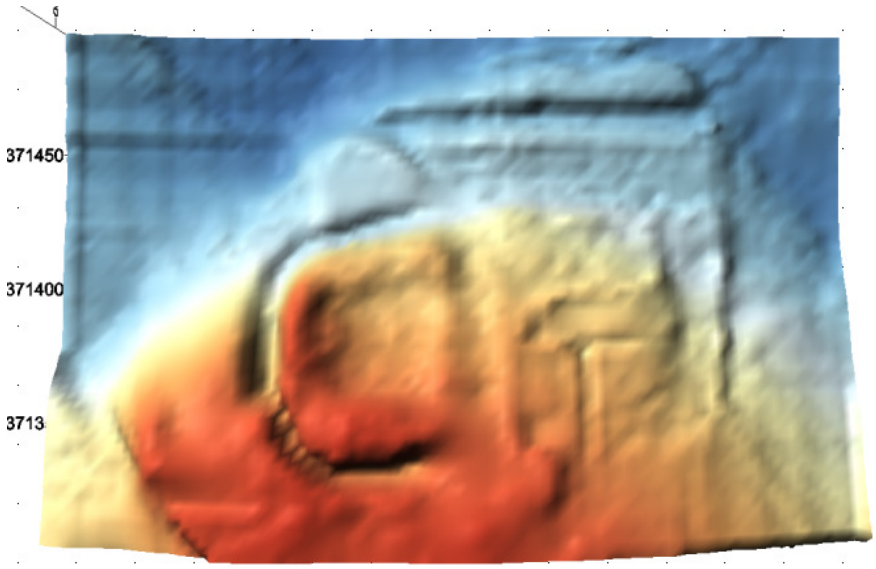


Figure 23: Digital Terrain Model (DTM) of earthwork survey data, North to top of image.

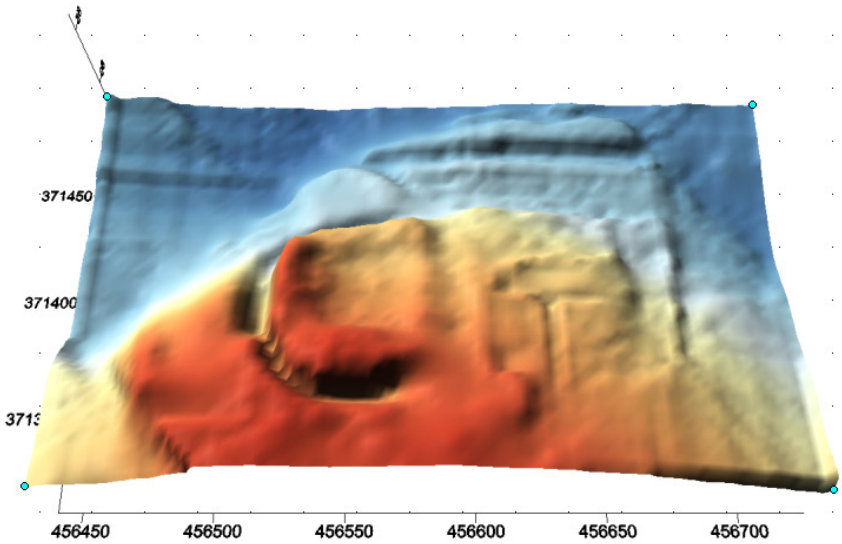


Figure 24: Digital Terrain Model (DTM) of earthwork survey data, oblique view. North to top of image.

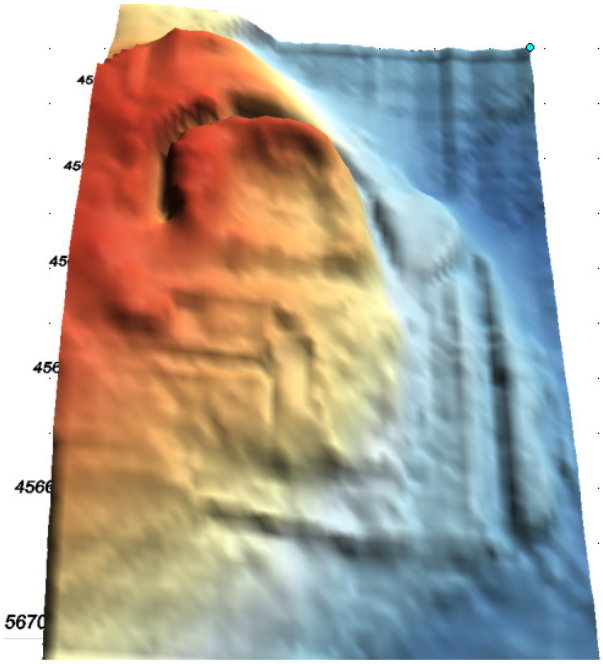


Figure 25: Digital Terrain Model (DTM) of earthwork survey data, oblique view. West to top of image.

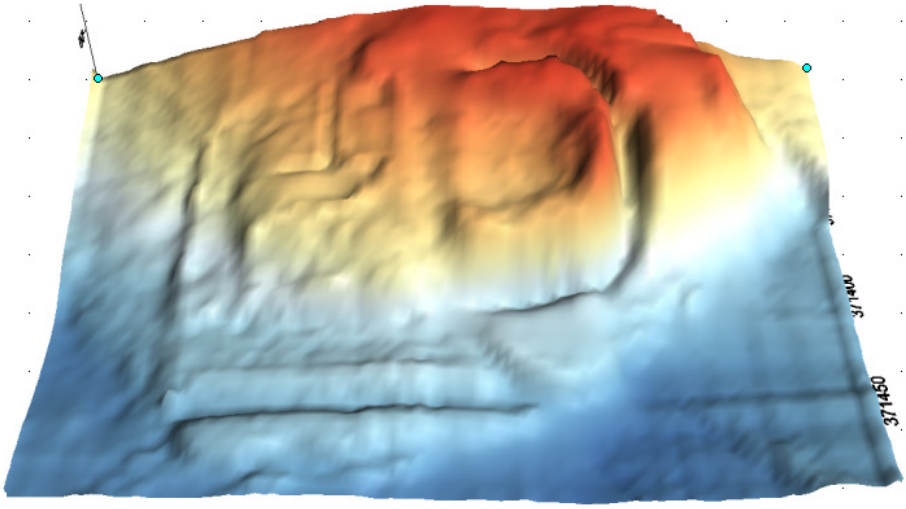


Figure 26: Digital Terrain Model (DTM) of earthwork survey data, oblique view. East to top of image.

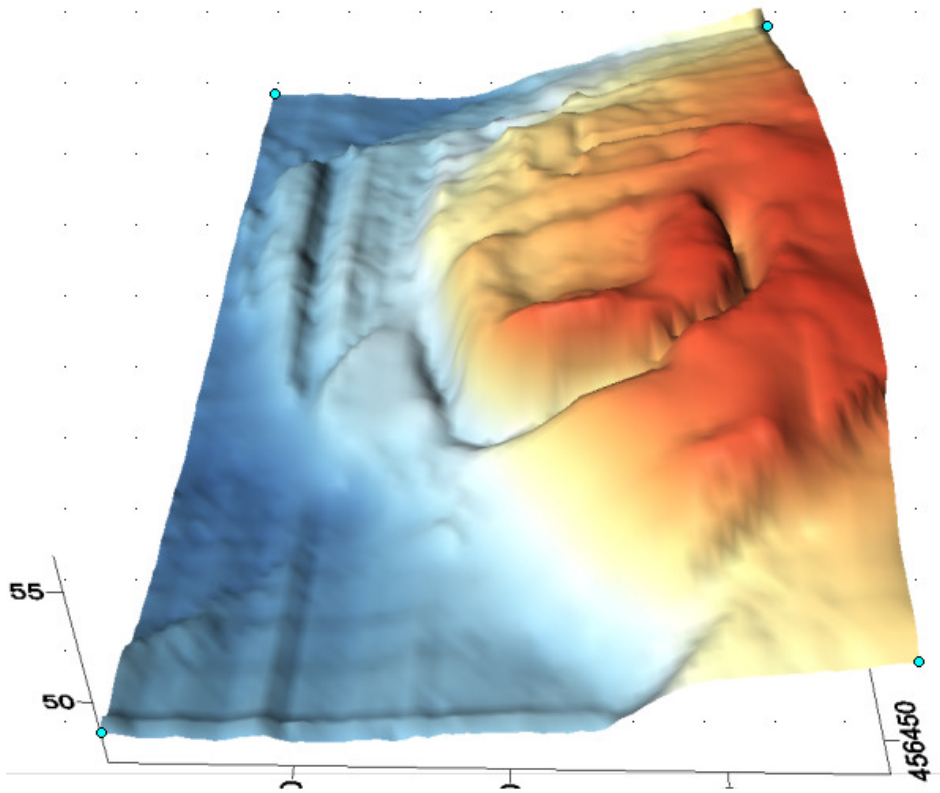


Figure 27: Digital Terrain Model (DTM) of earthwork survey data, low angle oblique view. East to top of image.

5. Interpretations, conclusions, and discussions

5.1 The integrated surveys revealed a large number of anomalies and features listed in the results above. The Magnetometer survey picked up a number of dipolar linear anomalies 1, 2, 3 and 4 which represent buried services, with features 2 and 3 running parallel to the line of the road. Feature 1 is perhaps a buried metal water pipe, as a series of manholes are present in the river flood plain. Feature 4 is the detection of services entering the church underneath a pathway forming the southern approach to the church.

5.2. The large areas of dipolar anomalies 14 and 19 are close to site boundaries where metal wire fencing has been dumped along with other material (19 is probably associated with material from the building of the road, and from dumped material, 14 is adjacent to the boundary wall of the churchyard, and probably also reflects dumped material and remnants of metal fencing). Dipolar anomalies 16 and 17 are caused by

manhole covers perhaps for brick or stone lined drains. The bipolar anomaly 18 may represent a buried metal object, the large number of weaker dipolar anomalies in area 2 along with similar sized and shaped positive and negative anomalies (unnumbered) probably represent human burials in the churchyard, where grave markers have been removed presumably in the later 20th century.

5.4. The alternating negative, positive, negative, positive, negative, positive, magnetic linear anomalies in feature 7 in figure 21 correspond with feature 10 in the hachure plan for the topographic survey, where they have been interpreted as ridge and furrow agricultural remains (figure 22).

5.5. To the north of these features is a long linear ditch marked 9 on the hachure plan, and detected as a positive anomaly in figure 21 marked 5. The bank to the north corresponds with a negative linear anomaly 6 on figure 21. This long linear channel cuts the shortest route across the meaner of the river, and may be a former 'leet' or water channel utilising the potential energy gradient of the water caused by the meander, perhaps to power a mill at the eastern, downstream end (beyond the survey area). The Historic England Scheduled Monument entry suggests that this feature is a double bank and ditch enclosing an outer bailey to the north, running parallel to the river which would have formed a further line of defence. This could also be a possibility. Although no ditch is seen to the east or west of the church (see below) to complete the outer bailey enclosure.

5.6. To the west of this long linear ditch is a large flat semi-circular feature 5 on hachure plan, with a bank; 7 on the northeastern edge and a meter deep ditch; 8 on the north eastern and eastern sides. This may be an enclosure between the suggested Motte to the south, and the river to the north. The Magnetometer survey shows positive and negative anomalies in line with the bank and ditches of this feature (9, 10, 11, 12, 13 on figure 22). The ditch in feature 8 corresponds with a ditch running north to south (feature 3 on figure 21) further to the south.

5.7. Feature 3 seems to form part of the remains of a series of banks

(features 1 and 2 in figure 21, and seen to the south in the DTMs above) that enclose a circular area (feature 5 on the hachure plan). This area is interpreted as a possible Motte in the Scheduling.

5.8. The western and southern part of the graveyard is enclosed by a deep ditch to the west and south of feature 3 (shown on the western side as positive anomaly 15 in the magnetometer interpretation plot in figure 21). It is depicted as feature 4 on the hachure plan and the vertical line of the wall is also show. According to the Scheduling for the Castle by Historic England: “The perimeter wall of the graveyard occupies the inner edge of a 10m wide ditch that encircles the west side of the Motte and encloses the inner bailey on the north side. Originally, it would also have enclosed the south side of the bailey but has been filled-in to the south of the church so that, on this side, only the area south of the Motte remains open. The remainder will survive as a buried feature in the unscheduled part of the inner bailey”.

5.9. Although a slight depression can be discerned in the western part of the southern churchyard, and possibly a slight depression in the southern part (DTM’s); there is no evidence in the magnetometer survey data in area 2 for a ditch extending through the churchyard to the south”.

5.10. The Scheduling also suggests that having encircled the church to the south, the inner bailey ditch should continue to the east of the church, however: “The ditch does not appear to have extended along the east side of the inner bailey, which also lies in the unscheduled area. This indicates that the original entrance would have occupied this side”. No ditch was seen in area 3 of the magnetic survey.

5.11. To the west of the Scheduled site is a large area of high ground with a flattish summit (feature 12 on the hachure plan in figure 22). A wide linear bank runs along the western edge of this summit marked 13 on the hachure plan.

5.12. Within feature 12 (on the hachure plan) are a number of discreet linear positive and negative magnetic anomalies that may represent occupation, possibly small trenches or building foundations.

6. Future work:

6.1. The surveys have detected many features and anomalies that can only be understood better through targeted excavation, features outside the scheduled area may benefit from further invasive investigations, particularly in the area of the mound to the west of the current scheduling where there may prove to be evidence of occupation.

This area in particular, along with the semi-circular platform north (feature 6 on hachure plane) would benefit from further geophysical survey. Resistance survey may help to determine if trenches or foundations are indeed present.

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8. Disclaimer:

Mercian Archaeological Services CIC is a limited company registered in England and Wales. Company Registration No. 08347842.

Geophysical techniques are not a map of the ground and are instead a direct measurement of subsurface properties. Detecting and mapping features requires that said features have properties that can be measured by the chosen technique(s) and that these properties have sufficient contrast with the background to be identifiable. The interpretation of any identified anomalies is always subjective. While the scrutiny of the results is undertaken by qualified, experienced individuals and rigorously checked for quality and consistency it is often not possible to classify all anomaly sources; while there will be degrees of certainty for others. Where possible an anomaly source will be identified along with the certainty of the interpretation. The only way to improve the interpretation of results is through a process of comparing excavated results with the geophysical reports.

The results of the GPR survey can only provide locations of anomalies, which were identified based on changes from surrounding ground conditions. This includes areas with hyperbolic reflections, amplitude variations, and distinct planar reflections. It should be noted that these signals are not exclusive to archaeological features, and may represent other natural or contemporary features. Further, not all features of archaeological interest will produce a recognisable signal, in particular small-scale isolated remains (such as discrete bones) which are not in a formal burial context, and those features which do not vary significantly in physical and chemical characteristics from surrounding deposits.

The size of objects detected is limited by the antenna frequency to objects with dimensions larger than ~10 cm (with the 800MHz in the upper 0-1m) and ~20 cm (with the 300MHz in the depth range 1-3m). As such, this GPR survey is not expected to have identified all locations where human remains may be present.

9. Acknowledgments

Mercian Archaeological Services CIC would like to thank the Battle of Hatfield Investigation Society; and in particular Paul Jameson and Joseph Waterfall for their hard work and research, and for their enthusiasm.

Tim Allen and Erin Lewis at Historic England for permission to undertake the Geophysical Surveys, and granting a Section 42 License.

Ursilla Spence, County Archaeologist, Nottinghamshire County Council for supporting the project.

The Heritage Lottery Fund for funding the project.

10. Publication, archiving, reporting, and Dissemination

10.1. An OASIS entry pertaining to the work has been created. The OASIS identifier for the project is OASIS ID: merciana2-246688.

10.2. All reports including those in the appendices are available for download from the Mercian website: http://www.mercian-as.co.uk.

10.3. A summary of the work will be published in the Archaeological Short Reports section of the Transactions of the Thoroton Society.

Appendix III: Community Archaeology Photographic Archive.

Mercian Archaeological Services CIC

Surveying earthworks to north of churchyard.

Surveying earthworks to north of churchyard.

Volunteer (High-visibility coat) undertaking objective survey using robotic Total Station

Volunteer recording gravestones.

Appendix IV: Historic Environment Record Search

Edited table of results of Historic Environment Record (HER) search for 1km radius (2km diameter) centered on SK565714 Easting 456593, Northing 371408.

Ref	Title	DateGenera	PartOfMon	Type01
M4376	Castle Hill, Cuckney	Med		Motte AND BAILEY
M4396	Cotton mill, Cuckney	1723		COTTON MILL
M4397	Ten Row, Cuckney	from late C18		WORKERS COTTAGE
M4409	Old Mill, Cuckney	by 1774		FLOUR MILL
M4411	Blacksmiths, Norton	pre 1800		BLACKSMITHS WORKSHOP
M4415	Church of St Mary, Cuckney	from Norman		CHURCH
M5369	Mill Hill, Cuckney	P Med-Mod		WINDMILL
M5378	Gorton's Mill, Cuckney	P Med		TEXTILE MILL
M5379	Sitwell's Forge, Cuckney	P Med		FOUNDRY
M6109	Mill Hill Sand Pit, Cuckney	by 1918		SAND PIT
M6110	Quarries, Cuckney	U		QUARRY
M6111	Building, Bar Lane, Cuckney	U		BUILDING
M6840	Well, Cuckney	U		WELL
M6854	Fish houses, Norton	by 1918		FISH HOUSE
M6864	Boat house, Cuckney	from C18		BOAT HOUSE
M8707	Burial pit, Cuckney Church	pre C13		BURIAL PIT
L4376	Earthworks at Castle Hill, Cuckney	Med	4376	bailey
L4396	Cotton mill, Cuckney		4396	
L4397	Ten Row, Cuckney	late C18	4397	Building
L4409	Old Mill, Cuckney	pre 1774	4409	Building
L4411	Blacksmiths, Norton	pre 1800	4411	Building
L4415	Church of St Mary, Cuckney - C13 Phase	C13	4415	Church tower
L4425	Cropmark enclosure, Norton	U		Enclosure
L4426	Cropmark enclosures, Cuckney	U		Enclosure

	Cuckney			
L5369	Mill Hill, Cuckney	pre 1972	5369	Place name
L5373	Roman coins from Cuckney	268-273		Finds spot
L5378	Gorton's Mill, Cuckney		5378	Architectural Fragment
L5379	Sitwell's Forge, Cuckney		5379	Documentary reference
L5381	Harvest Dam, Cuckney	Med-P Med		Dam
L6108	Mound, Cottage Lane, Cuckney	U		Mound
L6109	Mill Hill Sand Pit, Cuckney	pre 1918	6109	Hollow
L6110	Quarry hollows, Cuckney	U	6110	Hollow
L6111	Remains of Building, Bar Lane, Cuckney	U	6111	TERRACED GROUND
L6112	Banked enclosure, Cuckney	U		Bank
L6113	Irregular earthworks, Norton	U		Hollow
L6114	Building platform and earthworks, Norton	U		Building platform
L6840	Map depiction of Well, Cuckney	U	6840	Map Depiction
L6841	Sluice, Norton	pre 1918		Sluice
L6842	Sluice, Cuckney	pre 1918		Sluice
L6843	Sluices, Cuckney	pre 1918		Sluice
L6844	Sluice, Cuckney	pre 1918		Sluice
L6845	Sluices, Cuckney	pre 1918		Sluice
L6854	Map depiction of Fish houses, Norton	pre 1918	6854	Map Depiction
L6861	Embankment, Norton	U		Bank
L6864	Map depiction of Boat house, Cuckney	pre 1918	6864	Map Depiction
L8707	Burials under Cuckney Church	pre C13	8707	Inhumation
L9173	Documentary reference to Castle, Cuckney	1135-1154	4376	Documentary reference
L9176	Mill pond and dam, Cotton Mill, Cuckney		4396	Dam
L9179	Old Mill, Cuckney - Dam and Sluice	pre 1774	4409	Dam
L9181	Church of St Mary, Cuckney - C12 Phase	C12	4415	Doorway

L9182	Church of St Mary, Cuckney - C15 Phase	C15	4415	Window
L9183	Church of St Mary, Cuckney - C20 Phase	1907 and 1936	4415	Roof
L10855	Linear earthworks, Cuckney	P Med		Drain
L10857	Linear feature, Cuckney	U		Linear feature

Appendix V: Section 42 License for Geophysical Survey

Historic England

EAST MIDLANDS OFFICE

Mr Andy Gaunt
Mercian Archaeological Services CIC
Staffordshire House
Beechdale Road
Nottingham
NG8 3FH

Direct Dial: 01604 735460

Our ref: AA/030549/5

28 October 2015

Dear Mr Gaunt

Ancient Monuments and Archaeological Areas Act 1979 (as amended) section 42 - licence to carry out a geophysical survey

CUCKNEY MOTTE AND BAILEY CASTLE, CUCKNEY, NOTTINGHAMSHIRE
Case No:SL00116567
Monument no: SM 13393

I refer to your application dated 26 October 2015, to carry out a geophysical survey at the above site.

Historic England is empowered to grant licences for such activity and I can confirm that we are prepared to do so as set out below.

By virtue of powers contained in section 42 of the 1979 Ancient Monuments and Archaeological Areas Act (as amended by the National Heritage Act 1983) Historic England hereby grants permission for geophysical survey of CUCKNEY MOTTE AND BAILEY CASTLE, for the areas shown on the map that accompanied your application (copy attached). This permission is subject to the following conditions.

1. The permission shall only be exercised by Andy Gaunt of Mercian Archaeological Services CIC and his nominated subcontractors at RSK Archaeology and by no other person. It is not transferable to another individual.

2. The permission shall commence on 2 November 2015 and shall cease to have effect on 16 November 2015.

3. A full report summarising the results of the geophysical survey and their interpretation shall be sent in hard copy to Erin Lewis at the address below and electronic (pdf) format to tim.allen@HistoricEngland.org.uk, copied to Paul.Linford@HistoricEngland.org.uk no later than 6 months after the completion of the survey.

4. The enclosed questionnaire shall be completed and appended to the survey report. For convenience an electronic version of this questionnaire can be downloaded from http://HistoricEngland.org.uk/advice/technical-

advice/archaeological-science/geophysics.

5. A copy of the report shall also be sent (in their preferred format) to the local Historic Environment Record (HER). The local HER's contact details can be found at http://www.heritagegateway.org.uk/gateway/chr/default.aspx.

6. A record signposting your investigation shall be made with the Archaeology Data Service using their online OASIS Data Collection form no later than 6 months after completion of the survey. Please see http://oasis.ac.uk/ for details or contact oasis@HistoricEngland.org.uk for information and training.

7. An interim image of the processed survey results shall be provided to Tim.Allen@HistoricEngland.org.uk at the first available opportunity following the completion of the survey.

8. The final report shall be produced with reference to published guidelines in English Heritage (2008) *Geophysical Survey in Archaeological Field Evaluation*

It is the responsibility of the surveyor and landowner to clarify whether a derogation is required from Natural England to conduct any survey on land held within an environmental stewardship agreeement prior to commencing work on site.

This letter does not carry any consent or approval required under any enactment, bye-law, order or regulation other than section 42 of the 1979 Act (as amended).

You are advised that the person nominated under this licence to carry out the activity should keep a copy of this licence in their possession in case they should be challenged whilst on site.

Yours sincerely

Tim Allen
Inspector of Ancient Monuments
E-mail: tim.allen@HistoricEngland.org.uk
cc Ursilla Spence, Nottinghamshire County Council
Virginia Baddeley, Nottinghamshire County Council

Historic England

EAST MIDLANDS OFFICE

Purpose of Survey:

Location of:

a) Primary archive, i.e. raw data, electronic archive etc:

Nottinghamshire Historic Environment Record,

Mercian Archaeological Services CIC

OASIS ID: merciana2-246688.

b) Full Report:

Nottinghamshire Historic Environment Record, including electronic data from project.

Electoronic copy Mercian Archaeological Services CIC website: http://www.mercian-as.co.uk/publications.html

OASIS ID: merciana2-246688.

Hardcopy: Mercian Archaeological Services CIC

Hard Copy with clients

Hard Copy Historic England

2nd Floor, WINDSOR HOUSE, CLIFTONVILLE, NORTHAMPTON, NN1 5BE
Telephone 01604 735460
HistoricEngland.org.uk

Stonewall

Historic England

EAST MIDLANDS OFFICE

Enclosure:

Historic England Geophysical Survey Database Questionnaire

Survey Details

Name of Site: CUCKNEY MOTTE AND BAILEY CASTLE

County: NOTTINGHAMSHIRE

NGR Grid Reference (Centre of survey to nearest 100m):

SK565714 Easting 456593, Northing 371408

Start Date: 2/11/2015 **End Date:** 13/11/2015

Geology at site (Drift and Solid):

Lenton Sandstone Formation - Sandstone.

Known archaeological Sites/Monuments covered by the survey
(Scheduled Monument No. or National Archaeological Record No. if known)

Name: Cuckney motte and bailey castle. List entry Number: 1010909

Archaeological Sites/Monument types detected by survey
(Type and Period if known. "?" where any doubt).

Ditches, Banks, Ridge and Furrow. Date: ?

Surveyor (Organisation, if applicable, otherwise individual responsible for the survey):

Andy Gaunt of Mercian Archaeological Services CIC, and his nominated subcontractor RSK

Name of Client, if any:

Battle of Hatfield Investigation Society
Heritage Lottery Fund

2nd Floor, WINDSOR HOUSE, CLIFTONVILLE, NORTHAMPTON, NN1 5BE
Telephone 01604 735460
HistoricEngland.org.uk

Stonewall

Appendix VI: Finds Report

Mercian
Archaeological Services CIC

Artefacts from the Church of St Mary and Motte and Bailey Castle, Cuckney.

David Budge

31/03/2016

Summary:

During geophysical and topographic survey of earthworks at St Mary's, Cuckney, in November 2015 it was noted that the church yard was extensively disturbed by burrowing animals, particularly moles but also rabbits in the banks. Archaeological artefacts were clearly visible in the spoil generated by these creatures.

Where encountered the artefacts were recorded in three dimensions using the GPS and total station equipment engaged in the topographic survey. Following consultation with the Historic England inspector permission was granted for the collection and removal of those artefacts considered worthy of specialist analysis from the Scheduled Monument.

During the survey opportunity was also taken to examine the surface of the spoil heap from a freshly dug grave and other animal burrow spoil within the survey area but outside the Scheduled Monument.

In total two sherds of late Saxon and one of medieval date along with one piece of modern pottery were recovered from the topographic survey site, while three sherds of post medieval pottery and one clay tobacco pipe stem were recorded but not collected. Two pot boiler stones were also recorded but not collected.

The pottery suggests that the area around the present church and nearby in the Poulter valley saw human activity in the late Saxon period and may tentatively be suggested as a location for pre-conquest activity. The medieval sherd may be contemporary either with the supposed period of occupation of the castle or the current church.

Notably, only post medieval and modern pottery was found within the earthworks outside the present churchyard. Whether this is, for example, merely a product of deeper disturbance in the churchyard or represents a genuine lack of medieval activity could not be determined, but perhaps may cast slight doubt on the nature and date of these remains.

The opportunity is also taken to record a fragment of burnt daub found previously in a mole hill to the north of the Poulter which appears to derive from an accidentally or deliberately burned wattle and daub structure.

Introduction:

Cuckney is located in the west of Nottinghamshire, close to the Derbyshire border. Then as now it was situated within Bassetlaw District. Cuckney had a church and a priest at Domesday. The settlement was relatively large at Domesday (http://opendomesday.org/place/SK5671/cuckney/). The present church consists of a tower, nave, chancel and north aisle. The list description suggests the tower is 12th century and was heightened in the 13th century, with an ashlar upper stage with twin lancet plate tracery openings. The nave has a 12th century south door. The north arcade is considered to be Transitional work (Pevsner hints to this effect without specifically naming the period, while Barley seems to be in no doubt (Barley 1951). The south porch is 13th century.

The church lies within earthworks considered to represent the remains of a Motte and bailey adulterine caste of the early / mid 12th century (https://historicengland.org.uk/listing/the-list/list-entry/1010909 accessed 26/03/2016). The supposed Motte is located to the west of the church and the inner bailey is considered to extend eastwards from this, with the church occupying part of it.

The area to the north and west of the inner bailey, outside the present churchyard, is considered to be the remains of an outer bailey (https://historicengland.org.uk/listing/the-list/list-entry/1010909 accessed 26/03/2016).

In November 2015 Mercian Archaeological Services CIC on behalf of the Battle of Hatfield Investigation Society undertook geophysical and topographical survey in the churchyard and surrounding earthworks.

During the topographic survey it was quickly noted that the churchyard was extensively disturbed by burrowing animals. The disturbance primarily took the form of molehills but also included rabbit burrows with the excavated spoil cast down slope.

Molehills were common all over the flatter parts of the surveyed area and particularly in the area within the earthworks outside (to the north and west) of the churchyard boundaries. Rabbit burrows were largely limited to banks with cover, being particularly common on the western slope of the 'Motte' and in the banks associated with the church yard boundary wall, but also in the western side of the northern part of the internal north - south ditch possibly dividing the inner bailey in two.

It was impossible to miss the archaeological artefacts that were clearly visible in the spoil generated by these creatures.

Consequently, as no archaeological excavation had taken place and no artefacts that might allow dating of the site had previously been recovered (or at least retained), it was considered that the recording of the artefacts revealed by chance by these burrowing creatures would allow the first chance to examine past human activity within, and perhaps associated with, the Scheduled Monument and in the area adjacent to the Monument. Permission for the removal of such artefacts from within the area of the Scheduled Monument was granted by the regional Historic England inspector in an email dated 12/11/2015 (see appendix A).

Methodology:

The molehills were examined unsystematically during the course of the topographic survey. When artefacts were spotted, their co-ordinates were recorded using the topographic survey equipment, with an accuracy of +/- 1cm.

If the artefact was considered to be of post medieval date it was left where it was found, and its details were entered into the pointID field on the survey equipment. No further action was taken.

If the artefact was considered worthy of further analysis the co-ordinates were recorded as above, the find was given a unique three-letter identifier and the unique identifier was recorded with the positional data and with the find, which was collected.

The three sherds of pottery thus recovered were kindly examined by Jane Young, who provided ware identifications, dating and other comments (as noted below).

The recovered pottery was quantified in accordance with the Standards set out by the Medieval Pottery Research Group (MPRG 2001) using sherd count, sherd mass and vessel count by context. The pottery was examined under 20x magnification using a Brunel Microscopes MX1 stereomicroscope. Weighing was undertaken by means of a Maplin VV52G electronic balance calibrated prior to use with a 100g mass and checked following recording with the same 100g mass. These control readings showed no deviation, being precisely 100.0g. The mass of the pottery sherds was recorded to the nearest 0.1g.

The pottery was recorded using the post-Roman fabric code names for the City of Nottingham Ceramic Type series (Nailor and Young 2001) and the Lincoln Ceramic Type Series (Young, Vince and Nailor 2005).

Nomenclature of vessel forms and parts follows the guidelines for identification of medieval vessel forms by the Medieval Pottery Research Group (MPRG 1998).

Results:

The finds recorded are detailed in Table 01, while the distribution of finds is displayed in Figure 01. A small number of mid 19th - 20th century whiteware sherds were also noted in mole hills outside and to the west of the church yard, but were not recorded.

Code:	Date:	Collected?	Easting	Northing	Elevation
Pot Boiler Stone	Prehistoric?	No	456503.463	371367.077	55.156
Pot Boiler Stone (small fragment)	Prehistoric?	No	456645.117	371475.386	48.984
Torksey - type ware	10th - mid 11th century	Yes (code AAB)	456669.585	371396.785	50.876
Torksey - type ware	10th - mid 11th century	Yes (code AAC)	456452.841	371368.018	49.827
Early Medieval Handmade ware	12th - mid 13th century	Yes (code AAA)	456574.761	371392.337	53.486
Brown Glazed Earthenware	17th - 19th century	No	456503.423	371367.082	55.159
Brown Glazed Earthenware (bowl)	17th - 19th century	No	456507.153	371414.775	49.778
Brown Stoneware	18th - 19th century	No	456482.468	371398.746	49.451
Clay Tobacco Pipe Stem	mid 18th - 20th century	No	456507.347	371415.223	49.738
Pearlware	late 18th - mid 19th century	Yes	456680	371470	Not recorded

Table 01 - finds recorded, dating, if collected, and locations

Both of the pot boiler stones displayed the characteristic crazed surface and jagged fracture arising from thermal shock caused by rapid cooling, but were not obviously reddened (though it was not possible to be certain as they were not washed).

The tobacco pipe stem had a narrow bore and was made from a very iron poor clay (probably ball clay from Southern Britain). Peter Hammond suggests that these characteristics indicate a late date, assigning an approximate date range of somewhere in the middle of the 18th century through to the 20th (Hammond, pers comm).

The pottery that was not collected consisted of body sherds (though this had no bearing on whether it was collected or not). The two brown glazed earthenware sherds were from two separate coarse vessels and were internally glazed. One was certainly from a large bowl while the other was either from a large bowl or large jar. They most probably dated from the late 17th to 18th century, but as they were not cleaned it was not possible to be certain of this.

The brown stoneware vessel was not of Nottingham / 18th century Derbyshire type and was more likely to be of 19th than 18th century date.

Recovered pottery:

Four sherds of pottery with a combined mass of 33g were recovered. The distribution of these sherds can be seen on figure 01. They are quantified in table 02.

Context / code	Ware Code	Number of sherds	Number of vessels	Mass of sherds (g)	Vessel form	Part	Notes	Rim diameter (cm)	Circumference present(%)
AAA	EMHM	1	1	4.8	Jar	Rim	medium sandy; Ox/R/Ox;everted thickened flat topped rim with thumbing to external edge;wear mark outer rim edge	12	7.5
AAB	TORKt	1	1	2.6	Jar / bowl	BS	Trent Valley sand;more Fe than AAC	-	-
AAC	TORKt	1	1	3.8	Jar / bowl	BS	Trent Valley quartz sand, sparse Fe	-	-
N/A	PEARL	1	1	21.8	?oval dish / platter	base	flat base;no footring;extensive wear to outer edge of base;internal blue underglaze transfer print Willow Pattern;black deposits (depositional) to broken edges	-	-

Table 02 - quantification of recovered pottery.

The sherd coded AAA was the only sherd recovered from within the Scheduled Monument.

AAA - Early Medieval Hand Made Wares (EMHM). This sherd is the rim of a jar and has decorative thumbing to the outer edge of the rim. It displays a wear mark to its outside edge. Jane Young writes: "possibly produced within Nottinghamshire. Part of a widespread Eastern England tradition (Early Medieval Handmade), most vessels produced in East Anglia, but some vessels made at Bourne & [study of the] fabrics suggest several other places. 12th to mid 13th century".

AAB - Torksey-type Ware. Body sherd, jar or bowl. Found in spoil heap for new grave.

AAC - Torksey-type Ware. Body sherd, jar or bowl.

Of AAB and AAC, Jane Young notes that they are "Torksey-type but not main Torksey fabrics. Quartz indicates a Trent Valley source - Torksey-type ware was made at Newark & there are odd sherds from Marton & other places in Lincolnshire".

The final collected sherd was found by one of the volunteers in silt that had been dug out of a drain apparently associated with the water meadow or management system. It was not given a find code. It was a large dish or platter, probably oval, in Pearlware, and had an under glaze blue transfer print of the Willow Pattern. The flat base had extensive wear to the edge. The position of this find could not be recorded with the same accuracy as the others and an error of + / - 10m should be assumed in the given grid reference. Consequently this sherd is also not plotted on the distribution map.

Other finds:

The opportunity is also taken to record a fragment of burnt daub that had been found on a previous visit to the site by Mr Gaunt. It had also been found in a molehill but was on the north side of the Poulter at approximately 456586.55, 371550.57. The fragment has a mass of 6.7g and is in a fine, visually inclusion free, fabric. It is predominantly oxidised to an orange / brown but has some patches of dark (dark grey / black) un-oxidised or incompletely combusted carbonaceous material (terminology after Gibson and Woods 1997, p53). It displays the incomplete impressions of two parallel wattles with a diameter of greater than 10mm. Though it derives from a burnt wattle and daub structure (see discussion), it is not possible to suggest a date beyond that which could reasonably be extended to wattle and daub structures in general, being from Neolithic through to Post Medieval.

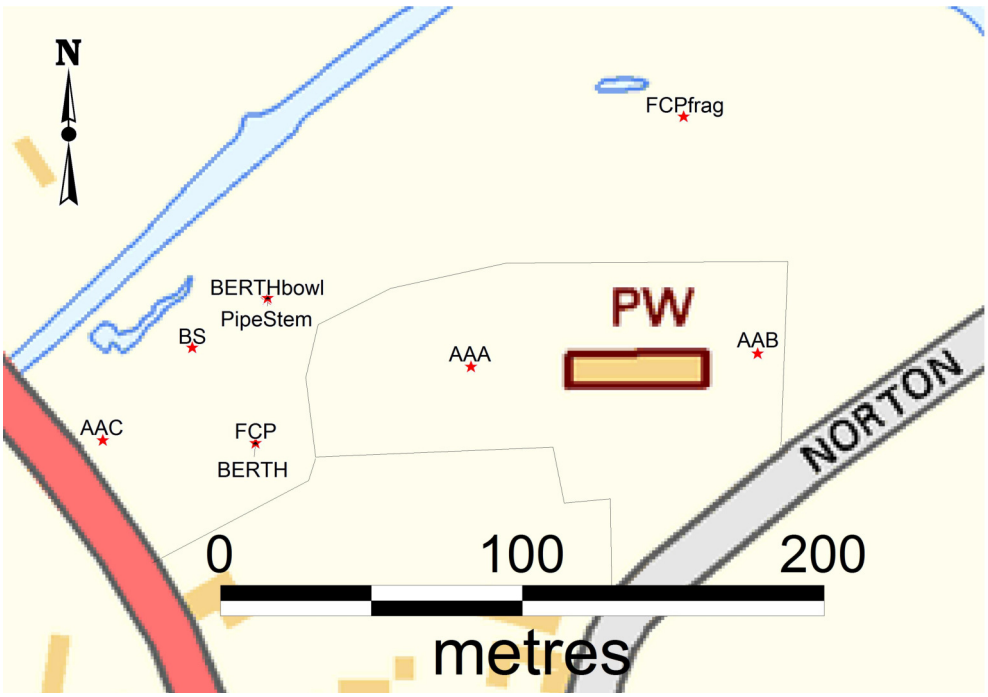

Figure 01 - distribution of finds in relation to Cuckney church (marked 'PW'). Find spots marked with a star and coded.
Key: FCP = pot boiler
BERTH = brown glazed earthenware
BS = brown stoneware
PipeStem = clay tobacco pipe stem
AAA - AAC =collected finds.
Note, in two cases ('BERTHbowl' and 'PipeStem' and 'FCP' and 'BERTH'), the finds were made in such close proximity that only a single point is visible on the map representing the two separate finds. in these cases, find codes are displayed above and below the point.

Discussion:

It should be stated that while attempts were made to examine the surfaces of all animal disturbed soil in the survey area this was not the primary purpose of the work being undertaken on site so was not done systematically. Further, the areas that could be examined depended entirely on the areas of animal burrowing, with a whole range of unquantifiable and unknown factors determining whether artefacts were revealed (some possible factors might include depth of archaeological deposits, depth of burial of archaeological deposits, depth of burrowing of animals, depth of grave digging). While it is therefore clearly impossible on present evidence to suggest how representative of below ground densities the artefacts recovered are, or how representative of the distribution of past activities the spread of artefacts revealed by this work actually were, there are some results from the exercise that appear worthy of note.

For a start, the spoil produced by the many rabbit burrows in the western slopes of the 'Motte' seemed, on subjective assessment, to represent by far the greatest volume of spoil on the site. Additionally this had been spread in debris fans stretching several metres down slope, thus also apparently exposing the largest surface area of spoil, and was in most cases well weathered. Consequently, the western slope of the 'Motte' could subjectively be considered the area most likely to reveal artefacts. Despite concerted search of the surface of this spoil not a single artefact was encountered. It was also notable that this rabbit burrow spoil (and indeed the walls of the burrows as far as could be seen going into the mound) consisted of reddish sand that was almost devoid of stones. This was in stark contrast to the evidence seen elsewhere in the survey area that seemed to suggest the underlying deposits contained significant quantities of gravel, most notably the grave spoil to the east of the church and in the mole hills to the north of the church yard.

The sides of the recently dug grave east of the church (where TORKT sherd designated AAB was found) were unfortunately not available for study; the section here may have clarified aspects of the geology. The common human skeletal remains evident in the spoil heap if nothing else indicated the presence of earlier burials here, despite the lack of headstones pre-dating the second half of the 20th century in this area. Human remains were not collected or otherwise recorded.

While the sections of the grave cut could not be examined the surfaces of the spoil heap provided opportunity to assess the substratum in this part of the site. It appeared to consist of sand and gravel with rounded, up to cobble sized, gravel predominating. This presumably represents a component of the clay / silt / sand / gravel superficial alluvium recorded by the BGS as masking the bedrock Lenton Formation sandstone in the valley bottom (BGS Geology of Britain Viewer, accessed 31/03/2016). Other molehills displayed significant quantities of gravel and pebbles, including those east of the mound within the churchyard and particularly those outside and to the north and west of the churchyard, suggesting similar gravely deposits are also present in these locations. However, the BGS mapping does not appear to record superficial alluvium deposits within the churchyard, only to the north and west in close proximity to the river Poulter. It should, however, be noted that the BGS have typically ignored deposits with a thickness of under 1m (e.g. see Garton et al, in press (2016)) and thus the actual spatial extent of alluvium may be considerably greater than that indicated by the published BGS mapping.

It is notable, though perhaps not significant (due to the uncertainties relating to the factors determining artefact visibility), that no artefacts were encountered in the extensive rabbit spoil on the western slope of the Motte. If there was human activity in the area prior to the posited 12th century construction of the supposed castle (as appears to be suggested by finds AAB and AAC) it might be anticipated that such artefacts would be incorporated into or be buried by the Motte deposits, if it is also assumed that the Motte

would be raised as a consequence of human endeavour from material dug in the immediate vicinity.

Should this be the case it might also be anticipated that the Motte should have a similar composition to the material it was dug from (i.e., be likely to consist of sand and gravel rather than just sand, unless the deposits to the south, which did not display extensive animal activity and could therefore not be commented on in this note, were notably different (recorded by BGS as Lenton Sandstone formation) and were exclusively quarried to raise the mound.

Though these unquantified observations of the apparent nature of the mound based on examination of limited excavation by rabbits cannot be considered to provide evidence of the true structure of the mound and, as the discussion has not sufficiently detailed or explored the likely scenarios or processes (archaeological, ecological and geological), that might produce such evidence, it is suggested that, at the least, the possibility that the mound may be geological in origin rather than a man-made Motte raised from the surrounding deposits should perhaps be considered by any future work (though such an origin would in no way preclude human use or modification of the feature).

It is presumed that the pot boiler stones represent water heating activity close to the Poulter. It is impossible to determine the date of this activity. Similarly, the burnt daub could not be dated. It is not even possible to be sure if it derives from an accidentally burnt structure such as a house or formed part of a deliberately fired wattle and daub construction such as an oven or kiln. The areas of probable incompletely combusted carbonaceous material (notably in the parts of this artefact furthest from the wattle channels) might however suggest a short firing time, a scenario perhaps more likely to occur in an accidental burning rather than the more long term or repeated activity associated with the deliberate firing of an oven or kiln. Either way, it does provide intriguing evidence for some kind of structure in the vicinity at some point in history.

The presence of the two late Saxon sherds, one just to the east of the present church and the other approximately directly 215m west of the first, within the valley of the Poulter, is significant. These sherds represent the first archaeological evidence for late Saxon activity in Cuckney. Though a settlement is recorded at Cuckney in the Domesday Book it does not necessarily follow that the present village occupies the same location as its Domesday predecessor.

It would likely be stretching the evidence too far to suggest that this pottery indicates the site of the Domesday settlement (it could alternatively represent manuring of fields in proximity to the settlement, for example, though the presence of the river seems to make this an unlikely location for a village field, or derive from other waste disposal practices, or even be the result of later earth moving activities, particularly in the case of AAC which is in an area potentially subject to disturbance during the construction of the water meadows). A number of factors, including the proximity of a water source in the form of the Poulter and the presence of the later church, containing 12th century fabric, in this location, does rather invite the suggestion that this part of the settlement of Cuckney, rather on the margins of the present village, might be a good candidate for the location of the late Saxon / Domesday settlement of Cuckney, or at least a part of it.

The dating of the Early Medieval Hand Made sherd is unfortunately not sufficiently tight to associate it with any particular phase of activity, it could be associated with pre-castle settlement activity, with the construction and use of the castle (if such it be) or with the post castle (church construction or use) use of the churchyard.

The lack of medieval sherds in the supposed outer bailey of the castle, to the north of the present churchyard, may be due to a whole range of factors. As earlier and later finds

were seen in this area though it is possible that the lack of medieval artefacts represents a true absence, at least of medieval activity associated with the presently visible earthworks. A slight question mark is therefore raised over whether these outer earthworks truly represent part of a medieval castle or whether they could perhaps relate to other, probably later activity, perhaps particularly something to do with the extensive modification of the Poulter valley to install the water meadows.

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Appendix A

Email communications regarding removal of artefacts from surface of Scheduled Monument.

From: "Allen, Tim" <Tim.Allen@HistoricEngland.org.uk>
To: "david@mercian-as.co.uk" <david@mercian-as.co.uk>
Date: 13 November 2015 at 09:41
Subject: RE: Finds at Cuckney castle SAM

cool

Tim Allen | Inspector of Ancient Monuments

Land Line: 0114 2303916

Mobile Phone: 07770 610***
Historic England
Windsor House, Cliftonville
NORTHAMPTON NN1 5BE

www.HistoricEngland.org.uk

We have launched four new, paid-for Enhanced Advisory Services, providing enhancements to our existing free planning and listing services. For more information on the new Enhanced Advisory Services as well as our free services go to our website: HistoricEngland.org.uk/EAS.

From: david@mercian-as.co.uk [mailto:david@mercian-as.co.uk]
Sent: 12 November 2015 21:36
To: Allen, Tim
Subject: Re: Finds at Cuckney castle SAM

Hi Tim, thanks for that. It is all stuff weathered out of the top of mole hills and rabbit spoil, so not really even any looking required to find it as it is just sitting there plainly obvious and well washed by the rain on the surface! Don't worry, we wouldn't disturb any soil, be it upcast or otherwise, on a SAM without prior scheduled monument consent and suitable funding / contingencies in place for analysis and conservation.

Thanks again,

Regards,
David.

On 12 November 2015 at 14:59 "Allen, Tim" <Tim.Allen@HistoricEngland.org.uk> wrote:

David

At the end of the day any finds belong to the parish, if they are sitting loose on surface I suggest you record them as brief annex to the geophysics report and return them to the parish / pass to museum if the parish agree.

Let's not go looking through upcast material though please as that moves into requiring consent and potentially produces things that need conservation / analysis / funds.

Best wishes
Tim

Tim Allen | Inspector of Ancient Monuments
Land Line: 0114 2303916
Mobile Phone: 07770 610***

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On 10 Nov 2015, at 21:32, " david@mercian-as.co.uk" < david@mercian-as.co.uk> wrote:

Hello Tim.

We're currently out doing non-intrusive survey (magnetometer, topographic) at Cuckney castle / church yard. Rabbits and moles are rather active in the graveyard and there are a number of artefacts visible in the spoil left by these creatures within the scheduled area. We have recorded the artefacts in 3 dimensions +/- 10mm and left them where they are. However, one (to the west of the church at E456574.761 N371392.337 H53.486m) is a small fragment of the rim (or handle) of a medieval vessel, possibly relatively early (probably somewhere between late 11th - early 13th) that would benefit from specialist analysis and possibly drawing. The question is, therefore, can we remove the sherd from the monument to do this? If yes, do we return the sherd to the original find spot once it has been reported on or take other steps, eg depositing it in the local museum (Mansfield?)?

We are due to finish on site at the end of this week, so if at all possible if we could have your thoughts before then it would be appreciated!

Regards,

David Budge

Director, Mercian Archaeological Services CIC

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Appendix VII: Ground Penetrating Radar Survey

Mercian Archaeological Services

Geophysical Report

St Mary's Church, Cuckney

Report 294920 R01(00)

http://www.mercian-as.co.uk

RSK GENERAL NOTES

Project No.: 294920-R01 (00)

Title: Geophysical Report, St Marys Church, Cuckney

Client: Mercian Archaeological Services CIC

Date: 27th November 2015

Office: RSK, 18 Frogmore Rd, Hemel Hempstead, Hertfordshire, HP3 9RT

Status: FINAL

Author	Matt Stringfellow *CGeol* Principal Geophysicist	**Project manager**	Matt Stringfellow *CGeol* Principal Geophysicist
Signature		Signature	
Date:	27th November 2015	Date:	27th November 2015
Technical reviewer	Tim Grossey *CGeol* Director	**Quality reviewer**	Jessica Western Project Administrator
Signature		Signature	
Date:	27th November 2015	Date:	27th November 2015

RSK Environment Ltd (RSK) has prepared this report for the sole use of the client, showing reasonable skill and care, for the intended purposes as stated in the agreement under which this work was completed. The report may not be relied upon by any other party without the express agreement of the client and RSK. No other warranty, expressed or implied, is made as to the professional advice included in this report.

Where any data supplied by the client or from other sources have been used, it has been assumed that the information is correct. No responsibility can be accepted by RSK for inaccuracies in the data supplied by any other party. The conclusions and recommendations in this report are based on the assumption that all relevant information has been supplied by those bodies from whom it was requested.

No part of this report may be copied or duplicated without the express permission of RSK and the party for whom it was prepared.

Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK Environment Ltd.

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Appendix A

EXECUTIVE SUMMARY

RSK have been commissioned by Mercian Archaeological Services CIC ('the Client') to carry out a geophysical site investigation at St Mary's Church, Cuckney, Nottinghamshire to locate anomalies that may relate to burial pits that could be associated with the 633 Battle of Hatfield.

Project Findings

Site Setting	The site is located in the village of Cuckney near Worksop, Nottinghamshire. The survey area comprises parts of the grounds of St Mary's Church, which dates from the 12th Century. The western part of the site comprises a mound which is related to a Motte and bailey castle.
Site Objectives	The object of the geophysical survey is to locate anomalies that may relate to burial pits, or recently re-interned pits.
Geophysical Techniques Employed	The geophysical technique employed was Ground Penetrating Radar (GPR) utilising a dual antenna frequency of 300MHz and 800MHz in order to scan the ground up to depths of 3m. The geophysical fieldwork was conducted between the 2nd and 5th November 2015.
Geophysical Survey Findings	The GPR data show several areas of high amplitude disturbed ground external to, and within the church which may be related to burial pits, obstructions or a change in ground conditions. Numerous features associated with discrete modern burials have also been detected. GPR time slice data showing the anomalous areas are presented in **Figures 4-7**. The Interpreted results are presented in **Figure 8**.

Project Conclusions

Recommendations	It is recommended that the cause of the anomalies references 1-6 are investigated further by targeted intrusive methods in order to confirm the causative feature of the anomalies.

INTRODUCTION

1.1 Introductions

On the instructions of Andy Gaunt of Mercian Archaeological Services CIC ('the Client'), RSK Geophysical, a division of RSK Environment Ltd, carried out a geophysical site investigation at St Mary's Norton Church, Cuckney, Nottinghamshire to locate anomalies that may relate to burial pits that could be associated with the 633 Battle of Hatfield which reportedly killed King Edwin of Northumbria. During underpinning works to the church in the 1950's, it is understood that bones were uncovered in mass graves below the church. It is understood that the bones were re-interred within the church grounds, however, there is little evidence to support this and no artefacts were found to help date the bones at the time they were uncovered. As part of a Heritage Lottery project, permission for non-intrusive works within the church and surrounding grounds has been granted in order to provide more information on the location of potential burials at the site, and to help inform the design of further possible investigations.

1.2 Details of the Project

The project was carried out to an agreed brief as set out in RSK proposal letter reference 294920-1(00) dated 19th March 2015, and included the following:

- A multi-frequency Ground Penetrating Radar (GPR) survey; and
- An Interpretative geophysical report

1.3 Limitations

Non intrusive geophysical techniques seek to locate boundaries across which there is a marked contrast in physical properties. Such a contrast may be detected remotely because it gives rise to a geophysical *anomaly*, which is indicative of variation in a physical property relative to some background value. Insufficient contrast (including high levels of cultural noise) can result in masking of the sought anomaly. Therefore, there may be other conditions prevailing at the site which have not been revealed by this investigation and which have therefore not been taken into account in this report.

The response of the ground to different physical forces can be highly variable. Interpretation of the responses contained in this report is based on experience in similar environments and site conditions. The materials encountered and samples obtained during on-site intrusive investigations represent only a small proportion of the materials present on-site. It should be accepted, therefore, that the interpretation from remotely sensed geophysical data may be inconsistent with that arising from direct methods of investigation.

THE SITE

1.4 Location and Site Setting

The site is located in the village of Cuckney near Worksop, Nottinghamshire. The survey area comprises parts of the grounds of St Mary's Church, which dates from the 12th Century. The site is centered at national grid reference SK 566 714. An extract of the 1:25k scale Ordnance Survey map showing the location of the site is given in **Figure 1**.

The eastern part of the churchyard contains modern interments from the last century up to present day, with rows of gravestones demarcating burials. The northern and western parts of the churchyard contain older interments with gravestones located more sporadically. The grounds also contain the possible remains of Cuckney Castle on a raised mound to the west of the site. The southern part of the churchyard has gravestones predominantly removed but likely contains unmarked burials. The ground surface comprises cut, rough grass. The layout of the site is shown in **Figure 2**.

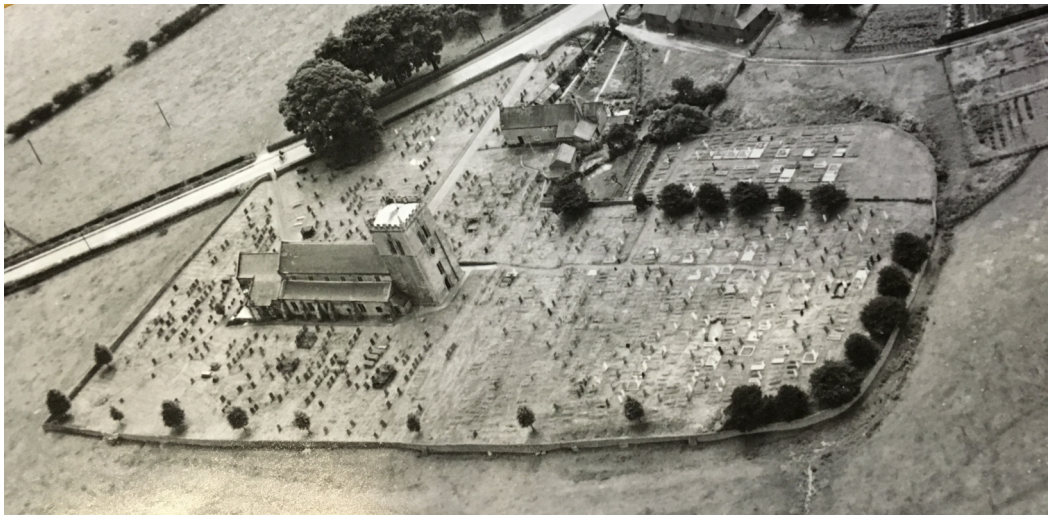


Plate 1. *Layout of the church (from the 1950s) (North is down). It is understood that reinterred bones recovered from the 1950s works were re-buried in the north east corner of the site.*

1.5 Geology and Ground Conditions

The published 1:50,000 scale BGS map of the area indicates that the site is underlain by the Triassic Lenton Sandstone Formation. Soils on site were noted as sandy. The site is located on a slight ridge on the south side of a valley along the River Poulter.

THE SURVEY

1.6 Objective and Geophysical Approach

It is understood that the church dates from the 12th Century, although it has been substantially altered and reconstructed several times since. During the last major phase of reconstruction works in 1950, which involved the excavation of six north-south orientated trenches across the nave to lay foundations to underpin the structure, skeletons were recovered from the trenches. Based on information from the client, the number of skeletons uncovered may have totalled as many as 200 in 3 or 4 (no.) separate areas from ~0.5m to 2.5m depth. The skeletons were all male and systematically buried. It is reported that the bones were then reinterred in several pits in the church grounds. Anecdotal evidence suggests that one such pit may be located in the north east corner of the grounds. It is not known how far the bones extended beneath the church away from the trenches.

The objective of the survey was to survey areas around the Church, and inside the Church where access allows, in order to evaluate the geophysical response for anomalous areas that may relate to the burial pits, or the re-interned pits from the 1950s. It has been suggested that the mound may also relate to activity from this period, and again any anomalous features may indicate where further intrusive excavations could be targeted.

The geophysical technique employed was Ground Penetrating Radar (GPR). The survey was undertaken between the 2nd and 5th November 2015.

1.7 The Ground Penetrating Radar Technique

In GPR surveys, electromagnetic waves of frequencies between 50MHz and 1.5GHz are transmitted into the ground or structure. This energy is reflected back to the surface when it encounters significant contrasts in dielectric properties.

Theory

Both surface and borehole GPR techniques use electromagnetic waves of frequencies between 50MHz and 1.5GHz to probe the subsurface (**Figure 3a**). A radio wave transmitter (T_X) is used to generate a short (<20ns) pulse of radio waves of specific frequency (depending on the antenna selected). These radio waves penetrate into the subsurface. Some of the energy carried by these waves is transmitted to greater and greater distances, while some of the energy is reflected back towards the receiver (R_X) whenever a contrast in electrical properties is encountered. The amount of energy reflected is dependent on the contrast in electrical properties encountered by the radio waves. The receiver measures the variation in strength of the reflected signals with time. The resulting profile is called a 'trace' and is a one-dimensional representation of the subsurface beneath the transmitter and receiver. To build up a two dimensional section of the subsurface (a radargram), the transmitter and receiver are traversed across the surface at a controlled speed.

The higher frequency antennas provide high resolution data over shallow depths (< 0.5m), and are mostly employed for near surface structural investigations (e.g., characterising rebar

in concrete). The lower frequency antennas can probe to greater depths (up to 30m, depending on subsurface conditions) but exhibit a reduced degree of resolution. These antennas are typically employed in geological/hydrogeological investigations (e.g., locating cave systems and sinkholes).

In order to present time sections as depth sections, some form of calibration is required through borehole or core information, or through an assessment of the electrical (dielectric) properties of the surveyed materials. The velocity of the EM pulse through the ground is directly related by the dielectric constant, (ξ) of the medium. As such the presence of moisture and voiding has a significant role in affecting the nature of the reflections encountered.

Application to Site

GPR can be used to detect responses associated with human burials in several ways. It may detect the disturbed soil of the grave shaft, or a break in the natural soil profile. It may also detect the coffin, bones or other articles in the burial. Reflections may be caused from air voids within the coffin or skull. These features within the otherwise homogeneous structure of the ground may constitute a contrast in dielectric (electrical) properties, and generate anomalous reflections within the radargrams. The nature and strength of these reflections will be dictated by the size/orientation of the objects, and to some extent, the respective contrast in dielectric properties with the surrounding ground. Decomposition of bones may also leach into the ground changing the electrical properties of the soil. Mass burials (in particular if positioned all in the same orientation) will provide a larger geometric response than of that expected from a single burial. For historic burials, features are likely to be much more subtle as the ground is likely to have compacted and settled, voids compressed, and ground chemistry returned to near background levels, however if the burials have subsequently been reinterred to a new location, the more recently disturbed ground should still be evident.

Equipment

Dual Frequency System

A dual frequency (DF) GPR system using the latest digital 300MHz and 800MHz antenna were deployed to site to provide the most appropriate depth penetration and resolution. The higher frequency antenna provided clearer information on shallow disturbed ground, and higher resolution features in the near surface, whilst the lower frequency antenna provided information on deeper features.

The GPR equipment used was the SIR (Subsurface Interface Radar) Dual Frequency system manufactured by Geophysical Survey Systems Inc (Serial no 2261). See equipment specifications in **Appendix A**. The scan rate was set to record 200 scans per meter and the depth range was set to 3m. A large odometer wheel was mounted to the antenna to ensure that the rough grass encountered at the site could be traversed.

Plate 2. *GPR data acquisition using the DF system in the eastern part of the churchyard.*

1.8 Survey Design

Areas of interest subject to the survey were highlighted to RSK by the client. These included areas of the churchyard immediately north, east, south and west of the church, together with accessible parts of the nave within the church. Additional areas requested by the client included two parts of the castle mound in the west of the site (one in the cemetery and one further west near the A60). All accessible areas covered with the GPR survey are shown shaded blue in **Figure 2** and covered as follows:

- North, west, south, east surrounds of churchyard – 4,000 m^2
- Nave (interior) – 125 m^2
- Castle mound – 725 m^2 (cemetery) and 490 m^2 (far west)

Data were acquired in accordance with the 'Geophysical Survey in Archaeology Field Evaluation' guidelines produced by English Heritage, 2008. A survey grid with parallel lines

generally spaced at 0.5m intervals in both north-south, and east-west orientations were used across the areas. In lower priority areas to the far west and south, an interline spacing of 1m was used.

1.9 Data Processing and Presentation

GPR data have been imported into the specialist processing software RADAN. This allows the user to apply complex processing routines and algorithms, which help to improve signal to noise ratio and highlight reflections of interest. Data are interrogated in section view. Anomalous reflections can be 'picked' from the data set and exported to other software packages to be superimposed onto a site plan.

Time slice data for the 1-2m depth range has been plotted in plan view to show amplitude data indicative of probable burials, together with ten example GPR radargrams from the site, which are presented in **Figures 4-7**. The colour scale represents signal amplitude, with deep red representing positive amplitudes. Raw data have been processed as described in **Table 1**.

Table 1: Summary of GPR processing methods

Method	Justification
Distance calibration	Horizontal measurement is undertaken using a wheel odometer mounted to the antenna and is calibrated daily and saved on the GPR console. An on-site check over 10m was conducted and found to be accurate.
Depth calibration	A dielectric constant of 14 for sandy moist soil has been used for the ground in order to give the most accurate indication of depth. Accuracies of ±20% are likely.
Zero-offset	To correct the signal to the actual ground surface level.
Gain control	Used an exponential attenuation factor to compensate for the signal attenuation with depth and enhance the signals from deeper reflectors to aid interpretation of features. Each profile was enhanced with the same gain parameters where possible.
Filtering	High and low pass filters were set at 150 MHz and 600 MHz for the 300GHz antenna, and 400 MHz and 1600 MHz for the 800GHz antenna to remove noise from the data, and to isolate "legitimate" signals from reflections of the pulse from the instrument.
Stacking	To increase the signal to noise ratio, a data enhancing acquisition stack (cumulative average) of 2 pulse repetitions was used for each data point.
Export	Apply appropriate colour scheme to combined grid and export dataset for presentation, with colour scale bar. High response anomalies are shaded red to indicate buried features within the ground.

DATA INTERPRETATION

1.10 Data Quality

The radar data acquired gave clear reflections in the shallow sub-surface, the maximum depth from which reliable reflections were obtained being approximately 1.0m with the 800MHz antenna and 3.0m with the 300MHz antenna.

The effectiveness of the GPR is determined by the soil conditions. At this site, soil conditions were generally sandy (with high electrical resistance) which helps to improve signal penetration depth. Due to the numerous modern burials ground conditions are often heterogeneous which has contributed to signal scattering which can mask responses from features at deeper depth.

Numerous buried services have also been located across the site, leading from, and around the church. These have been drawn on the interpretation plan. In these areas the presence of the service may obscure responses from possible burials below.

As a result of the underpinning works undertaken in the 1950's, the presence of the new foundations will obscure responses from burials directly below. Within the church nave the reinforced foundation beams are narrow at ~1m width therefore in the ~3m width of ground between the beams, the GPR is able to image into the ground unhindered. Exterior to the church, there is a 2-3m wide strip of disturbed ground all around the church outer wall which is likely the result of trenchwork which was dug in the 1950's as part of the underpinning works. Due to this interference it is difficult to image through the 'noise clutter' generated, however changes in response are still visible and show additional features below this area.

1.11 Results

GPR Results and Discussion

Modern burials are located at 1-2m depth, have a consistent size (typically 1x2m) and orientation (burials evenly spaced in parallel, linear rows). Sometimes burials can be double stacked in the same plot, or include smaller containment vessels at shallower depth. At this site, many features from discrete modern burials have been detected. These are classified as 'false positives' for this survey (as the objective is for larger mass burials). For the purposes of interpretation and identification, the GPR inferred modern graves together with the location of gravestones have been marked on the interpretation drawing in **Figure 8**.

There are a number of anomalies which differ from the singular discrete features which suggests that in a number of locations, the ground conditions differ than the remainder of the site. A detailed description of the findings of the GPR survey for each area is presented in **Table 2** below.

Table 2: Findings of the GPR survey

Anomaly Reference In Fig 8	GPR Description	Interpretation
Eastern graveyard	Characterised by regular spaced, hyperbolic reflections parallel lines in the northern half. These likely relate to recent burials from the 20th century. Reflections show the likely presence of coffins/air filled cavities. Older graves in the southern part of this area are more subtle in the dataset. No significant features are imaged in the northeast corner of the area (near the wall) – see example radargram in Figure 4C. This is one of the areas where reinterment of the mass burial may be located. It should be noted that the ground conditions next to the wall were saturated and boggy which has caused poorer data quality from this area.	
Ref 1	High amplitude, discontinuous reflections at 1.20-2.00m depth. 8m x 2m in extent.	This area is located in the centre of the eastern cemetery and to the immediate south of the most recent burials as shown highlighted in Fig 4A (plan view) and labelled 3 in Fig4B. The strong reflections indicate a change in ground conditions. This could be the result of ground disturbance from a possible burial pit (such as a re-interment of the 1950s bodies). It should be noted that the strong reflections could also be a result of higher conductivity in the ground. This may be due to leaching from the recent nearby burials to the north into the soil. However, as the site is sloped down to the north, any leaching would more likely flow to the north away from this anomalous area. Although this area does not contain any gravestones, it is noted that historically the area contained gravestones (see Plate 1) hence the presence of modern burials in this area cannot be discounted. This should be taken into consideration in the event the area is investigated further.
Northern graveyard	See plan view in Figure 5A. Characterised by some clear modern burials (see labelled 2 in Fig 5C), and other subtle features (older burials). Some more disturbed areas (see below). In a 2-3m zone around the perimeter of the church, the ground is very disturbed – likely due to the trench works as part of the underpinning.	

Ref 2	High amplitude, discontinuous reflections next to the church. Some features flat in nature, and some occur isolated at depth. Occurs in 6 no. areas immediately north of the church	Within the disturbed zone around the church perimeter, lie additional high amplitude features (see labelled 4 in Figure 5B). These probably relate to buried obstructions – either as part of the structure of the church, or possible burials. Is it understood some burials under the church were shallow (from 0.5 to 2m depth). The GPR detected features are within this range. It is noted that the disturbed ground does not extend more than ~3m northwards of the church. The client should be aware that the disturbed nature of the ground will likely mask responses from more subtle features such as older bones in this area.
Ref 3	Horizontal high amplitude feature on the small mound north east of the church. (see labelled 2 in Fig 5D)	The mound was one of the locations marked as a possible burial area. The nature of this feature suggests a flat obstruction in the ground. Given its small size, it is unlikely to represent a large burial pit, but a probably obstruction nonetheless.
Ref 4	Discontinuous high amplitude feature near the northern boundary. (see labelled 2 in Fig 5E)	Data suggests an area (2.5 x3.5m) of disturbed ground or change in ground conditions at shallow (0.5m) depth. A dipping reflector present may indicate the edge of a burial pit or similar.
Ref 5	Discontinuous high amplitude feature near the northern boundary. (see labelled 2 in Fig 5F)	Data suggests an area (3 x4m) of disturbed ground or change in ground conditions at depth (~1.5m). It is noted that the surrounding ground surface contains a small depression which suggests some ground settlement has occurred.
Church Interior	All accessible parts of the nave were surveyed (where pews could be moved). The GPR survey clearly reveals the 1950s reinforced ground beams at ~0.30 depth as a series of linear, high amplitude features (see Fig 6A). Between the beams lie a number of discrete features (see below)	
Ref 6	Moderate amplitude features at depths between 0.5m and 2.0m located between the beams in six areas.	The features indicate the presence of possible buried obstructions in the ground below the church floor. These may relate to the structure of the church or other possible burial feature. As multiple skeletons were encountered in these areas previously, the presence of additional skeleton features cannot be discounted. Some of the features identified line up with features identified outside the church immediately to the north which suggests the features may extend below the north church wall.
West of Church	No significant anomalies were detected in this area other than discrete and disturbed reflections expected of modern graves.	
South of Church	No significant anomalies were detected in this area other than discrete and disturbed reflections expected of modern graves. It is noted that although this area does not contain any gravestones, the stones have likely been moved in recent times, hence many unmarked burials likely exist in this area.	

Castle Mound in west of Church ground	No significant anomalies were detected in this area other than discrete and disturbed reflections expected of modern graves. As the burials in this area of the site are older, the features detected are more subtle. No features indicative of buried structures from the former castle were recorded in the data.
Castle Mound in far west field beyond church yard next to A60	No features indicative of discrete buried were detected in the GPR data. However, two areas of disturbed ground (see labelled 3 in Fig 7B, and hatched in Fig 8 Sheet 2) have been detected which may indicate the presence of buried obstructions or a possible burial pit. 4 (no.) linear features indicate of buried services are also shown in the data crossing the survey area orientated running parallel to the road.

1.12 Limitations

The results of the GPR survey can only provide locations of anomalies, which were identified based on changes from surrounding ground conditions. This includes areas with hyperbolic reflections, amplitude variations, and distinct planar reflections. It should be noted that these signals are not exclusive to archaeological features, and may represent other natural or contemporary features. Further, not all features of archaeological interest will produce a recognisable signal, in particular small-scale isolated remains (such as discrete bones) which are not in a formal burial context, and those features which do not vary significantly in physical and chemical characteristics from surrounding deposits.

The size of objects detected is limited by the antenna frequency to objects with dimensions larger than ~10 cm (with the 800MHz in the upper 0-1m) and ~20 cm (with the 300MHz in the depth range 1-3m). As such, this GPR survey is not expected to have identified all locations where human remains may be present.

1.13 Recommendations

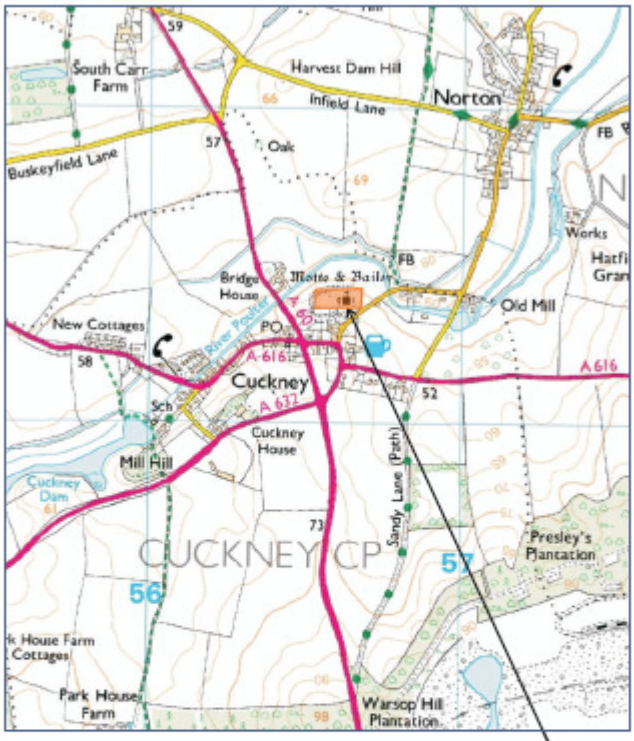
It is recommended that the cause of the anomalies references 1-6 are investigated further by targeted intrusive methods in order to confirm the causative feature of the anomalies.

CONCLUSIONS

- RSK have been commissioned by Mercian Archaeological Services CIC ('the Client') to carry out a geophysical site investigation at St Mary's Norton Church, Cuckney, Nottinghamshire to locate anomalies that may relate to burial pits that could be associated with the 633 Battle of Hatfield.The geophysical technique employed was Ground Penetrating Radar (GPR). The survey was undertaken on the evenings of 19th, 20th and 21st October 2015.
- The geophysical technique employed was Ground Penetrating Radar (GPR) utilising a dual antenna frequency of 300MHz and 800MHz in order to scan the ground up to depths of 3m.
- The geophysical fieldwork was conducted between the 2nd and 5th November 2015.

- The GPR data shows several areas of high amplitude disturbed ground external to, and within the church which may be related to burial pits, obstructions or a change in ground conditions. Numerous features associated with discrete modern burials have also been detected.
- GPR time slice data showing the anomalous areas is presented in **Figures 4-7**.
- The Interpreted results are presented in **Figure 8**.
- Whilst detailed data have been gathered by the geophysical survey, the results should be used in the context of all available information regarding the presence of burials at the site. The geophysical survey should not be relied upon as a sole and complete record of the presence of burials at the site. Not all features of archaeological interest will produce a recognisable signal, in particular small-scale isolated remains which are not in a formal burial context.
- It is recommended that the cause of the anomalies references 1-6 are investigated further by targeted intrusive methods in order to confirm the causative feature of the anomalies.

Figures



Notes

Based from Ordnance Survey map

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N W E S

RSK

SITE LOCATION MAP

National Grid Reference: SK 566 714

Client: Mercian Heritage Series Ltd

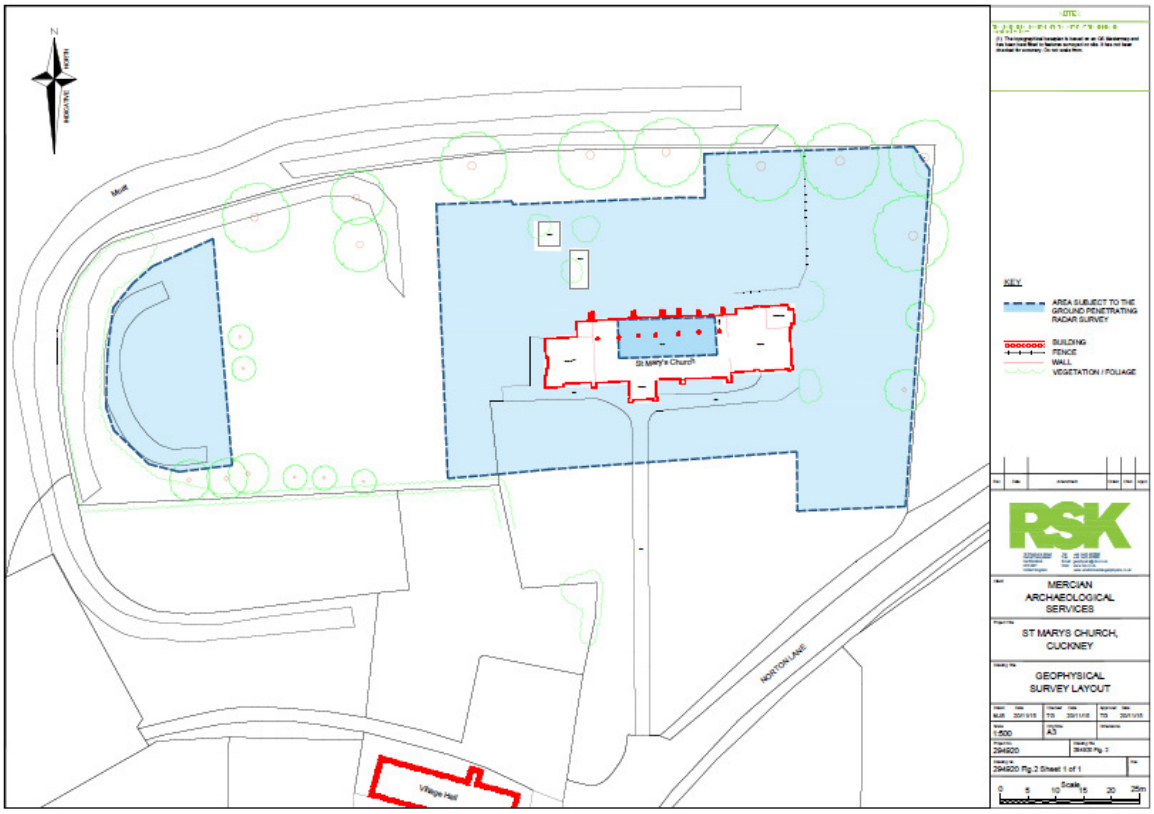
Figure No.: FIGURE 1

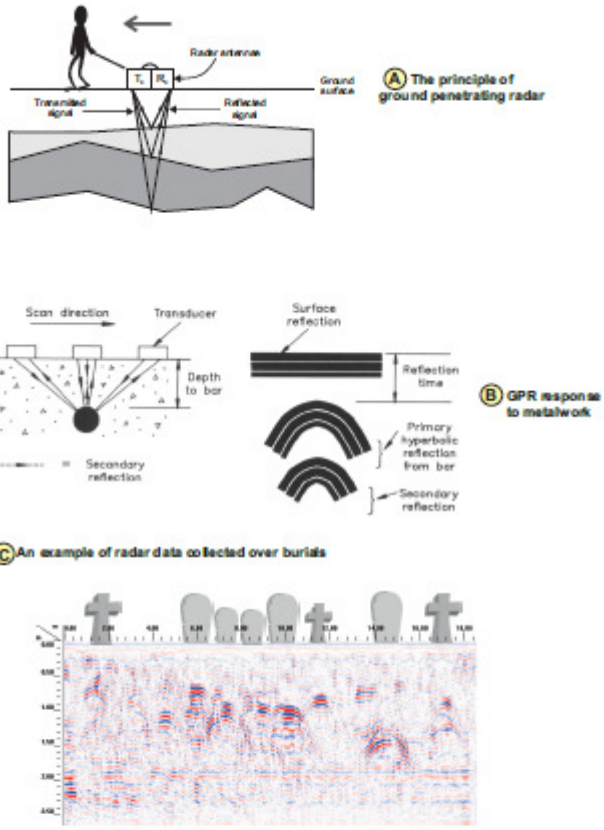
Project No: 294920

Site/Project: ST MARYS CHURCH, CUCKNEY

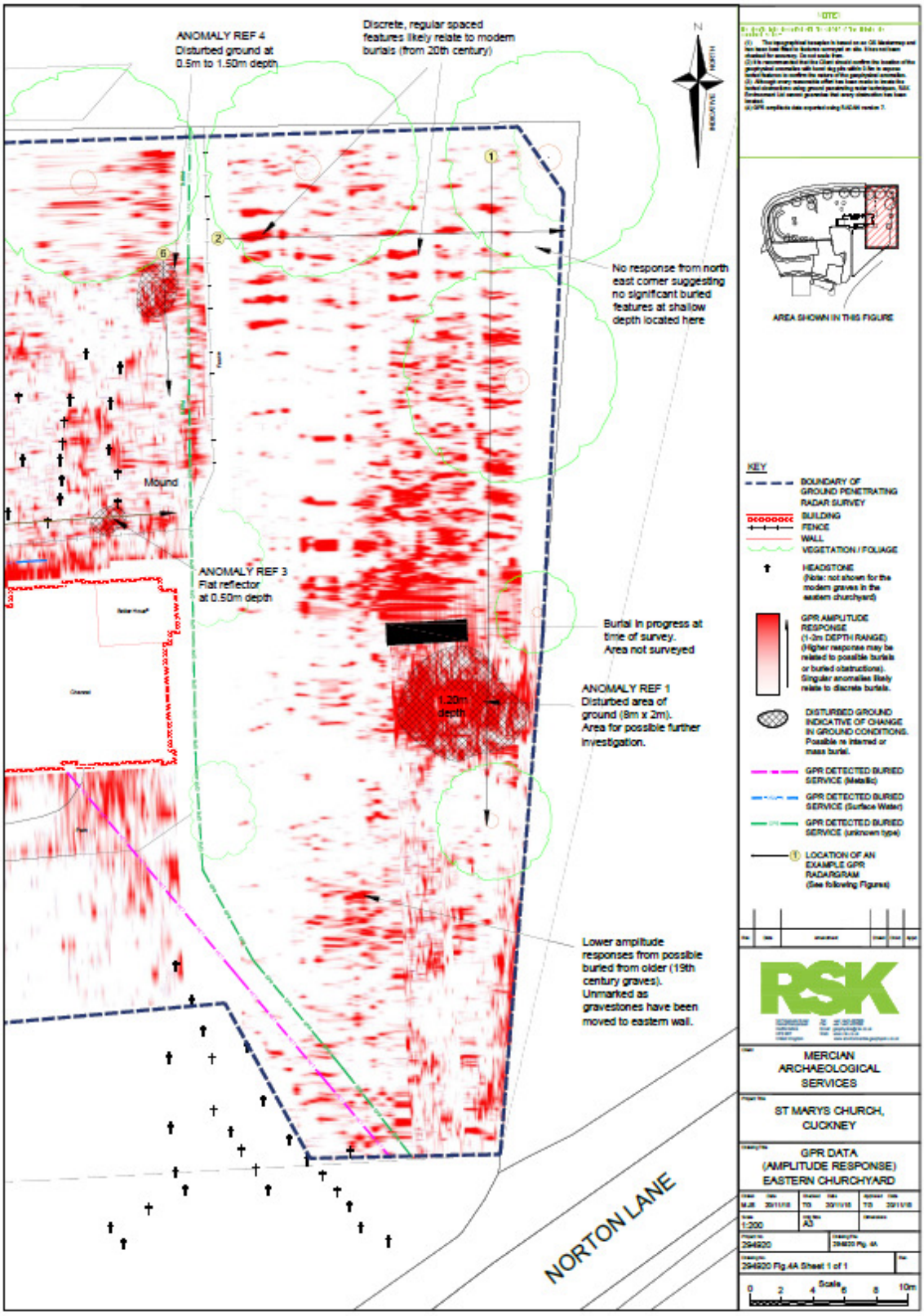
Scale: 1:25,000 @A4

Date: November 2015


N
NORTH
MAGNETIC
Moat
St Mary's Church
Village Hall
NORTON LANE
KEY
AREA SUBJECT TO THE GROUND PENETRATING RADAR SURVEY
BUILDING
FENCE
WALL
VEGETATION / FOLIAGE
RSK
MERCIAN ARCHAEOLOGICAL SERVICES
ST MARYS CHURCH, CUCKNEY
GEOPHYSICAL SURVEY LAYOUT
1:500
A3
284920
284920 Fig 2 Sheet 1 of 1
Scale
0 5 10 15 20 25m

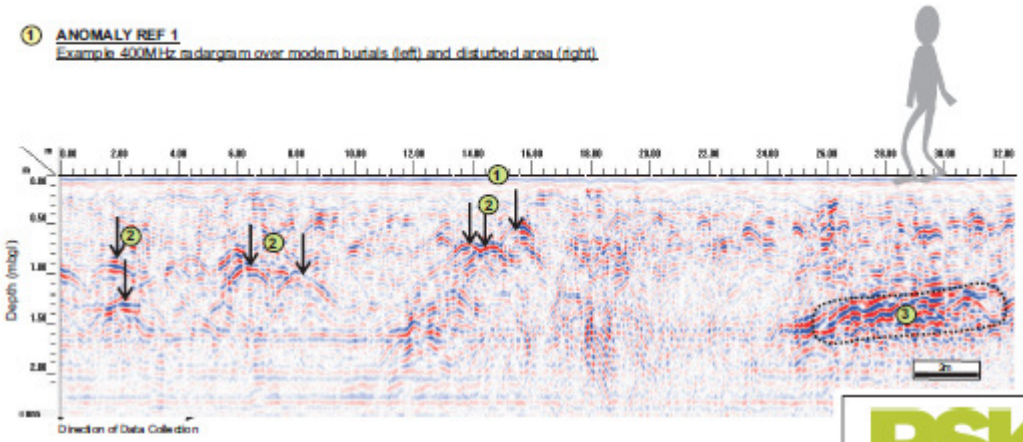


RSK	THE GROUND PENETRATING RADAR TECHNIQUE	
Client: Mercian	Figure No: FIGURE 3	Project No: 294920
Site/Project: ST MARYS CHURCH, CUCKNEY	Scale: N/A	Date: November 2015


ANOMALY REF 4
Disturbed ground at 0.5m to 1.50m depth
Discrete, regular spaced features likely relate to modern burials (from 20th century)
N
NORTH
No response from north east corner suggesting no significant buried features at shallow depth located here
Mound
ANOMALY REF 3
Flat reflector at 0.50m depth
Burial in progress at time of survey. Area not surveyed
1.20m depth
ANOMALY REF 1
Disturbed area of ground (8m x 2m). Area for possible further investigation.
Lower amplitude responses from possible buried from older (19th century graves). Unmarked as gravestones have been moved to eastern wall.
NORTON LANE
AREA SHOWN IN THIS FIGURE
KEY
BOUNDARY OF GROUND PENETRATING RADAR SURVEY
BUILDING
FENCE
WALL
VEGETATION / FOLIAGE
HEADSTONE (Note: not shown for the modern graves in the eastern churchyard)
GPR AMPLITUDE RESPONSE (1-2m DEPTH RANGE) (Higher response may be related to possible burials or buried obstructions). Singular anomalies likely relate to discrete burials.
DISTURBED GROUND INDICATIVE OF CHANGE IN GROUND CONDITIONS. Possible re interred or mass burial.
GPR DETECTED BURIED SERVICE (Metallic)
GPR DETECTED BURIED SERVICE (Surface Water)
GPR DETECTED BURIED SERVICE (unknown type)
LOCATION OF AN EXAMPLE GPR RADARGRAM (See following Figures)
RSK
MERCIAN ARCHAEOLOGICAL SERVICES
ST MARYS CHURCH, CUCKNEY
GPR DATA (AMPLITUDE RESPONSE) EASTERN CHURCHYARD
1:200
A3
294920
294920 Fig.4A Sheet 1 of 1
Scale
0 2 4 6 8 10m

① **ANOMALY REF 1**

Example 400MHz radargram over modern burials (left) and disturbed area (right).



Key Features

① Ground surface

② Discrete, singular, high amplitude hyperbolic reflections indicative of likely recent burials (features shown likely coffins or containment vessels)

③ High amplitude, discontinuous reflections indicative of disturbed strata, change in ground conditions or multiple buried obstructions. Burial pit possible.

GPR signal:

Strong positive reflection — Strong negative reflection

Location of scan line shown in Figure 4A.

RSK

Client: Mercian

Site/Project: ST MARYS CHURCH, CUCKNEY

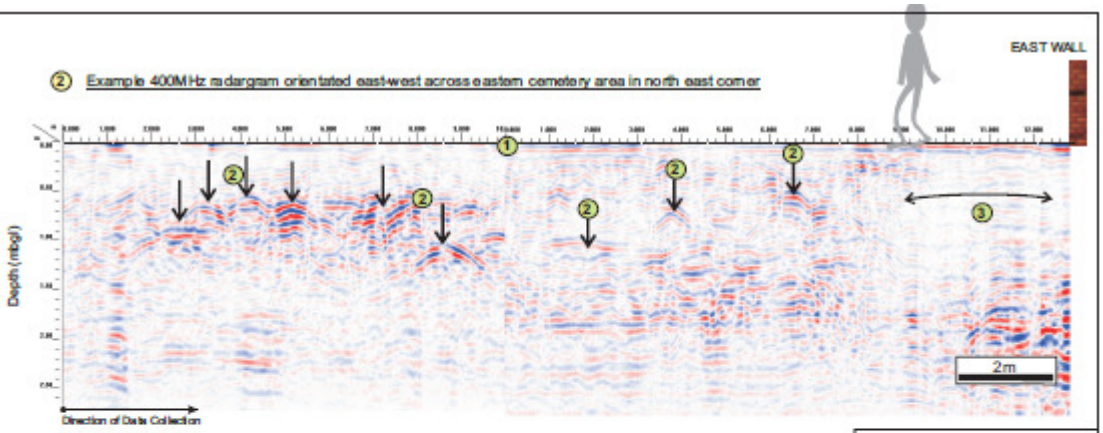
Title: EXAMPLE GPR DATA: EASTERN CHURCHYARD

Drawing Reference: 294920 Figure 4B

Scale: As shown

Date: November 2015

② Example 400MHz radargram orientated east-west across eastern cemetery area in north east corner



Key Features

① Ground surface

② Discrete, singular, high amplitude hyperbolic reflections indicative of likely recent burials (features shown likely coffins or containment vessels)

③ Radar 'quiet area'. In part this is caused by the poor ground coupling in this area next to the wall due to the presence of grass clippings on the ground. There are no significant reflections at depth, which suggest no significant buried obstructions such as recent mass burials in this area.

GPR signal:

Strong positive reflection — Strong negative reflection

Location of scan line shown in Figure 4A.

RSK

Client: Mercian

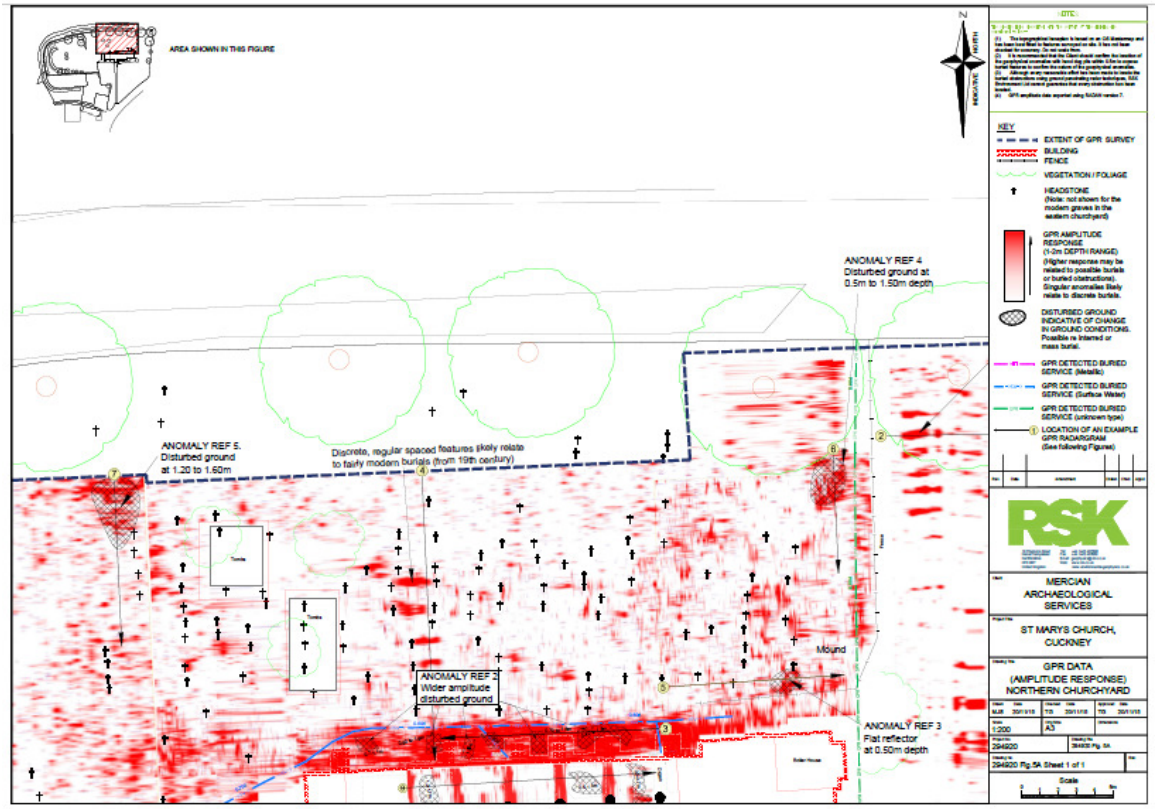
Site/Project: ST MARYS CHURCH, CUCKNEY

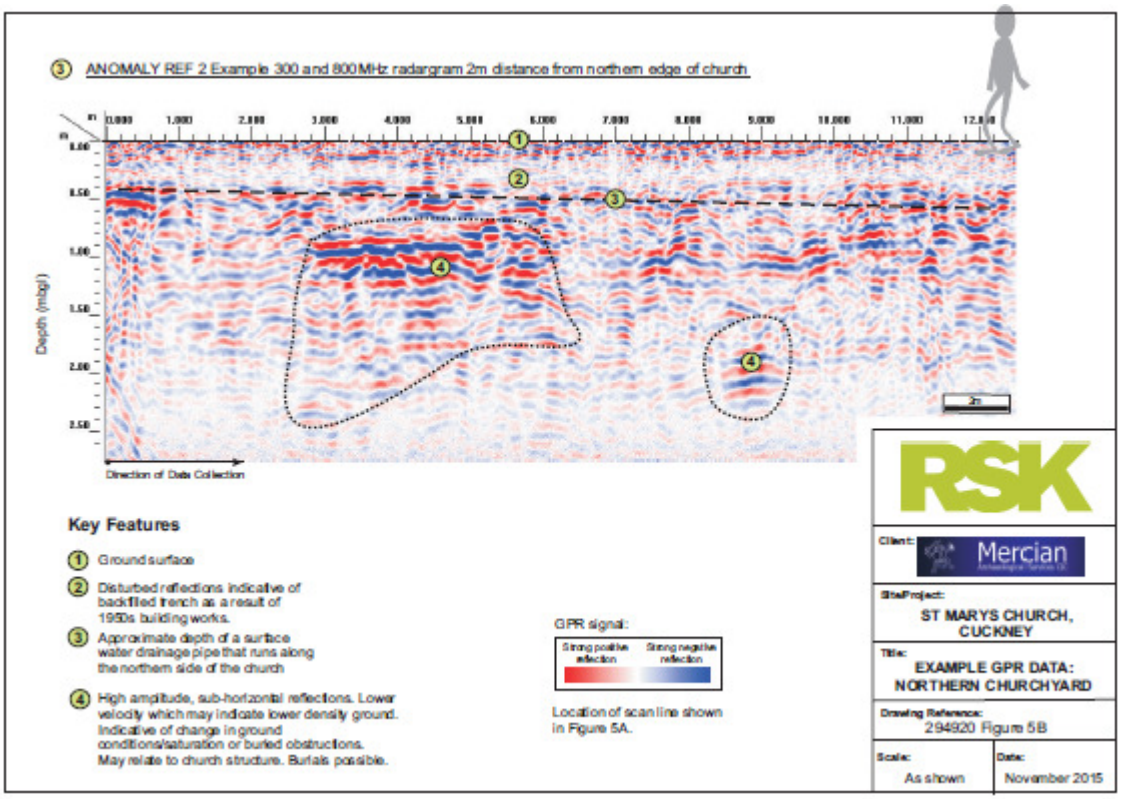
Title: EXAMPLE GPR DATA: EASTERN CHURCHYARD

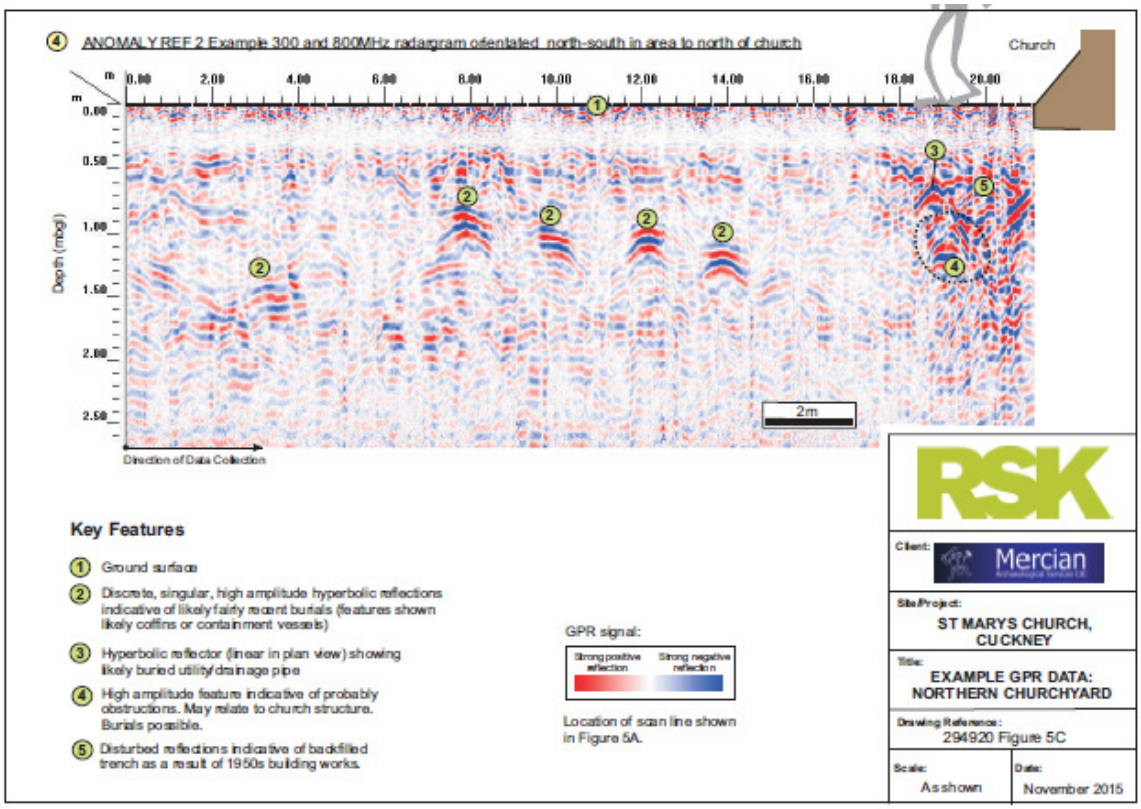
Drawing Reference: 294920 Figure 4C

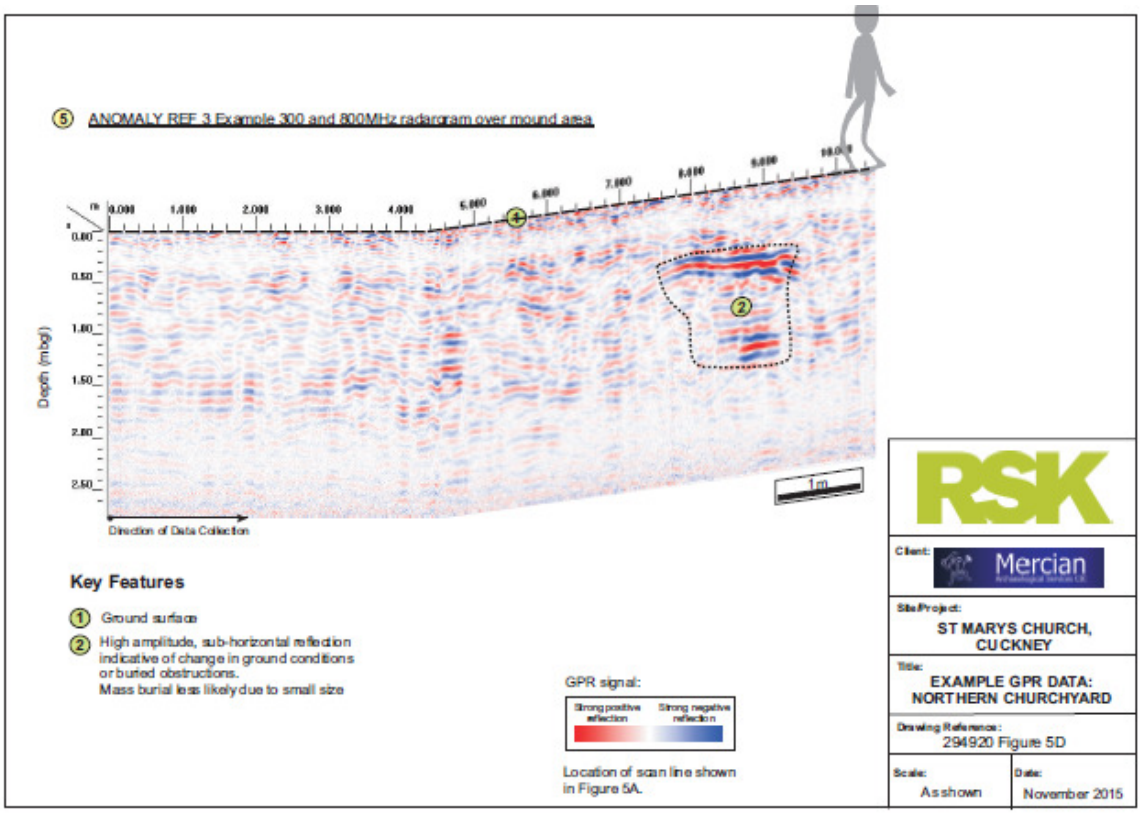
Scale: As shown

Date: November 2015

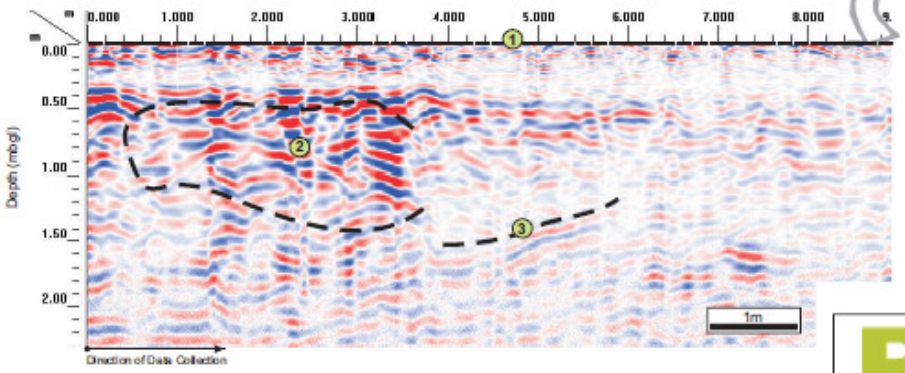

AREA SHOWN IN THIS FIGURE
KEY
EXTENT OF GPR SURVEY
BUILDING
FENCE
VEGETATION / FOLIAGE
HEADSTONE
GPR AMPLITUDE RESPONSE
DISTURBED GROUND INDICATIVE OF CHANGE IN GROUND CONDITIONS.
GPR DETECTED BURIED SERVICE (Metallic)
GPR DETECTED BURIED SERVICE (Surface Water)
GPR DETECTED BURIED SERVICE (unknown type)
LOCATION OF AN EXAMPLE GPR RADARGRAM
ANOMALY REF 4
Disturbed ground at 0.5m to 1.50m depth
ANOMALY REF 5.
Disturbed ground at 1.20 to 1.60m
Discrete, regular spaced features likely relate to fairly modern burials (from 19th century)
ANOMALY REF 2
Wider amplitude disturbed ground
Mound
ANOMALY REF 3
Flat reflector at 0.50m depth
RSK
MERCIAN ARCHAEOLOGICAL SERVICES
ST MARYS CHURCH, CUCKNEY
GPR DATA (AMPLITUDE RESPONSE) NORTHERN CHURCHYARD
1:200
A3
294920
294920 Fig.5A Sheet 1 of 1
Scale


③ ANOMALY REF 2 Example 300 and 800MHz radargram 2m distance from northern edge of church
Depth (mbgl)
Direction of Data Collection
2m
Key Features
① Ground surface
② Disturbed reflections indicative of backfilled trench as a result of 1950s building works.
③ Approximate depth of a surface water drainage pipe that runs along the northern side of the church
④ High amplitude, sub-horizontal reflections. Lower velocity which may indicate lower density ground. Indicative of change in ground conditions/saturation or buried obstructions. May relate to church structure. Burials possible.
GPR signal:
Strong positive reflection
Strong negative reflection
Location of scan line shown in Figure 5A.
RSK
Client:
Mercian
Site/Project:
ST MARYS CHURCH, CUCKNEY
Title:
EXAMPLE GPR DATA: NORTHERN CHURCHYARD
Drawing Reference:
294920 Figure 5B
Scale:
As shown
Date:
November 2015


4 ANOMALY REF 2 Example 300 and 800MHz radargram orientated north-south in area to north of church
Church
Depth (mbgl)
2m
Direction of Data Collection
Key Features
1 Ground surface
2 Discrete, singular, high amplitude hyperbolic reflections indicative of likely fairly recent burials (features shown likely coffins or containment vessels)
3 Hyperbolic reflector (linear in plan view) showing likely buried utility/drainage pipe
4 High amplitude feature indicative of probably obstructions. May relate to church structure. Burials possible.
5 Disturbed reflections indicative of backfilled trench as a result of 1950s building works.
GPR signal:
Strong positive reflection
Strong negative reflection
Location of scan line shown in Figure 5A.
RSK
Client:
Mercian
Site/Project:
ST MARYS CHURCH, CUCKNEY
Title:
EXAMPLE GPR DATA: NORTHERN CHURCHYARD
Drawing Reference:
294920 Figure 5C
Scale:
As shown
Date:
November 2015


5 ANOMALY REF 3 Example 300 and 800MHz radargram over mound area
Depth (mbgl)
1m
Direction of Data Collection
Key Features
1 Ground surface
2 High amplitude, sub-horizontal reflection indicative of change in ground conditions or buried obstructions. Mass burial less likely due to small size
GPR signal:
Strong positive reflection
Strong negative reflection
Location of scan line shown in Figure 5A.
RSK
Client:
Mercian
Site/Project:
ST MARYS CHURCH, CUCKNEY
Title:
EXAMPLE GPR DATA: NORTHERN CHURCHYARD
Drawing Reference:
294920 Figure 5D
Scale:
As shown
Date:
November 2015

⑥ ANOMALY REF 4 Example 300 and 800MHz radargram near the northern boundary



Key Features

1. Ground surface
2. Discontinuous, high amplitude reflections with some dipping reflectors at depth suggest an area of disturbed and modified ground within otherwise heterogenous ground conditions
3. Sloping reflector may indicate the side of an excavation

GPR signal:

Strong positive reflection — Strong negative reflection

Location of scan line shown in Figure 5A.

RSK

Client: Mercian

Site/Project: ST MARYS CHURCH, CUCKNEY

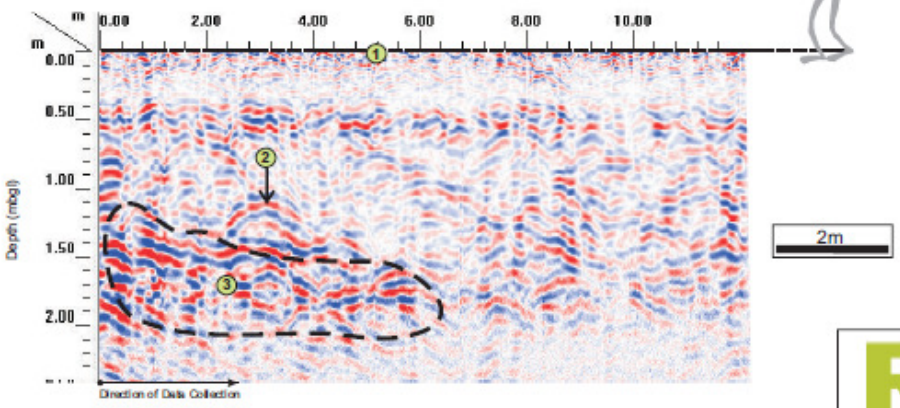
Title: EXAMPLE GPR DATA: NORTHERN CHURCHYARD

Drawing Reference: 294920 Figure 5E

Scale: As shown

Date: November 2015

⑦ ANOMALY REF 5 Example 300 and 800MHz radargram near the northern boundary



Key Features

1. Ground surface
2. Discrete, singular, high amplitude hyperbolic reflection indicative of likely fairly recent burials (features shown likely coffins or containment vessels)
3. High amplitude, discontinuous reflections indicative of disturbed strata, change in ground conditions or multiple buried obstructions. Burial pit possible. It is noted that there is a slight depression at the ground surface at this location.

GPR signal:

Strong positive reflection — Strong negative reflection

Location of scan line shown in Figure 5A.

RSK

Client: Mercian

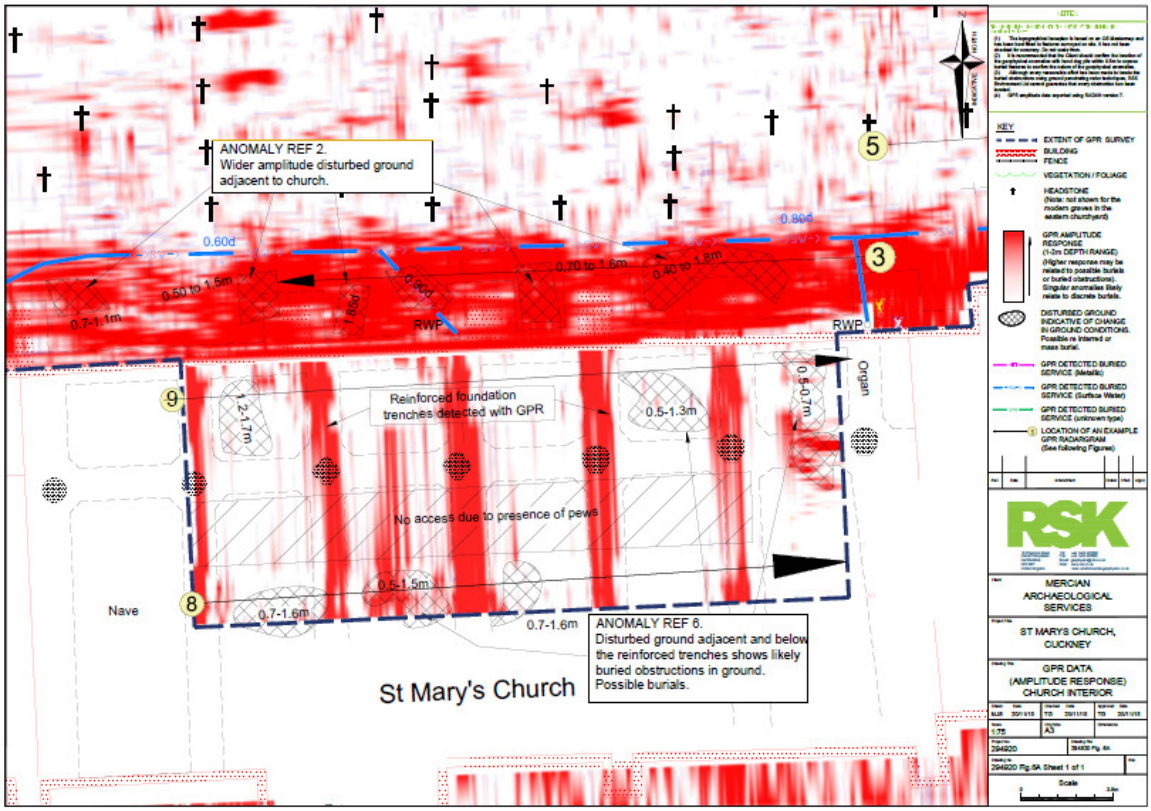
Site/Project: ST MARYS CHURCH, CUCKNEY

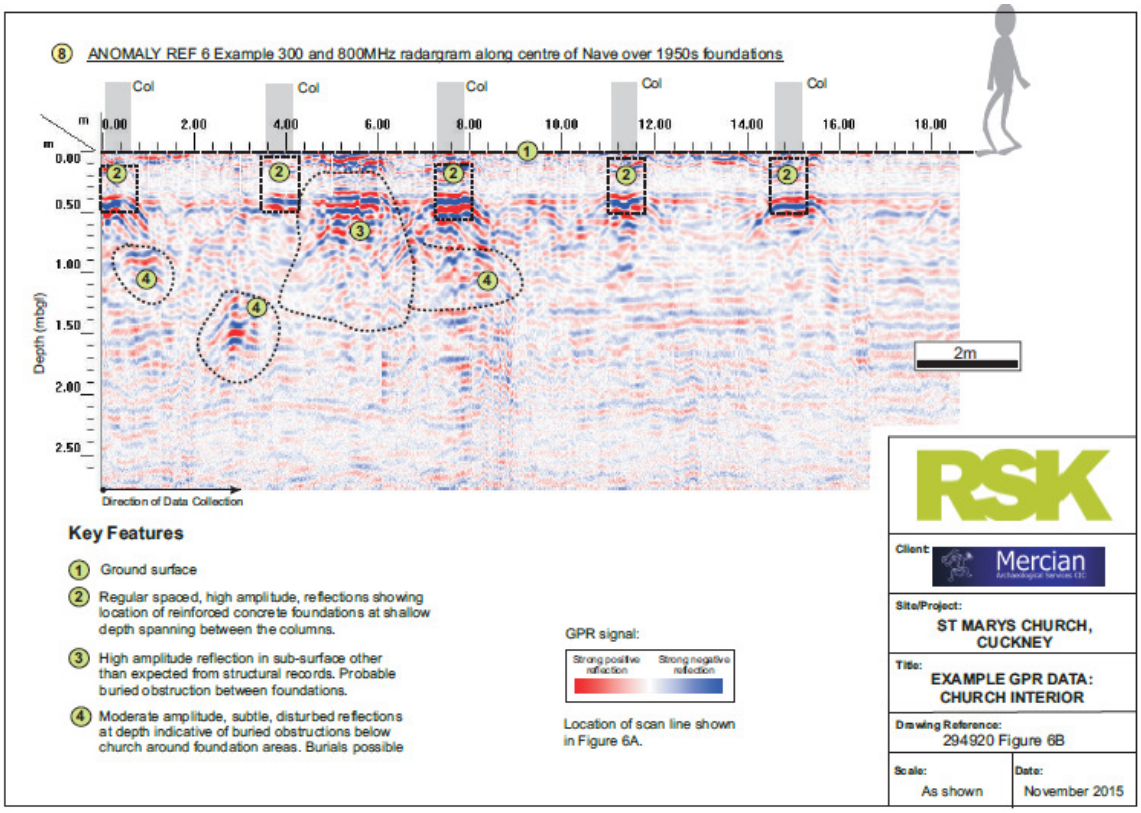
Title: EXAMPLE GPR DATA: NORTHERN CHURCHYARD

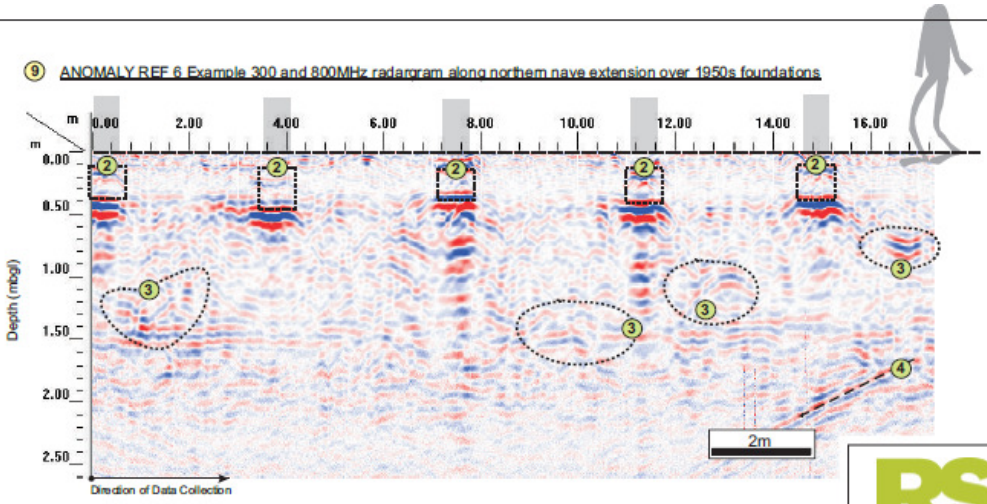
Drawing Reference: 294920 Figure 5F

Scale: As shown

Date: November 2015


ANOMALY REF 2.
Wider amplitude disturbed ground adjacent to church.
0.60d
0.86d
0.50 to 1.5m
0.70 to 1.6m
0.40 to 1.8m
0.7-1.1m
1.85d
RWP
RWP
Reinforced foundation trenches detected with GPR
0.5-1.3m
0.5-0.7m
Organ
No access due to presence of pews
0.5-1.5m
Nave
0.7-1.6m
0.7-1.6m
ANOMALY REF 6.
Disturbed ground adjacent and below the reinforced trenches shows likely buried obstructions in ground.
Possible burials.
St Mary's Church
KEY
EXTENT OF GPR SURVEY
BUILDING
FENCE
VEGETATION / FOLIAGE
HEADSTONE
GPR AMPLITUDE RESPONSE
DISTURBED GROUND INDICATIVE OF CHANGE IN GROUND CONDITIONS.
GPR DETECTED BURIED SERVICE (Metallic)
GPR DETECTED BURIED SERVICE (Surface Water)
GPR DETECTED BURIED SERVICE (unknown type)
LOCATION OF AN EXAMPLE GPR RADARGRAM
RSK
MERCIAN ARCHAEOLOGICAL SERVICES
ST MARYS CHURCH, CUCKNEY
GPR DATA (AMPLITUDE RESPONSE) CHURCH INTERIOR
294920 Fig.5A Sheet 1 of 1
Scale


8 ANOMALY REF 6 Example 300 and 800MHz radargram along centre of Nave over 1950s foundations
Col
Col
Col
Col
Col
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
0.00
0.50
1.00
1.50
2.00
2.50
Depth (mbgl)
2m
Direction of Data Collection
Key Features
1 Ground surface
2 Regular spaced, high amplitude, reflections showing location of reinforced concrete foundations at shallow depth spanning between the columns.
3 High amplitude reflection in sub-surface other than expected from structural records. Probable buried obstruction between foundations.
4 Moderate amplitude, subtle, disturbed reflections at depth indicative of buried obstructions below church around foundation areas. Burials possible
GPR signal:
Strong positive reflection
Strong negative reflection
Location of scan line shown in Figure 6A.
RSK
Client:
Mercian
Site/Project:
ST MARYS CHURCH, CUCKNEY
Title:
EXAMPLE GPR DATA: CHURCH INTERIOR
Drawing Reference:
294920 Figure 6B
Scale:
As shown
Date:
November 2015



Key Features

1. Ground surface
2. Regular spaced, high amplitude, reflections showing location of reinforced concrete foundations at shallow depth spanning between the columns.
3. Moderate amplitude, subtle, disturbed reflections at depth indicative of buried obstructions below church around foundation areas. Burials possible
4. Sideswipe from adjacent arch/wall above ground at top of nave

GPR signal:

Strong positive reflection — Strong negative reflection

Location of scan line shown in Figure 6A.

RSK

Client: Mercian Archaeological Services CIC

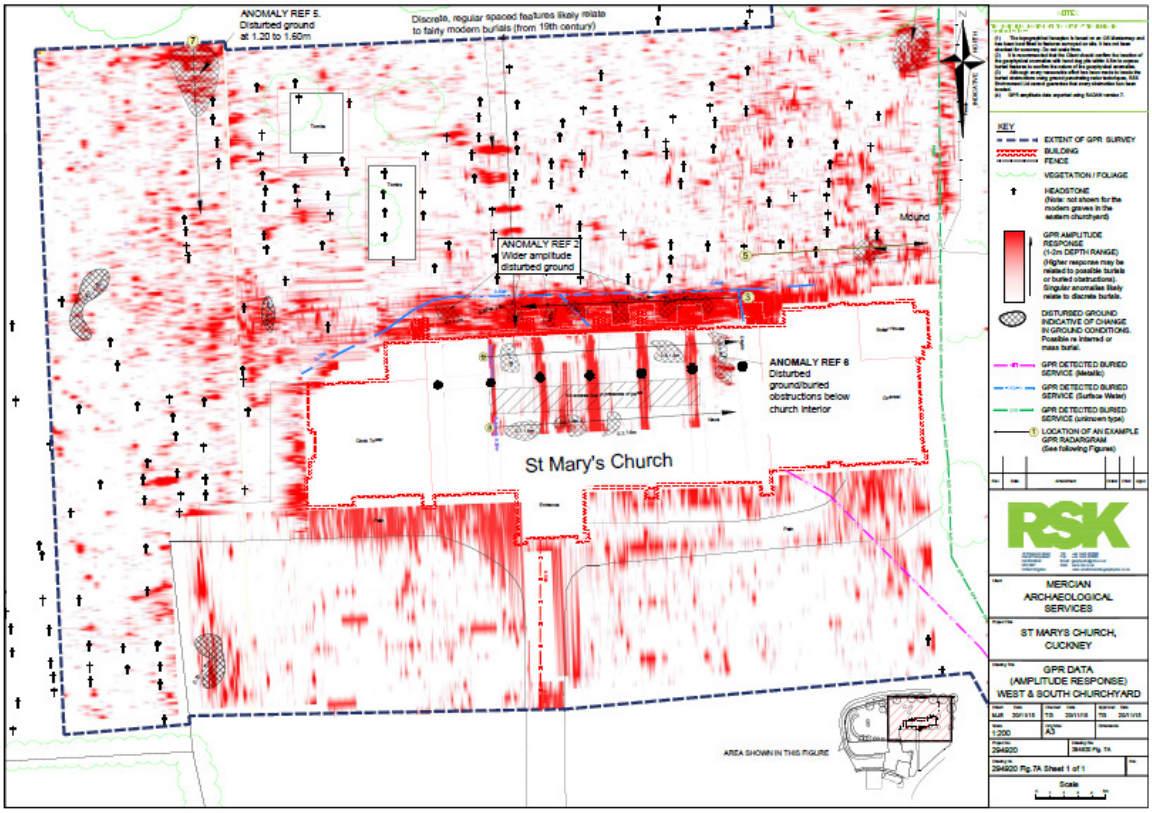
Site/Project: ST MARYS CHURCH, CUCKNEY

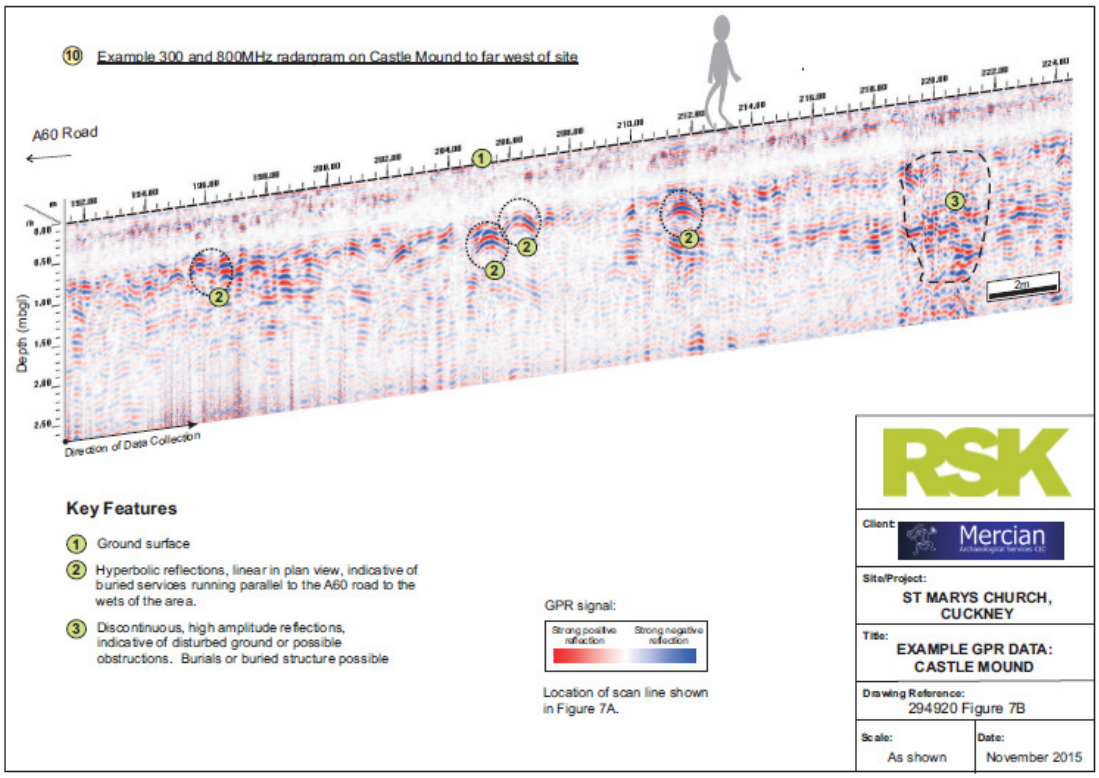
Title: EXAMPLE GPR DATA: CHURCH INTERIOR

Drawing Reference: 294920 Figure 6C

Scale: As shown

Date: November 2015





Key Features

1. Ground surface
2. Hyperbolic reflections, linear in plan view, indicative of buried services running parallel to the A60 road to the wets of the area.
3. Discontinuous, high amplitude reflections, indicative of disturbed ground or possible obstructions. Burials or buried structure possible

GPR signal:

Strong positive reflection | Strong negative reflection

Location of scan line shown in Figure 7A.

RSK

Client: Mercian Archaeological Services CIC

Site/Project: ST MARYS CHURCH, CUCKNEY

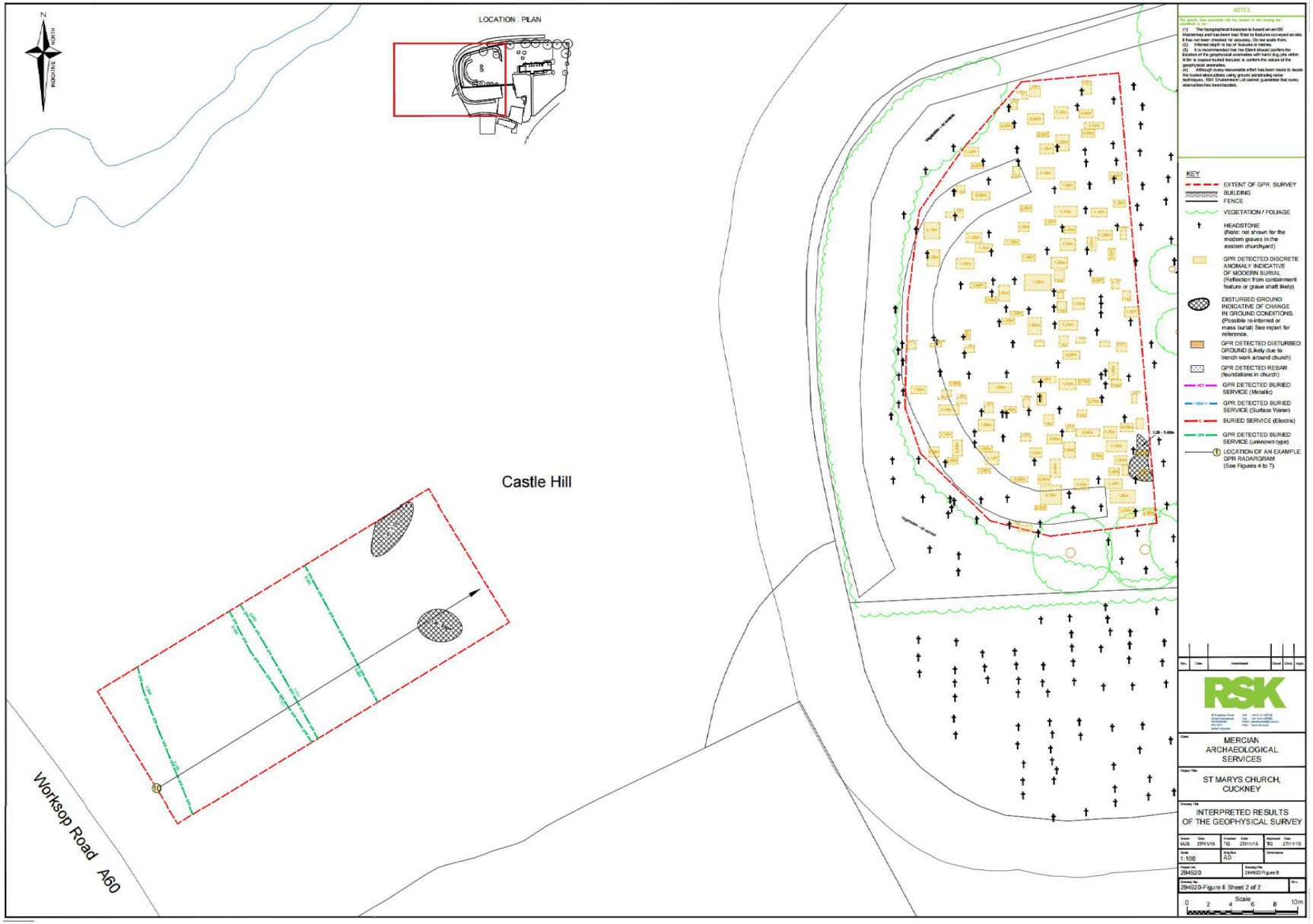
Title: EXAMPLE GPR DATA: CASTLE MOUND

Drawing Reference: 294920 Figure 7B

Scale: As shown

Date: November 2015


N
NORTH
ANOMALY REF 5. Localised depression and Disturbed ground at 1.2m to 1.60m
ANOMALY REF 4 Disturbed ground
Discrete, regular spaced features likely relate to modern burials (from 19th century)
Fan reflectors at 1.30m depth - possibly related to strata / ground layers
ANOMALY REF 3 Flat reflector at 0.60m depth
Mound
ANOMALY REF 2 Disturbed ground adjacent to church
ANOMALY REF 6 Disturbed ground/buried obstructions below church interior
No access due to presence of trees
Clock Tower
Nave
Chancel
Vestry
Entrance
Path
St Mary's Church
Fence
Buried services
Buried services
Buried services
Mound in cemetery is long of 3 off with Apex off centre
ANOMALY REF 7 Data best viewed at depths of 0.20m to 1.30m. Deeper depth Jobs for possible further investigation
Fence
Path
Path
Path
NORTON LANE
LOCATION . PLAN
NOTES
(1) The topographical baseplan is based on an OS Mastermap and has been best fitted to features surveyed on site. It has not been checked for accuracy. Do not scale from.
(2) Interpret depth to top of features in metres.
(3) It is recommended that the Client should confirm the location of the geophysical anomalies with hand dug pits within 0.5m to expose buried features to confirm the nature of the geophysical anomalies.
(4) Although every reasonable effort has been made to locate the buried obstructions using ground penetrating radar techniques, RSK Environment Ltd cannot guarantee that every obstruction has been located.
KEY
EXTENT OF GPR SURVEY
BUILDING
FENCE
VEGETATION / FOLIAGE
HEADSTONE (Note: not shown for the modern graves in the eastern churchyard)
GPR DETECTED DISCRETE ANOMALY INDICATIVE OF MODERN BURIAL (Reflection from containment feature or grave shaft likely)
DISTURBED GROUND INDICATIVE OF CHANGE IN GROUND CONDITIONS. (Possible re-interred or mass burial) See report for reference.
GPR DETECTED DISTURBED GROUND (Likely due to trench work around church)
GPR DETECTED REBAR (foundations in church)
GPR DETECTED BURIED SERVICE (Metallic)
GPR DETECTED BURIED SERVICE (Surface Water)
BURIED SERVICE (Electric)
GPR DETECTED BURIED SERVICE (unknown type)
LOCATION OF AN EXAMPLE GPR RADARGRAM (See Figures 4 to 7)
Rev. Date Amendment Drawn Chkd App.
RSK
Client: MERCIAN ARCHAEOLOGICAL SERVICES
Project Title: ST MARYS CHURCH, CUCKNEY
Drawing Title: INTERPRETED RESULTS OF THE GEOPHYSICAL SURVEY
Drawn MJS 27/11/15 Checked TG 27/11/15 Approved TG 27/11/15
Scale 1:100 Drg Size A0 Dimensions
Project No. 264920 Drawing No. 264900 Figure 8
Drawing No. 264920-Figure 8 Sheet 1 of 1 Rev.
Scale 0 2 4 6 8 10m


N
NORTH
INDICATIVE
LOCATION . PLAN
Castle Hill
Worksop Road A60
NOTES
KEY
EXTENT OF GPR SURVEY
BUILDING
FENCE
VEGETATION / FOLIAGE
HEADSTONE (Note: not shown for the modern graves in the eastern churchyard)
GPR DETECTED DISCRETE ANOMALY INDICATIVE OF MODERN BURIAL (Reflection from containment feature or grave shaft likely)
DISTURBED GROUND INDICATIVE OF CHANGE IN GROUND CONDITIONS. (Possible re-interred or mass burial) See report for reference.
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GPR DETECTED REBAR (foundations in church)
GPR DETECTED BURIED SERVICE (Metallic)
GPR DETECTED BURIED SERVICE (Surface Water)
BURIED SERVICE (Electric)
GPR DETECTED BURIED SERVICE (unknown type)
LOCATION OF AN EXAMPLE GPR RADARGRAM (See Figures 4 to 7)
RSK
MERCIAN ARCHAEOLOGICAL SERVICES
ST MARYS CHURCH, CUCKNEY
INTERPRETED RESULTS OF THE GEOPHYSICAL SURVEY
1:100
294920
294920-Figure 8 Sheet 2 of 2
Scale
0 2 4 6 8 10m

Appendix A

GPR Equipment Specification Sheet

GSSI DUAL FREQUENCY RADAR

1 Touch-screen control unit
2 Interior, dual-frequency antenna
3 Adjustable, protective capsule
4 Ergonomic handle and flexible mount
5 Rugged, removable wheels
6 Internal, integrated survey wheel encoder

The UtilityScan DF is ideal for locating the position and depth of metallic and non-metallic objects, including service utilities such as gas, communications, sewer lines as well as underground storage tanks and PVC pipes in various soils. The UtilityScan DF is purpose-built and offers an easy-to-use touchscreen interface to view shallow and deep targets simultaneously in a single scan.

The new dual-frequency 300 MHz and 800 MHz antenna is GSSI's first digital antenna, allowing the operator to locate targets at depths of up to 4 m.

With an operation life of up to eight hours and survey speed up to 3 mph, data collection is fast and efficient. Advanced software features offer the user several options to view the data; each channel individually, both channels separated via split screen, or the Blend mode.

The UtilityScan DF also provides advanced signal processing tools such as stacking, signal floor tracking and background removal.

Model 655 Specifications

- 4-wheel compact survey cart
- Internal, integrated survey wheel encoder
- Removable, 12-inch wheels
- Compact, weather resistant design
- Antenna centerline to front of cart: 38.2 cm
- Dimensions: 24.3 x 39.4 x 40.3 in
- (61.7 x 100 x 102.4 cm)
- Total System Weight: 66 lbs (29 kg)
- Batteries Li-Ion battery pack (10.8 V typical 9300 mAh)
- Number of Hardware Channels 2 (two)
- Frequencies 300 and 800 MHz
- Typical Range 4 m
- Operating Temperature -10°C to 50°C

GSSI DF RADAR SYSTEM

RSK

Appendix VIII: Mercia and the Anglo-Saxon Kingdoms

Mercia and the Anglo-Saxon Kingdoms

Sean Crossley

Mercian Archaeological Services CIC.

Anglo-Saxon Kingdoms

The Anglo-Saxon peoples belonged to the Germanic-speaking groups. These people migrated during the fifth and sixth centuries from the continent, what is today northern Germany, settling in the southern and eastern parts of the British mainland. Anglo-Saxon England was a product of the migration of Saxons, Frisians, Angles and Jutes.

However as Higham and Ryan (2013. p7) comment that the term "'Anglo-Saxon' is, however, a modern label and one that would not have been easily understood, if understood at all, by many of those to whom it is now applied." Though Higham and Ryan (2013) go on to say that the peoples we now label Anglo-Saxon would have seen themselves, and have been seen by other cultural groups, as "a distinct and identifiable group".

This period of history has always been bound up with the concept of national identity and greater importance has been given to the differences between peoples than to their similarities. The traditional view of the Anglo-Saxons has been one of an invading army descending upon the natives, displacing the Romano-Britons of eastern and southern Britain, so that the English became a distinct people from the Welsh and the Scots (Hills 2009). Archaeologists are challenging this view now.

During the second half of the first millennium AD, following the Roman Empire's withdrawal from the province of Britannia, England, Scotland and Wales began to take form. Further the removal of Roman authority and the military in the early fifth century, the province fell apart into numerous small warring groups. These groups were led by chiefs (and kings) of both indigenous and invader ancestry. By the seventh century the larger kingdoms had emerged, these formed the

basis for the medieval kingdoms of Britain (Hills 2009). The main Anglo-Saxon kingdoms were Northumbria, Mercia, East Anglia, Essex, Kent, Sussex and Wessex.

"The tribal name Mierce, from which a convenient territorial name 'Mercia' has been derived, means 'boundary folk'. In the seventh century the Mercians appear as a people of 12000 households, occupying the whole country from the lower Trent to the forests of the western midlands." (Stenton 1971 p40).

Mercia was the central kingdom. "At its largest extent Mercia stretched from East Anglia westward to Wales, from the Thames northward to the Humber. In other words it was the heartland of Anglo-Saxon England." (Hindley, 2006, p19)

Christianity

The most important cultural change, which would have long term ramifications, for the people of Britain was the adoption of Christianity during the early 600s AD. During the early decades of the seventh century many of the chiefs and kings converted to Christianity. Despite rulers both native and invader by origin converting to Christianity, a shared faith did not stop warfare during the early Anglo-Saxon period. Later on the church was to help provide "the basis of a structure of organisation, with bishops and metropolitan bishops, which overreached the frontiers of the individual, highly competitive English kingdoms." Webster and Backhouse (1991 p15).

Not only did the conversion to the Christian religion lead to the introduction of literacy and the written record, it also lead to the acceptance of Latin as the universal means for the dissemination of knowledge and learning. This acceptance of the Latin language had a long-term impact because, fundamentally, it involved the rulers accepting the authority of the church. Anglo-Saxon kings began to accept that the Church's boundaries extended well beyond those of the kingdom. It was also an acceptance of "the servants of the church as a source of local authority". (Webster and Backhouse (1991 p15). Though the above go on to comment that the conversion of the pagan Anglo-Saxons was to arise multiple sources and perhaps the least important of these was the contribution of neighbouring Christian British territories converting. "Archaeological evidence for Christianity takes various forms, and the conversion was not a uniform process, and it was driven by politics as often by faith". (Hills 2009, p233)

The acceptance and conversion to the Christian faith was very much tied to the establishment of larger units of political power, essentially Anglo-Saxon kings thought Christianity a means to extend their influence and hegemonies. “Three of the successive kings credited with authority over other kingdoms, Æthelberht of Kent, Rædwald of East Anglia and Edwin of Northumbria, passed on the new faith, one to the next, almost as though it were the talisman for effective rule.” Webster and Backhouse (1991 p15).

At this time to complicate matters there were two forms of Christianity practiced in the Anglo-Saxon kingdoms. British Christianity which followed Irish customs originating from Iona and Lindisfarne, and the Roman form (Catholicism) (Zaluckyj 2013).

Events leading to Battle of Hatfield

Æthelfrith, the pagan king of Bernicia, emerged as the first ruler of the kingdom of Northumbria in about 592 AD when he united the two northern kingdoms of Bernicia and Denira (forcing Edwin his brother-in-law into exile).

Edwin, son of king Ælle, was the heir of the Deiran kingdom. He was forced to seek refuge with Rædwald, the king of the east angles. Æthelfrith demanded of Rædwald that he should kill Edwin or at least surrender Edwin to him. Rædwald apparently refused having been persuaded by his wife that betraying Edwin, his guest, was not an honourable manner in which to behave. Ultimately Rædwald was to assist Edwin in getting back his own kingdom.

At this time Rædwald had “recently become supreme in England south of the Humber”. War followed with Æthelfrith, in the summer or early autumn of 616. The battle took place on the southern border of Deira, close to where the river Idle is crossed by the roman road from Lincoln to Doncaster. This was to be the first recorded battle between the King of Northumbria and an “over-lord of the southern English confederation” that being Rædwald. Æthelfrith was defeated and killed, and his sons fled into exile. Victory meant Edwin was accepted as king in Bernicia as well as Deira; later Edwin succeeded Rædwald as “overlord of all the English peoples south of the Humber.” (Stenton 78-79)

Edwin became the overlord of the realm of England, with the exception of Kent, which made Edwin the most powerful ruler in the region; it was Edwin’s leadership and diplomacy that was to “set the map” that would eventually

become England. Though it would not be a Mercian king but a Wessex one which was to rule.

Edwin was a pagan but he married a Christian princess from Kent. When his princess left Canterbury for York she travelled with Paulinus who was the first missionary of Rome to northern England. Paulinus was to convert Edwin in 627 AD - or at least he baptized him. (Lee 2012)

Unfortunately for Edwin other Anglo-Saxon kingdoms did not appreciate this alliance between Northumbria and Kent. Edwin's new alliance was a destabilizing factor in the violent world of tribal and national politics resulting in Penda, the heathen king of Mercia, conniving an alliance with Cadwallon of north Wales (himself a declared British Christian). The reason: to unseat Edwin and the increasingly powerful kingdom of Northumbria. Penda and Cadwallon may have had little in religious common interest with one another, but they agreed over Edwin. Lee (2012)

The Battle of Hatfield

"On 10 October 633 catastrophe struck. King Edwin was killed at the battle of Hatfield Chase by the combined forces of Penda, the pagan ruler of Mercia, and Cadwallon, the British/Welsh Christian, king of Gwynedd". Hindley (2006 p67)

Zaluckyl (2013) comments that if the 'tradition' is true and that Edwin had once been fostered by Cadwallon's father (Cadfan) then it would explain Cadwallon's personal hatred of Edwin. This hatred would have been further compounded by Cadwallon having been besieged off Anglesey and forced into exile in Ireland, probably at Edwin's instigation. The Welsh referred to Edwin as 'the deceitful'. Further there is a suggestion that the sense of betrayal felt by the Welsh could have been a caused by Edwin having a change in attitude towards this welsh kingdom following conversion to the Roman form (not British) of Christianity.

Zaluckyl (2013) also highlights other reasons for Edwin having powerful enemies; Penda determined to increase his political power either through invasion and the acquisition of more territory and/or tribute, the kingdom of Northumbria was one such opportunity. Further to above Æthelfrith installed Penda's dynasty after Cearl's (first king of Mercia) demise and it probably would not help Edwin (Æthelfrith's arch rival) being related to Cearl's family. Penda may well have wanted to remove such a bloodline. "Thus personal revenge mixed with desire

for land and booty provided the reasons for conflict with Northumbria." Zaluckyl (2013, p28)

The aftermath for Mercia

After 632/3 Penda was the central figure in English history for a generation. Penda was the enemy of every Northumbrian king who tried to bring the peoples of southern England under his lordship; ultimately he was to die in battle in 654. Mercia was fortunate to have many strong warrior kings.

"The outstanding fact in the history of the Mercian kingdom is the unique eminence of the family to which Penda and at least eight of his successors belonged." Stenton (1971. p 39)

Æthelbald, king of Mercia called himself 'rex Britanniae' from 716 AD, which was the Latin for the Saxon English title, bretwalda, ruler of Britain. The Anglo-Saxon chronicle informs us Æthelbald was fighting, and winning, as far south as Somerset. King Æthelbald controlled a large area of the kingdom of Wessex also. One indication of that control was that he could buy and sell land as he wished. He was the strongest figure in southern Britain. (Lee 2012)

Offa, king of the Mercians (750? -796), was to become one of the most famous names of this period and a contemporary of Charlemagne (741-814). Offa saw himself as the 'defender of the faith' and had his son anointed as king of Mercia and consecrated. Probably the first time that an English king had been consecrated. This was therefore the moment that marked a 'religious dimension' to the English throne (Lee 2012). Offa is most renowned for his earthwork: Offa's Dyke. His battles against the Welsh resulted in the need to construct an obvious 'border' which was recognizable to both the Welsh and the Mercians (English). Perhaps more impressive is the fact that pope Adrian I described Offa as king of the 'English' and by this Adrian did not mean England as a land mass or state, but king of the 'people'. King Offa negotiated treaties on equal terms with Charlemagne who went on to become Holy Roman Emperor. (Lee 2012)

"By the eight century, it seemed that the midlands kingdom of Mercia, under king Offa, would form the core of a consolidated England, but Mercia fell victim to the

ninth-century Viking invasions, and it was instead the kings of Wessex, Alfred and his descendants, who first created a strong West Saxon kingdom south of the Thames and then, during the tenth century, conquered the rest of England to create the late Anglo-Saxon kingdom which was then in turn conquered by William of Normandy in 1066." (Hills 2009, p 219)

(See main bibliography for full references).

Appendix IX: Historic Mapping

Historic map regression for the site has been undertaken with all maps dating back to Sanderson's 1835 map of 20 miles around Mansfield being examined for the site. Historic maps of the surrounding parish dating back to the 17th century have also been consulted.

The first edition 6-inch ordnance survey map published in 1884 is included below. The map clearly shows 'Castle Hill' to the west of the churchyard. The ditch or 'moat encircles the 'Castle Hill' and churchyard to the north west and south, as recorded in the survey. The depiction on the west and south sides show the churchyard wall and a ditch on the opposing outer side, representing a Ha Ha as recorded in the topographic survey. The Ordnance Survey records the 'moat' extending across the north side of the churchyard. The topographic survey did not record this area as a ditch, but as a steep slope from the higher ground of the churchyard on the south to the lower ground in the north. The earthworks recorded to the north of the churchyard as part of the castle in the Historic England Scheduling are not recorded as part of the castle in 1884 by Ordnance Survey. Neither is the continuation of the moat on the southern side of the church mentioned in the Scheduling as likely as being present. A property was in fact shown in line with the Ha Ha to the east; where the ditch is supposed to have continued. Photographic records show this property into the 1950s and personal communications with villagers suggests the property stood until the 1960s.

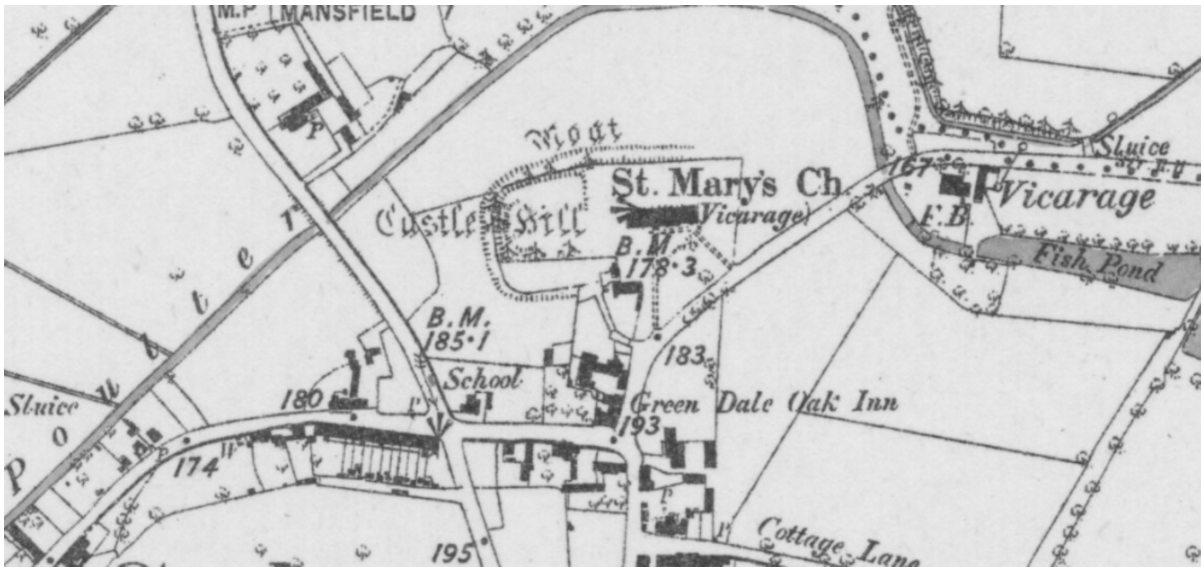

Figure 1: Cuckney 'Castle Hill' depicted on the First Edition Ordnance Survey 6 inch to 1 mile map, published in 1884. Nottingham, sheet 18, North west.