

Report on the Geophysical Survey at Bodiam Castle, East Sussex, August 2012

On behalf of

Compiled by

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Report on the Geophysical Survey at Bodiam Castle, East Sussex, August 2012

Summary

This report presents the results of the geophysical survey undertaken at Bodiam Castle, in the county of East Sussex between Hawkhurst and Hastings. It specifies the survey methodology together with an interpretation and discussion of the survey results. The survey was carried out within and around the extant remains of the castle, and across the floodplain of the river Rother. The results indicate the remains of structures associated with the medieval castle, and the Iron Age and Roman settlement of the area, including the tenement boundaries of the medieval village, and associated features relating to the building of the castle, also features linked to iron smelting and industrial activity in the area from the Roman period onwards. The possible line of a Roman road was located, and the presence of features relating to a Romano-British settlement close to the river floodplain.

1. Introduction

Between the 14th – 25th March 2011 and 4th – 23rd August 2012 a geophysical and topographical survey was conducted at Bodiam Castle, East Sussex. In 2011 the survey was undertaken by 2nd and 3rd year undergraduate students and staff from the University of Southampton. The 2012 season work was carried out by undergraduate and postgraduate students and staff from the University of Southampton and North West University from Chicago in the USA. The survey in 2011 was conducted as part of the student tuition for the undergraduate courses in Field Survey and Archaeological Geophysics to provide a dataset for the final student assessment, and in 2012 formed part of the compulsory field component for undergraduate students from both institutions. In addition the survey was conducted to investigate the nature and extent of buried archaeological material at the site, and to provide the National Trust with a new plan of the archaeological features located during the survey.

1.1 Location and Background

Bodiam Castle is located on the south-facing slope of the north side of

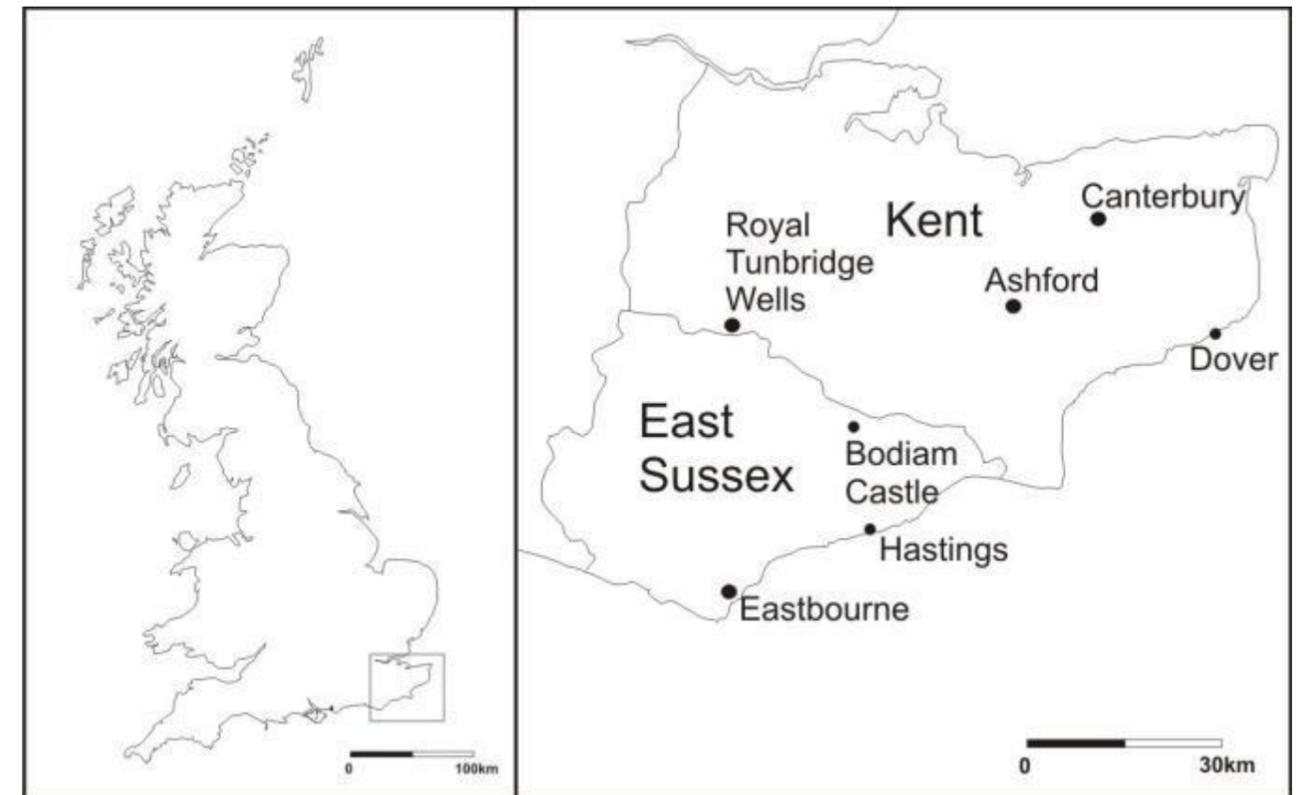


Figure 1 Location of East Sussex and Bodiam Castle

the River Rother, in the parish of Bodiam, East Sussex (Fig. 1). The castle occupies a spur of land which projects into the Rother valley, with associated features located along a higher ridge to the north. The underlying geology comprises Ashdown beds of Cretaceous sandstone to the north, corresponding to the higher ground of the National Trust property (Fig. 2), and alluvial deposits with peat corresponding to the Rother valley bottom and the southern portion of the National Trust property (Johnson

et al. 2001). The soils of the area consist of Curtisden Association greyish brown silt loam or silty clay loams on the valley sides, with Fladbury 3 Association clayey silts and silty loams on the valley bottom (Jarvis et al. 1984; Johnson et al. 2001, 2).

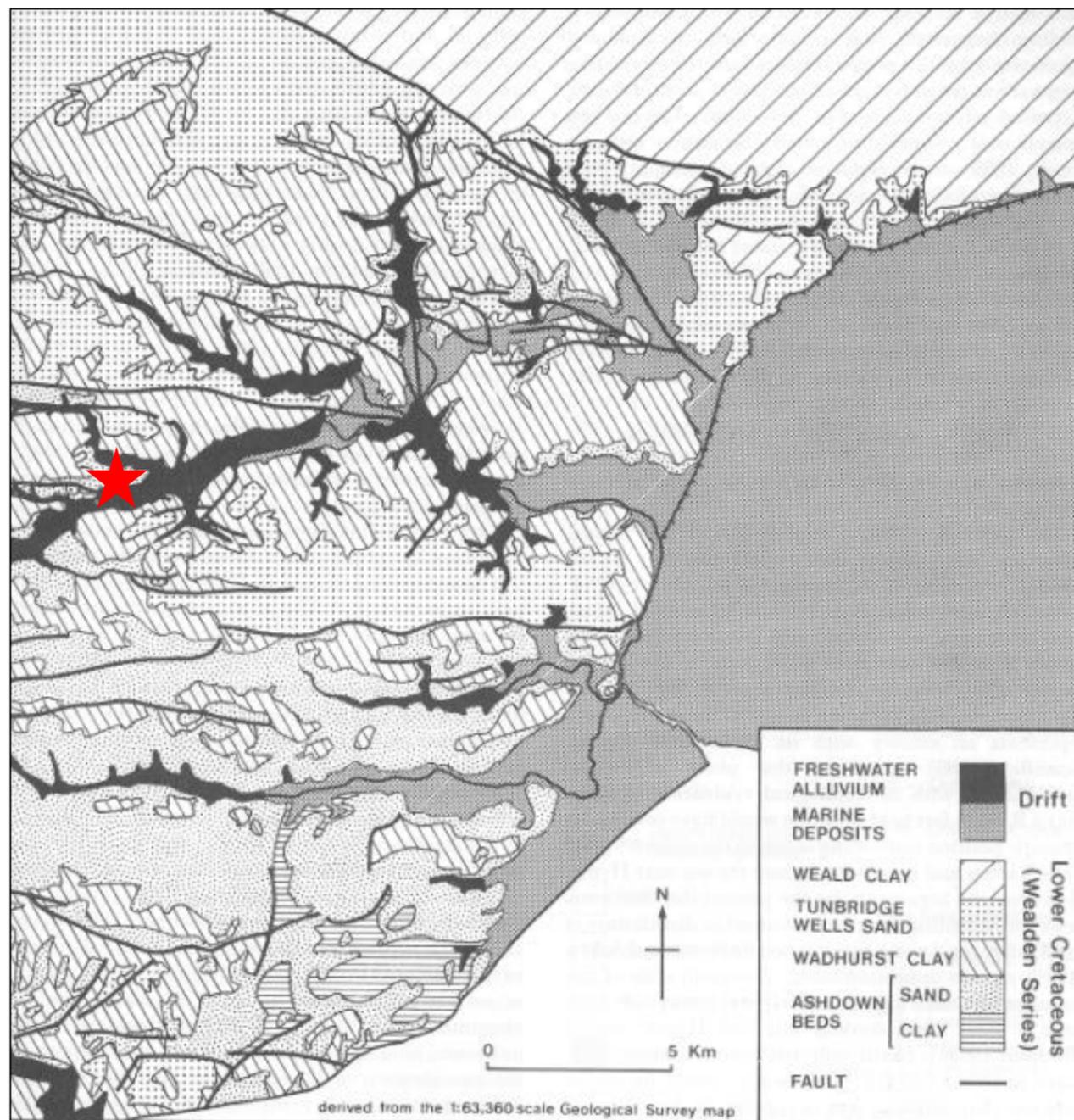


Figure 2 The geology of the area East Sussex and Kent with the location of Bodiam Castle indicated

Bodiam castle is situated in an area of high archaeological potential corresponding to the High Weald, with a wealth of archaeological

material from the Palaeolithic through to Roman, medieval and post-medieval periods (Johnson et al. 2001). While the main focus of the

current project is concerned with the medieval and post-medieval aspects of the landscape around Bodiam castle (Fig. 3), a number of other sites and monuments dating to various periods are reflected in the landscape and the results of the topographic and geophysical surveys that have been conducted to date.

In prehistory the landscape of the Rother valley around Bodiam consisted of mixed deciduous woodland. Land close to the Rother was populated in the Neolithic and Bronze Age. The location of the site on an interface between river sediments to the west, and complex peri-marine sediments downstream to the east is of interest, and while the relationship between the two forms of sediment are not fully understood, the peat deposits and Radiocarbon dating of the sediments along this section of the Rother indicate the build-up of peat in the Bronze Age linked to the presence of a Carr with associated flora and fauna. The presence of these deposits and the wetland landscape along the Rother corresponds to finds of material dating from the Mesolithic through to the Bronze Age (Johnson et al. 2001, 26).

Evidence for settlement in the immediate vicinity of Bodiam Castle is represented from the late Iron Age onwards. A cinerary urn was recovered from the area at Bodiam Rectory, indicating the possible presence of settlement and mortuary activity from the 1st century BC. A Romano-British settlement is located to the south-west of the Castle on the south bank of the Rother, associated with a possible port on the river. A Roman road is also supposed to have run across the Rother at this point on the route from Rochester to Hastings (Johnson et al. 2001, 27). The line of the road is reported to have run across the valley within the curtilage of the National Trust property at Bodiam, joining the line of the modern road to Hastings. Furthermore there is speculation that the course of the Rother was located further to the south of the present day channel, which would potentially have implications for the nature and full extent of any Romano-British settlement on the valley floor and the first river terrace to the south of the Rother.

The presence of a hall is recorded for Bodiam in the Domesday Book, but no physical evidence of Saxon settlement has been noted (Johnson et



Figure 3 Satellite photograph of Bodiam Castle and its immediate surroundings

al. 2001, 29). The parish of Bodiam was probably formed in the 12th century to encompass the territory held by the de Bodiam family (Rushton 1999). In the 13th century the manor was acquired by the Sywell family, and in 1264 William de Sywell was named lord of Bodiam. In 1304 the lands reverted to

Henry Wardedieu, passing to his sons Richard and Thomas. The property of this period may be identified with the moated site to the north of Court Lodge (Johnson et al. 2001, 30). The manor of Bodiam was carried to Sir Edward Dallingridge through his marriage to Elizabeth Wardedieu in 1363, and was in

possession of the property by 1378. In 1383 Dallingridge obtained a grant for a market and fair, in 1385 a licence to crenellate and in 1386 a licence to divert the course of the Rother to power a watermill (Johnson et al. 2001). These items in general mark a period of work on the manor of Bodiam, including the building of the current castle. The manor remained in the hands of the family until 1470 when the estate was inherited by Sir Roger Lewknor. The estate was held, apart from a short period of forfeiture, by the Lewknors until 1543 when, with the death of Sir Roger Lewknor the estate was held in three separate shares by his descendants.

More recently the estate was purchased by Curzon in the late 19th century, and a number of works were undertaken, including the draining of the castle moat, and the attempted creation of a cricket ground to the south of the castle.

1.2 Aims of the Survey

The geophysical survey was initiated with the aim of locating and mapping the remains of sub-surface archaeological deposits in the vicinity of Bodiam Castle, and on land surrounding the medieval and later palace. It was hoped that a number of structures at the site may be discovered, possibly relating to the earliest phases of the palace's development, and to the Roman deposits located through excavation in different parts of the site. The 2010 survey, and the results presented here, comprises an initial season of work, and a document of preliminary interpretations, designed as a working document for debate prior to the commencement of the second season of work in 2011.

An omission from much of the discussion about Bodiam Castle has been the interior of the castle. Scholars have concentrated on the landscape setting of the castle, and the impression conveyed by its external facades. Therefore a detailed building survey of the castle was one of the principal aims of the fieldwork. The building survey facilitated the creation of a comprehensive set of plans of the castle to provoke

discussion on an interesting and complex domestic building. In addition, data were collected for significant elevations. Sufficient data were also collected to facilitate 3D reconstructions of certain areas.

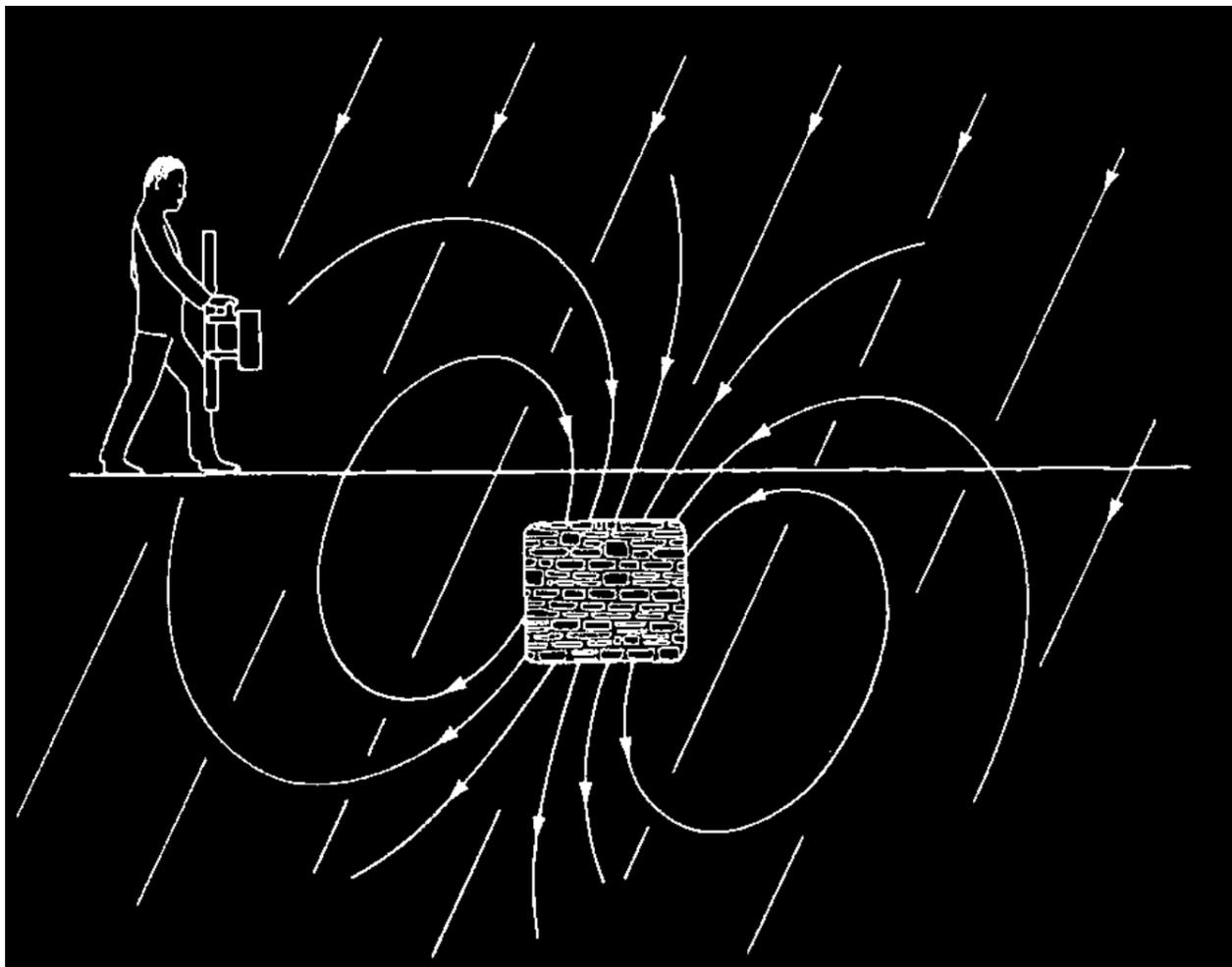


Figure 4 Diagram illustrating the effect of the earth's magnetic field and the local magnetic field generated by buried material, measured during magnetometer survey (after Clark 1996)

2. Survey Methodology

2.1 Techniques of Geophysical Survey: Magnetometry, Resistivity, Ground Penetrating Radar and Electrical Resistivity Tomography (ERT)

Although a number of different geophysical survey techniques could have been applied at Bodiam Castle, the geology of the area and the

presence of masonry structures suggested that use of resistivity would be successful in recording the remains of sub-surface archaeological structures (Barker et al. 2005; David 1996, 9; Strutt et al. 2004).

Magnetometer survey was also conducted to provide comparative survey data across the site. This technique was chosen as a relatively time-saving and efficient survey

technique (Gaffney et al. 1991, 6), suitable for detecting burials, pits, kilns, hearths, ovens and ditches, although in areas of modern disturbance the technique is limited by ferrous material. (Geoscan Research 1996a; Patella 1991; Scollar et al. 1990, 362ff).

Magnetic prospection of soils is based on the measurement of differences in magnitudes of the earth's magnetic field at points over a specific area (Fig. 4). The iron content of a soil provides the basis for its magnetic properties, with the presence of minerals such as magnetite, maghaemite and haematite iron oxides all affecting the magnetic properties of soils. Although variations in the earth's magnetic field which are associated with archaeological features are weak, especially considering the overall strength of the magnetic field of around 48 Teslas (48,000,000,000 nanoTesla, or nT). It follows that these instruments are very sensitive indeed. Three basic types of magnetometer are available to the archaeologist; proton magnetometers, fluxgate gradiometers, and alkali vapour magnetometers (also known as caesium magnetometers, or optically pumped magnetometers).

Fluxgate instruments are based around a highly permeable nickel iron alloy core, which is magnetised by the earth's magnetic field, together with an alternating field applied via a primary winding. Due to the fluxgate's directional method of functioning, a single fluxgate cannot be utilised on its own, as it cannot be held at a constant angle to the earth's magnetic field. Gradiometers therefore have two fluxgates positioned vertically to one another on a rigid staff. This reduces the effects of instrument orientation on readings. Fluxgate gradiometers are sensitive to 0.5nT or below depending on the instrument. However, they can rarely detect features which are located deeper than 1m below the surface of the ground.

Archaeological features such as brick walls, hearths, kilns and disturbed building material will be represented in the results, as well as more ephemeral changes in soil, allowing location of foundation trenches, pits and ditches. Results are however extremely dependent on the geology of the particular area, and whether the archaeological remains are derived from the same materials. Around 1.5 hectares can be surveyed each day.

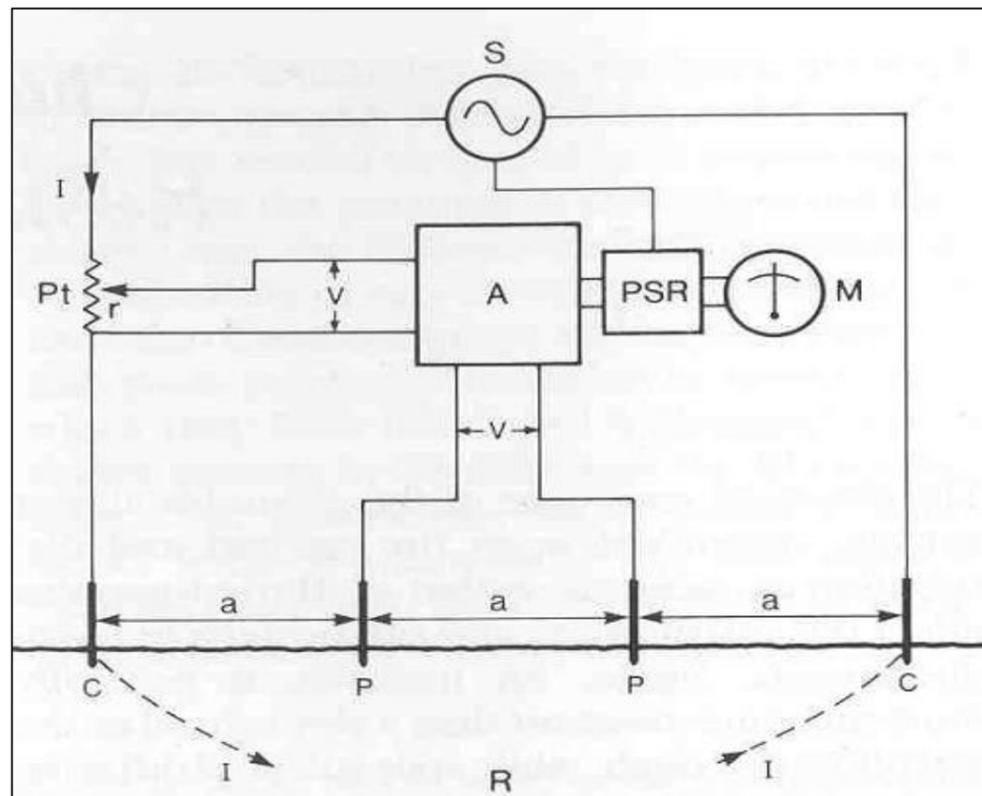


Figure 5 Diagram showing the basic four probe circuit for a resistance meter (after Clark 1996)

resistance to an electrical current (Clark 1996, 27).

The technique is based on the passing of an electrical current from probes into the earth to measure variations in resistance over a survey area. Resistance is measured in ohms (Ω), whereas resistivity, the

resistance in a given volume of earth, is measured in ohm-metres (Ωm).

Four probes are generally utilised for electrical profiling (Gaffney et al. 1991, 2), two current and two potential probes. Survey can be undertaken using a number of different probe arrays; twin probe, Wenner, Double-Dipole, Schlumberger and Square arrays.

A twin probe array resistance survey was also carried out at the site. Resistivity survey is based on the ability of sub-surface materials to conduct an electrical current passed through them (Fig. 5). All materials will allow the passing of an electrical current through them to a greater or lesser extent. There are extreme cases of conductive and non-conductive material (Scollar et al 1990, 307), but differences in the structural and chemical make-up of soils mean that there are varying degrees of

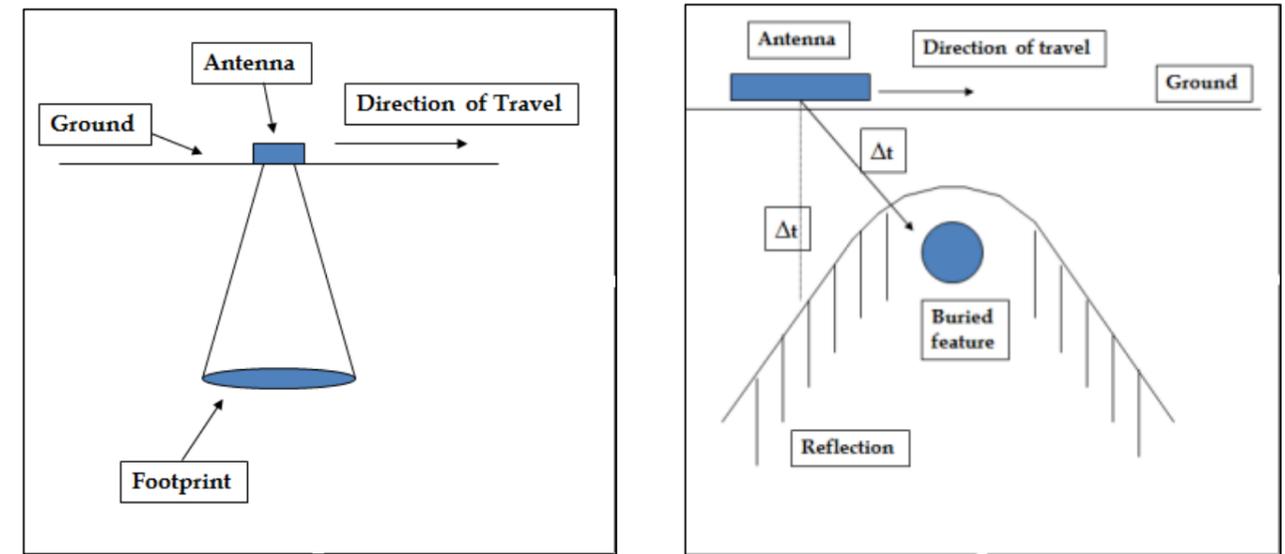


Figure 6 Diagram showing the application of a GPR antenna and the radar wave propagating through the ground, and the reflection caused by a circular or oval body located below the surface of the ground as the GPR antenna passes over

In addition Ground Penetrating Radar (GPR) was conducted over parts of the site, particularly the interiors of rooms associated with the extant remains of the palace. GPR survey is based on the use of an electromagnetic radar wave propagated through the soil to search for changes in soil composition and the presence of structures, measuring the time in nanoseconds (ns) taken for the radar wave to be sent and the reflected wave to return (Fig. 6). The propagation of the signal is dependent on the Relative Dielectric Permittivity (RDP) of the buried material (Conyers and Goodman 1997). It was thought that this method would provide a useful complementary technique to the resistivity survey, and would ensure

as much of the remains of masonry structures could be located as possible.

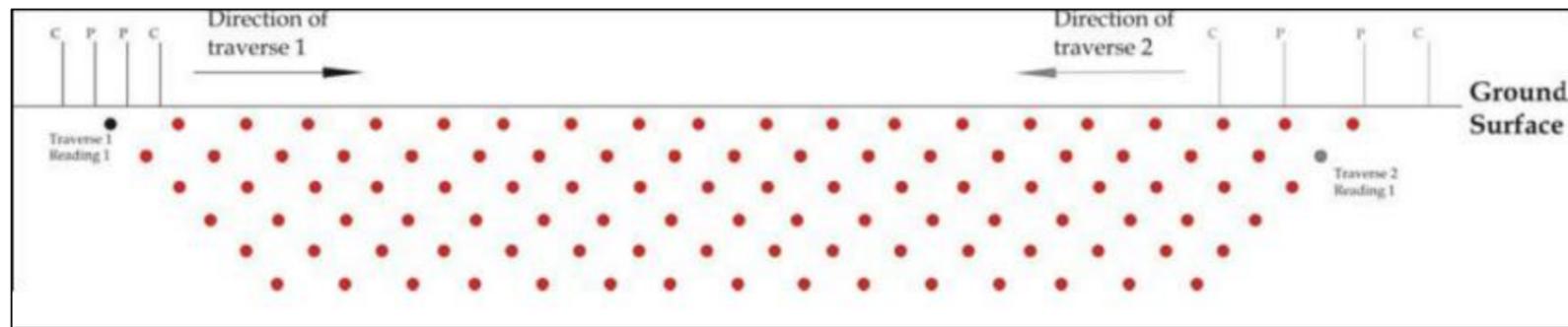


Figure 7 Diagram showing the application of ERT survey to build up a profile of resistivity readings

An Electrical Resistivity Tomography (ERT) survey was also conducted. ERT relies on the passing of an electrical current through the earth, and the measuring of the resistance to the current at intervals to build up a profile of the changing material below the surface of the ground (Fig. 7), and enables the archaeologist to detect localised anomalies and features.

Finally magnetic susceptibility survey was also carried out, principally to train the students in the use of the technique, but also to provide comparative data to complement the resistivity and magnetometry.



Figure 8 Total station survey being carried out to the south-east of Bodiam Castle. (photo: K. Strutt)

2.2 Survey Strategy

For the geophysical survey, grids of 30m by 30m were set out across the entire survey area. In the 2010 and 2011 seasons the gridding was almost all done using a Leica TC 307 total station (Fig. 8). However in the 2011 and 2012 seasons differential GPS was used, configured for use either with a base station (Fig. 9) or using Smartnet, which relies on mobile phone masts to gain a fixed location. The grid was located on a north - south axis, using a local or arbitrary coordinate system. In the 2012 season Doke's Field was gridded out using the local system, however all other

survey areas were gridded out using the Ordnance Survey coordinate system for location and alignment. In addition to the gridding out these instruments were used to record all extant archaeological remains, and an elevation model of the site based on measurements taken at 5m intervals across the site (Fig. 10).

A total of six weeks' intensive survey of the interior of the castle was



Figure 9 The differential GPS base station located along the dyke of the River Rother, with the East Sussex and Kent steam locomotive in the distance. (photo: K. Strutt)

conducted by Catriona Cooper and Penny Copeland, as well as James Miles, of the University of Southampton, under the direction of Matthew Johnson, latterly of Northwestern University. The work was spread over the 2010 - 2012 seasons, at the end of which the building had been viewed in different lights, at different times of the day and in both spring and late summer. During this time, a number of different experts on medieval buildings visited and offered their views on our provisional interpretations. At the end of the process Cooper and Copeland had developed a close eye for original medieval fabric versus post-medieval restoration.

The equipment used was a Leica reflectorless total station (Fig. 15). TheoLt, a programme to download the data straight into AutoCad, was used, so that the work could be visualised instantly on screen as the work progressed. Two teams of 3-4 students and staff worked simultaneously. The drawings were then manipulated to produce the 2D plans and elevations reproduced here; the final versions were then edited in CorelDraw. The AutoCad

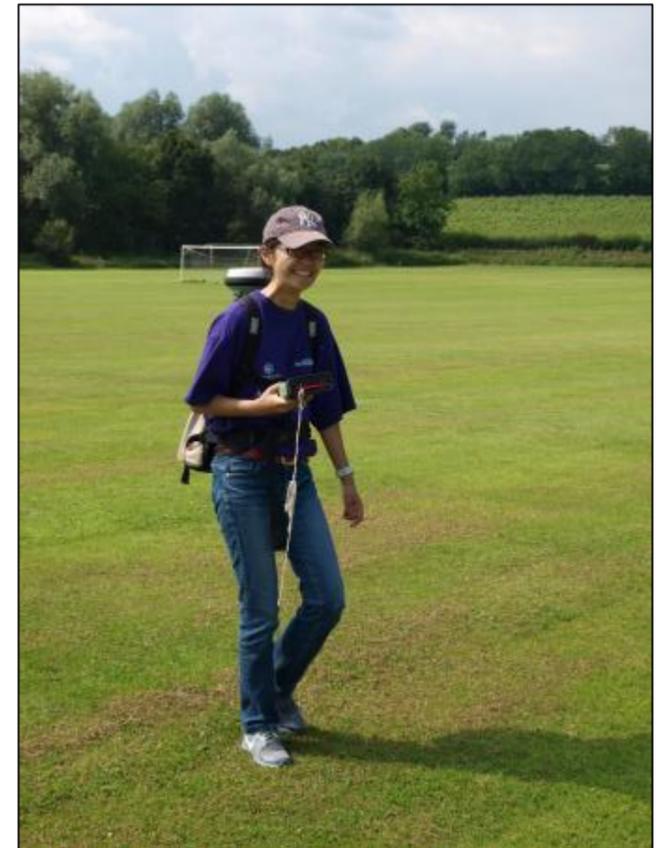


Figure 10 Topographic survey being conducted in the parish sports field using the dGPS rover. (photo: K. Strutt)

data was also used by Cooper to create visualisations in 3DSMax.

It was not possible to gain access to all areas due to health and safety considerations (for example in the upper parts of the eastern tower). The restrictions on space in many of the small corridors and toilets made it impossible to carry the total station survey through to these areas and in these instances, measured survey was carried out on paper where time allowed. The assistance and

cooperation of the National Trust Staff has been invaluable during the survey.

The magnetometer survey was carried out using a Bartington Instruments 601-2 dual sensor fluxgate gradiometer (Fig. 11). Readings were taken at 0.25m intervals along 0.5m traverses.

Resistivity was carried out using a Geoscan Research RM15 resistance meter, with measurements taken at 0.5m intervals along traverses spaced 0.5m apart (Fig. 12).

The magnetometer and resistivity survey data were imported into and processed using Geoplot 3.0 software. The processing of data was necessary to remove any effects produced by changes in the earth's magnetic field during the course of survey, and to minimise any interference in the data from surface scatters of modern ferrous material and ceramics. Data were despiked to remove any large peaks or 'spikes' from the data produced by material on the surface of the field. A mean traverse function was then applied to average out any changes in the data produced by the 'drift' in the earth's magnetic field. Filters were subsequently applied to

smooth out any high frequency, small disturbances in the data. Finally 0.5m values were interpolated from the existing readings to improve the spatial resolution of the results across the traverse lines.

The GPR survey was conducted in 2010 and 2011 using a Sensors and Software instrument with Smart Cart. A 500 Mhz antenna was used, with traverses recorded at 0.5m intervals in one direction (Fig. 13). The survey in 2012 was conducted with a GSSI 200 Mhz antenna, with traverses again at 0.5m intervals, but with survey focused solely in the parish sports field to the west of the Castle Inn (Fig. 14).



Figure 11 Magnetometer survey being conducted in the parish sports field using Bartington Instruments Grad 601 fluxgate gradiometers. (photo: K. Strutt)

The GPR data were processed in GPR slice. All profiles were processed to remove background noise, and a regain function was applied to strengthen the deeper responses to the radar signal. All data were then sliced and resampled to produce a series of timeslices through the site.



Figure 12 Resistivity survey being conducted using a Geoscan Research RM 15 resistance meter. (photo: K. Strutt)

The magnetic susceptibility survey was conducted using a Bartington Instruments MS-2 magnetic susceptibility meter. All data were recorded in the field using notebook, and were then entered into a spreadsheet on



Figure 13 GPR survey being undertaken to the west of Bodiam Castle using a Sensors and Software Noggin Plus 500 Mhz antenna and cart. (photo: K. Strutt)

completion of the fieldwork.

For the ERT an Allied Associates Tigre 64-probe resistivity system was used to take readings. Measurements were taken using an expanding Wenner array (Figure 18), with readings taken with the probes at differing intervals for each profile according to the length and depth

required to answer the questions being asked.

A reading is taken at the centre of four probes chosen by the computer programme starting with probes 1, 2, 3 and 4 the reading is take at the centre of the probes.



Figure 14 GPR survey being conducted using a GSSI 200 Mhz antenna with SIR 3000 console. (photo: K. Strutt)



Figure 15 Building survey being carried out in the castle using a Leica TC805 total station with TheoLT software. (photo: K. Strutt)



Figure 16 Geophysical survey under way in Dokes' Field. (photo: K. Strutt)



Figure 17 James Miles conducting resistivity survey. (photo: K. Strutt)

The depth at which measurements are taken corresponds approximately to half the distance between the individual probes, for example in P4 the probes were set at 3m spacing so that readings were taken every 3m horizontally and every 1.5m vertically below the ground ie at 1.5m, 3.0m, 4.5m, 6.0m ... for 13 levels down to 19.5m. P6, which crosses the line of the dewatering trench, was set at 1m spacing for a higher resolution and thus readings were taken every 1m horizontally and every 0.5m vertically. At this resolution it is not possible to take readings as deep as when the probes are spaced further apart. The data was processed and inverted using the Res 2D Inv software program.

The data from each survey were exported as a series of bitmaps, and were imported into and georeferenced in a GIS, relating directly to other salient spatial information such as AutoCAD maps of the site and relevant air photographic imagery. An interpretation layer of archaeological and modern features was digitized deriving the nature of different anomalies in the survey data from their form, extent, size and other appropriate information.



Figure 18 ERT survey being conducted in the Rother valley. (photo: K. Strutt)

As no direct chronological information can be derived from the geophysical survey data, much of this had to be inferred from the morphology of anomalies, and the

relationships between different features.

3. Survey Results

The following section presents the results of the archaeological survey at Bodiam Castle, for the 2010 – 2012 seasons of survey.

3.1 The Topographical Survey

Bodiam castle is situated on the northern valley side of the Rother at an approximate height of 4m asl. The survey area for the current project was designed to cover the area of landscape surrounding the castle, comprising Court Lodge on the ridge to the north, the area of Bodiam Castle and village, the river Rother and the floodplain to the south of the current river course. The topography of the area is dominated by the ridge and sloping valley to the north of the Rother comprising Dokes' Field and the vineyard immediately to the east. The valley at this point slopes southwards from the ridge at Longacre and Court Lodge, and from the School House to the west (Figs 19 and 20), creating a broad depression in the centre of Dokes' Field (A). There is a break in the natural slope in the western part of the field, commencing immediately to the south of Longacre (B), running from north to south (C) and arriving at the

property of the Old Rectory (D), running for a distance of 250m.

The northern confines of the topographic survey are dominated by a series of features lying to the south of Court Lodge, comprising a terrace and bank with an outer ditch, running from the edge of Dokes' Field (E) and from east to west (F) along the edge of the Court Lodge property, before curving around the eastern side of the property (G), encompassing a platform (H) measuring some 70m by 45m. To the south of the platform the ground slopes away towards Bodiam Castle (I). Slope is continuous, broken only by a large rabbit warren mid-way down the slope. The slope of the valley side is broken by the modern works access road to the Castle (J) and (K) which runs from west to east for a distance of 200m between the Castle and the Trust cottages and offices. The ground to the south of the road (L) is broken by the presence of a dried up cascade, measuring some 100m by 30m. The ground then rises to a low ridge (M) which defines the topography between Dokes' Field and Bodiam village. The Old Rectory is situated on the highest point of this ridge. A break in the slope marks the eastern extent of the ridge (N),

running from north-west to south-east for a distance of 80m, then turning to run on the same alignment as the village tenement boundaries to the west (O). Immediately to the south of this the slope of the valley side is broken by a series of regular parallel linear features (P) demarcating the boundary lines of the tenement plots associated with the village of Bodiam. The eastern extremity of the low ridge is cut off by the moat of Bodiam Castle (Q), indeed the topography of the eastern-central portion of the survey area is dominated completely by the cut of the medieval moat and castle. A low embankment and pathway (R) marks the eastern and southern edge of the moat, together with two low areas of ground. The topography falls slightly to the south eastern corner of the property (S) where a series of linear and rectilinear breaks in the topography indicate the presence of buried structures. The area to the south of the castle is marked by a raised footpath (T) running between a millpond to the east, and the broader car park and 'cricket ground' situated to the west (U), measuring some 120m by 50m. A raised area of ground (V) marks the zone between the 'Cricket Ground' and the river Rother to the east of the Wharf.

To the south of the river Rother most of the ground owned by the National Trust covers the floodplain of the river. The southern bank of the modern course of the river is marked by a dyke, running from the western confines of the survey area (W) and curving alongside the river (X), before ending at the bridge, and recommencing to the east (Y) and continuing on the bank opposite the Wharf and castle (Z).

To the south of the dyke the floodplain proper of the river is visible as a broad expanse of low ground (A') measuring 200 by 150m, with two parallel lines of raised ground (B') marking terrain associated with an earlier course of the river. This low ground continues to the east (C') narrowing as the course of the Rother turns to the south east.

The ground to the south rises slowly, marking the first sand terrace to the south of the Rother (D') and (E') and the possible location of the Romano-British settlement. The raised ground continues to the east, curving slightly northwards then turning east (F') and (G'), taking the form of two parallel lines of raised ground running for over 250m.



Figure 19 Results of the topographic survey at Bodiam Castle 2010-2012

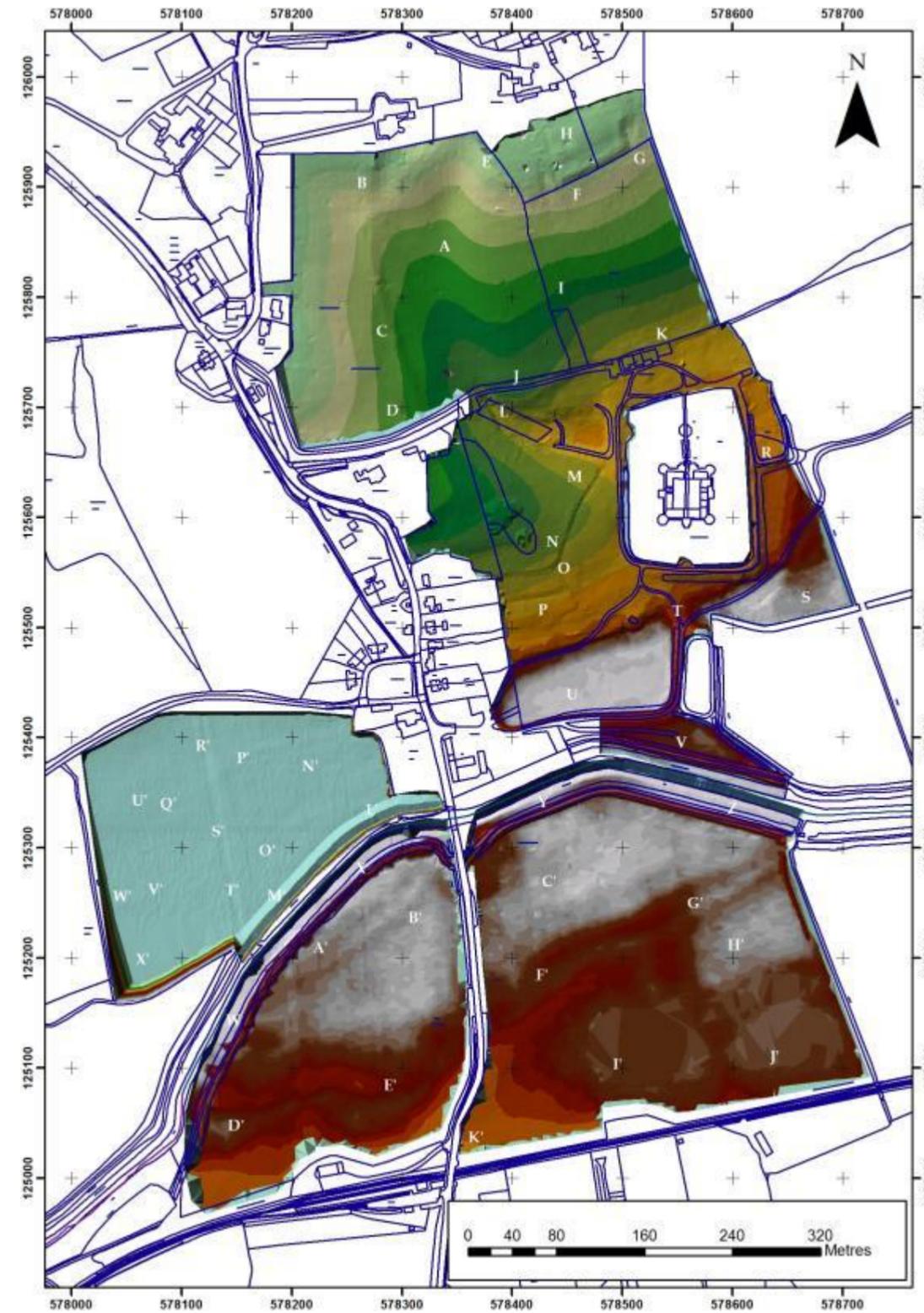


Figure 20 Results of the topographic survey at Bodiam Castle 2010-2012 with labels referring to the text

The area to the south of these features (H') is marked by a rectangular depression measuring 100m by 50m. Two further depressions (I') and (J') of similar dimensions are visible to the south and west, all marking either large ponds, or possible features associated with a port or harbour area relating to the Romano-British settlement. The higher ground in the south western corner of the East Field (K') also corresponds to the location of Roman deposits.

The 2012 topographic survey in the cricket field, to the west of the Bodiam Castle public house, also shows some indication of topographic features. The dyke runs for a distance of 200m along the northern edge of the Rother (L') and (M'). The eastern expanse of the cricket ground is level (N') marked with slight linear depressions (O') indicating field drainage. A faint linear depression (P') runs from west to east across the field for a distance of over 120m, crossing a deeper linear feature, and can be traced faintly in the western part of the field (Q') running in a south-western direction. A strong linear depression some 8m across runs from north to south across the field, from the northern edge (R') to the west of the cricket

square (S') and to the dyke alongside the Rother (T'), a distance of over 210m. A narrower fainter linear feature (U') and (V') runs parallel to the broader depression some 67m to the west, again suggesting a drainage feature. The western and southern extremes of the cricket field (W') and (X') are level.

3.2 The Standing Building Survey

Results of the standing building survey are at this stage preliminary, but the survey indicates a number of interesting points, together with areas for further elaboration. The overall plan and exterior form of the castle are similar to that of the Ordnance Survey maps, showing a slight unevenness in the plan of the castle, and a kink in the line of the causeway to the north. The plans from the 2011 and 2012 seasons (Figs 21 – 23) show the initial results of the building survey. The plans require further validation on site to ensure that no errors have unwittingly crept in during the survey and analysis of nearly 4,000 lines. We have attempted to be honest in the plans, indicating those areas which have been fully surveyed, those which can be extrapolated from available evidence

but have not been surveyed due to time constraints or access problems and those features which have indications of existence but cannot be confirmed.

The basement area of the castle extends over the east side of the castle from the gatehouse round to the Great Hall where it apparently ceases, to commence again to the east of the kitchen. It is clear from the plan that the majority of this area had access only from the courtyard, with the exception of the areas on the south range which had access from the Great Hall or cross passage. This ground floor plan shows the full layout of the castle, including the surviving vaulting in the gatehouses.

The first floor extends right around the castle, in many areas duplicating the layout of the ground floor but the walls are rebated for floor joists making the rooms slightly larger. Many of the first floor walls around the courtyard have been removed so much important layout information is missing and therefore open to interpretation. A small area of cornice survives in the south west corner of the courtyard to confirm that the internal ranges of the castle only extended up to the first floor.

The second floor plan is essentially a plan of towers and crenelated walkways, highlighting the design of the perimeter of the castle. This plan in particular highlights the asymmetrical design of the castle perimeter walls and the lack of access to one particular section of walkway in the south west corner, suggesting access must have come from or over the roofs of the adjacent range. In addition, it is obvious that the numerous chimneys in the castle often interfere with access around the walkways.

The survey has led to many interesting observations on the process of building the castle and its later modification and adaptation for use. A paper is in preparation to detail these observations and to interpret the findings. There is also still much work to do in processing the data collected, checking it on site, and testing theories. Future work with the data will include the creation of elevations for the west side of the castle and 3D modelling in various areas, particularly the courtyard.

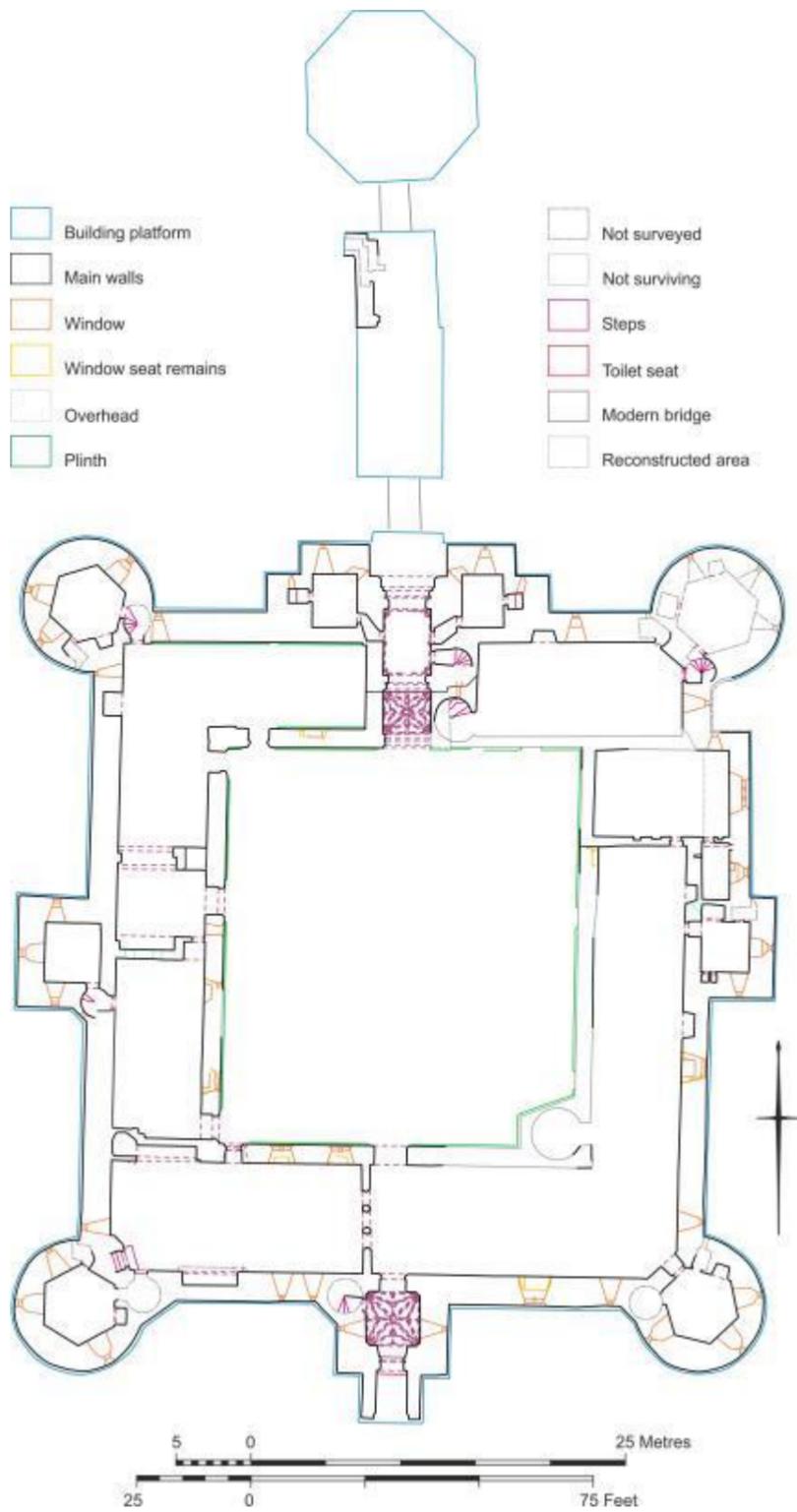


Figure 21 The ground floor of Bodiam Castle

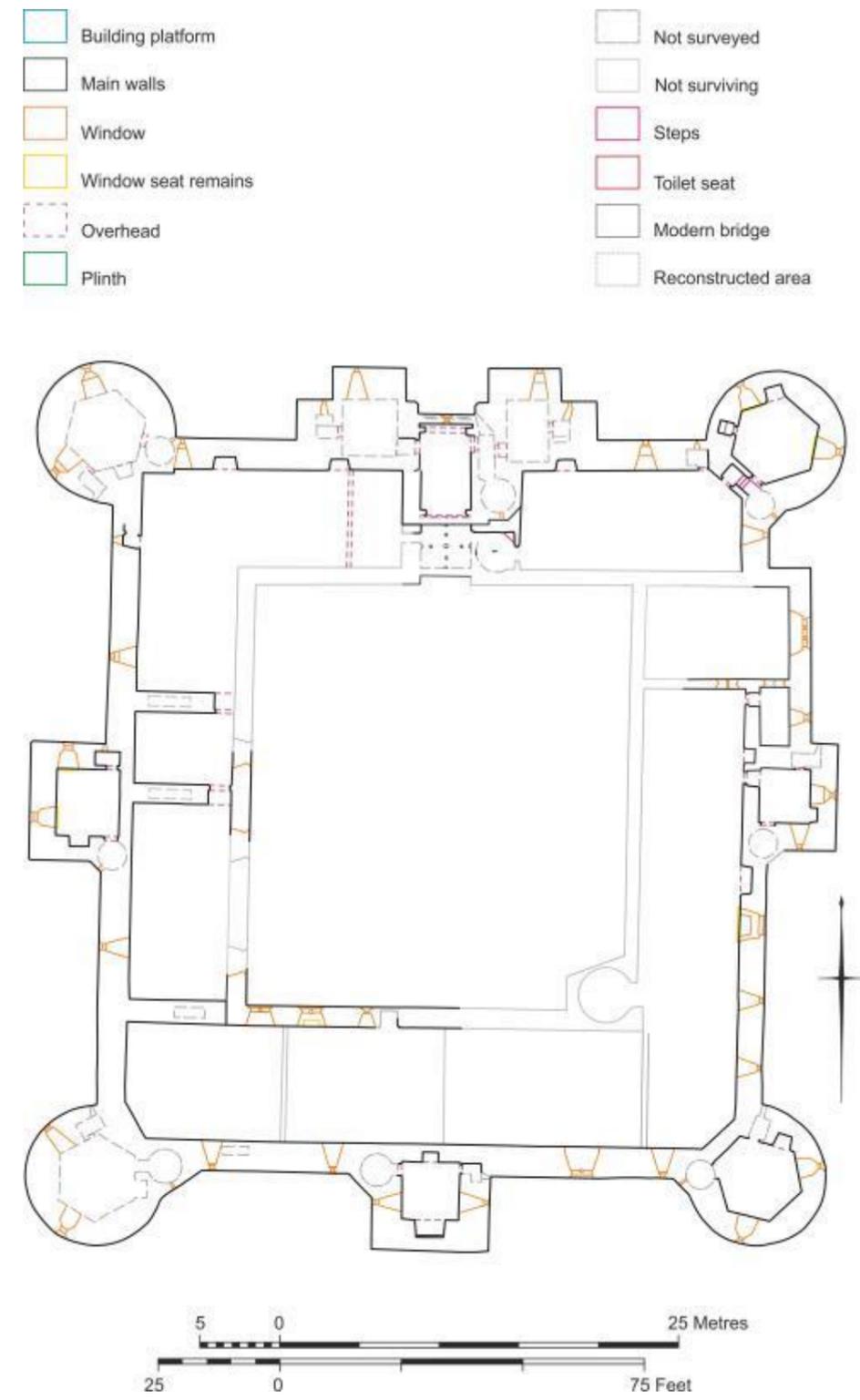


Figure 22 The first floor of Bodiam Castle

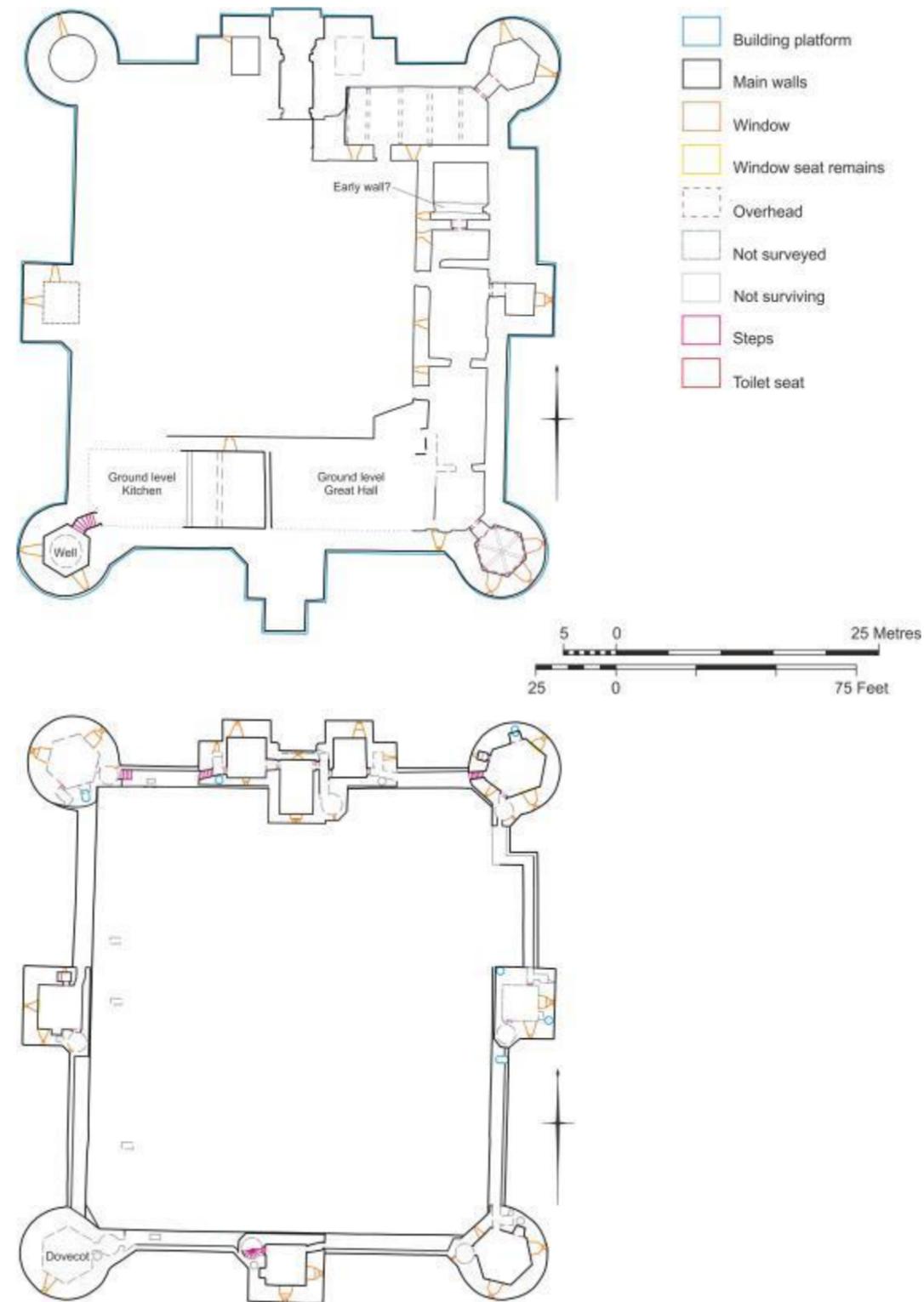


Figure 22 The basement (top) and second floor (bottom) of Bodiam Castle

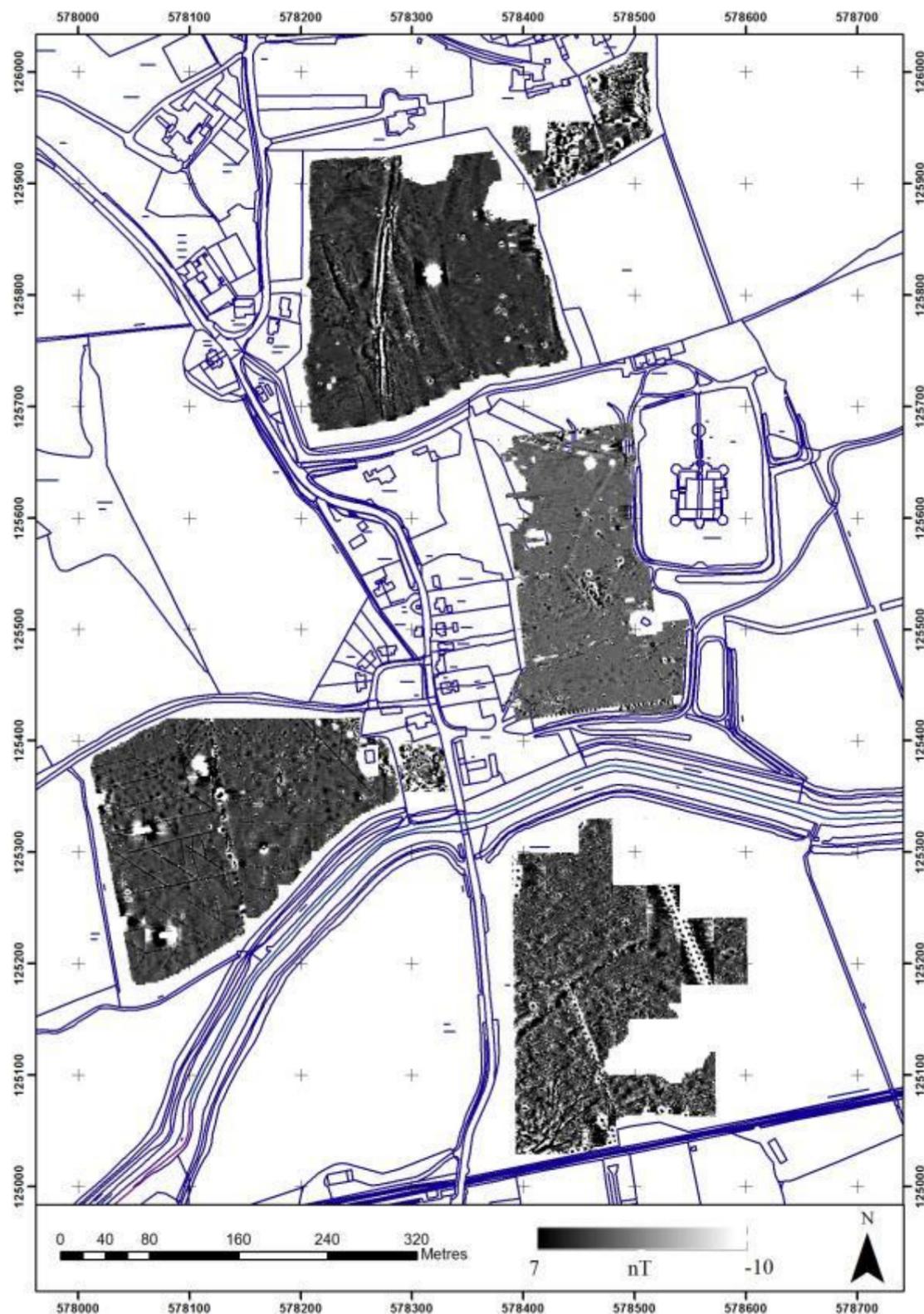


Figure 24 Results of the magnetometer survey at Bodiam Castle 2010 – 2012

3.3 The Magnetometer Survey

Some 17 hectares of magnetometry have been carried out in the 2010-2012 surveys. Results of the magnetometry indicate a large number of archaeological features (Fig. 24) that had previously not been recorded at the site, particularly in the area to the west of the castle (Figs 25 and 26). The cascade is marked by a positive linear band of measurements [m1] and [m2] running for a distance of over 90m. The centre of the cascade is marked by a negative linear band of readings, and the northern edge of the feature is obscured by a substantial number of large dipolar anomalies [m3] indicating the presence of modern ferrous material. The northern edge of the cascade is marked by a further band of positive readings [m4]. Anomalies in the north eastern corner of the survey area [m5] and [m6] show a massive spread of modern ferrous material, possibly associated with the modern pathway circuiting the castle. A rectilinear dipolar feature [m7] measuring 6m across marks the location of a possible structure, presumably associated with the modern development of the site. The bank and ditch features to the west of the castle are marked in

the magnetometry with the presence of a broad positive linear band of readings [m8] running parallel to a band of negative measurements [m9] marking the ditch, and running for a distance of over 90m, broken only by a number of dipolar discrete anomalies [m10]. The area demarcated by the cascade and the eastern ditch show evidence of a number of more subtle features, including several sub circular anomalies [m11], and a faint rectilinear feature [m12] measuring 13m by 20m.

A faint positive linear anomaly [m13] runs from north-west to south-east across the enclosed area for a distance of 28m. The line of this feature can then be traced further to the east [m14] running for 34m. A more dispersed scatter of discrete dipolar anomalies [m15], [m16], [m17], [m18] and [m19] and two areas of disturbance are visible [m20] and [m21] close to the modern garden boundaries of the Old Rectory and within the small copse to the east. Three small discrete dipolar anomalies [m22] and [m23], each measuring 3-4m in diameter, mark the position of three possible kilns, and a further anomaly [m24] marks another kiln. Two small dipolar

anomalies [m25] are situated alongside a faint curvilinear anomaly probably associated with industrial workings further to the south.

A cluster of dipolar anomalies [m26] and several rectilinear features [m27] are situated alongside the south western corner of the castle moat, and mark a number of kilns and associated structures. Two other anomalies [m28] and [m29] are located to the west. A large complex of what appear to be kilns and other industrial features runs along the edge of the medieval tenement boundaries. Three dipolar anomalies [m30] are visible in the results, with two other anomalies situated further to the east [m31] and [m32]. A large dipolar anomaly [m33] measuring 4m across is located at the centre of this concentration of features, with a rectilinear dipolar feature [m34] running adjacent to the south. Several further dipolar features are situated to the east [m35] and a broad area of dipolar material [m36] is situated to the south of the rectilinear structure, measuring 7m by 5m.

The eastern edge of the medieval tenements, associated with Bodiam village, is visible in the magnetometer results, consisting of a

positive linear anomaly [m37] over 25m in length and a broader negative anomaly [m38] which curves to the west. The edge of the tenements can be traced as a faint positive linear anomaly [m39] running from west to east for a distance of 62m. The industrial material visible to the east of the boundary appears to stretch across the boundary to the west [m40] covering an area of 12m by 10m.

A structure [m41] measuring 9m by 10m is situated in the northern tenement plot together with two discrete areas of positive readings [m42] possibly associated with the eastern line of the tenement boundary. Two dipolar anomalies [m43] are situated in the second tenement to the south, suggesting the presence of slag or iron ore material. A similar anomaly [m44] is located along the southern edge of the tenements. A long positive linear anomaly [m45] and [m46] runs from east to west along the northern edge of the 'Cricket Ground' for a distance of over 93m, with a second linear feature running to the south. Both of these mark the line of modern field drains associated with Curzon's draining of the ground to the south.

Several large scale dipolar anomalies [m47], [m48] and [m49] mark a scatter of modern ferrous material to the south of the castle and pill box. Similar features run along the eastern edge of the 'Cricket Ground' [m50], [m51] and [m52] showing an area where modern material has been dumped, or where the remnants of fencing and hard standing are located. Two linear anomalies [m53] and [m54], each measuring over 110m in length, run from west to east showing the location of field drains. Two shorter linear features [m55] and [m56] mark similar drains cutting across the area, and a longer linear feature [m57] marks a further drain. Two other linear anomalies [m58] and [m60] show similar drains, and a broad linear dipolar anomaly [m59] and [m61] which split to the east [m62] marks a large field drain.

In the fields to the south of the river Rother a trial area of magnetometry was conducted to assess the potential for archaeological remains associated with the Romano-British settlement (Figs 27 and 28). A series of dipolar anomalies are spread close to the line of the modern road, starting in the northern part of the survey area [m63] with an anomaly some 3.5m across, and a double dipolar anomaly

[m64] further to the south. A cluster of similar features [m65], [m66] and [m67] are situated nearby and the line of features extends along the remaining western edge of the area [m68] and [m69]. The anomalies in the southern part of the area appear to resemble kilns or other fired features, and several other dipolar anomalies [m70], [m71], [m72] and [m73] suggest the presence of kilns. A positive rectilinear feature [m74] measuring 9m by 5m marks the presence of a possible building or structure, and several other positive dipolar and positive anomalies [m75] and [m76] suggest a continuation of features possibly related to the Romano-British settlement in the area. A strong linear feature [m77] running from south-west to north-east also suggests the presence of archaeological features in the area, all on a south-west to north-east alignment. A positive linear anomaly [m78] measuring some 14m in length suggests one side of a possible structure. A broad linear anomaly [m79] and [m80], measuring 150m in length and 6m in width shows deposits probably associated with either a natural channel of the Rother, or a slight bank created along the southern edge of the natural channel.



Figure 25 Greyscale image of the magnetometer survey results from the vicinity of the Castle

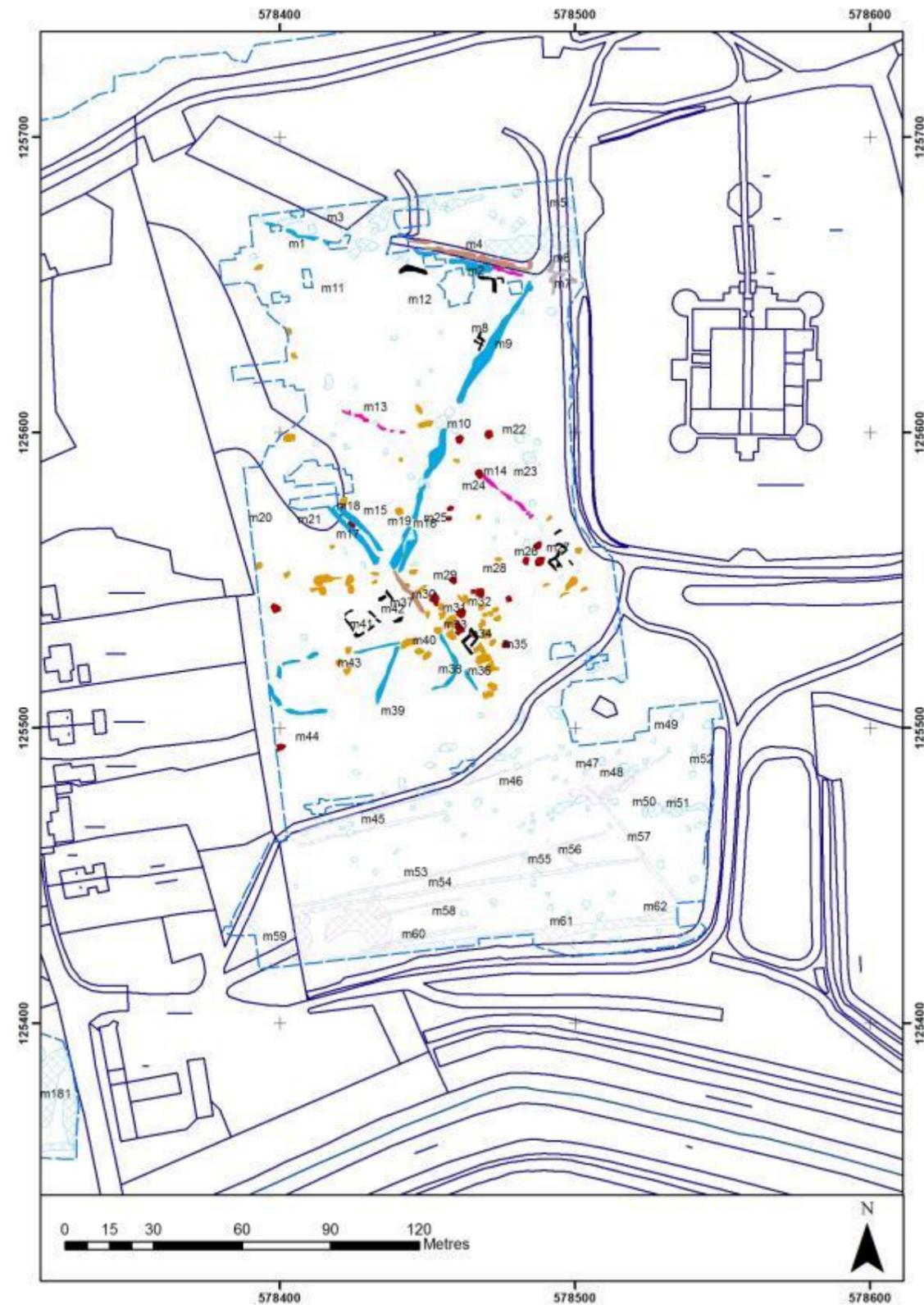


Figure 26 Interpretation plot derived from the magnetometer survey results from the vicinity of the Castle

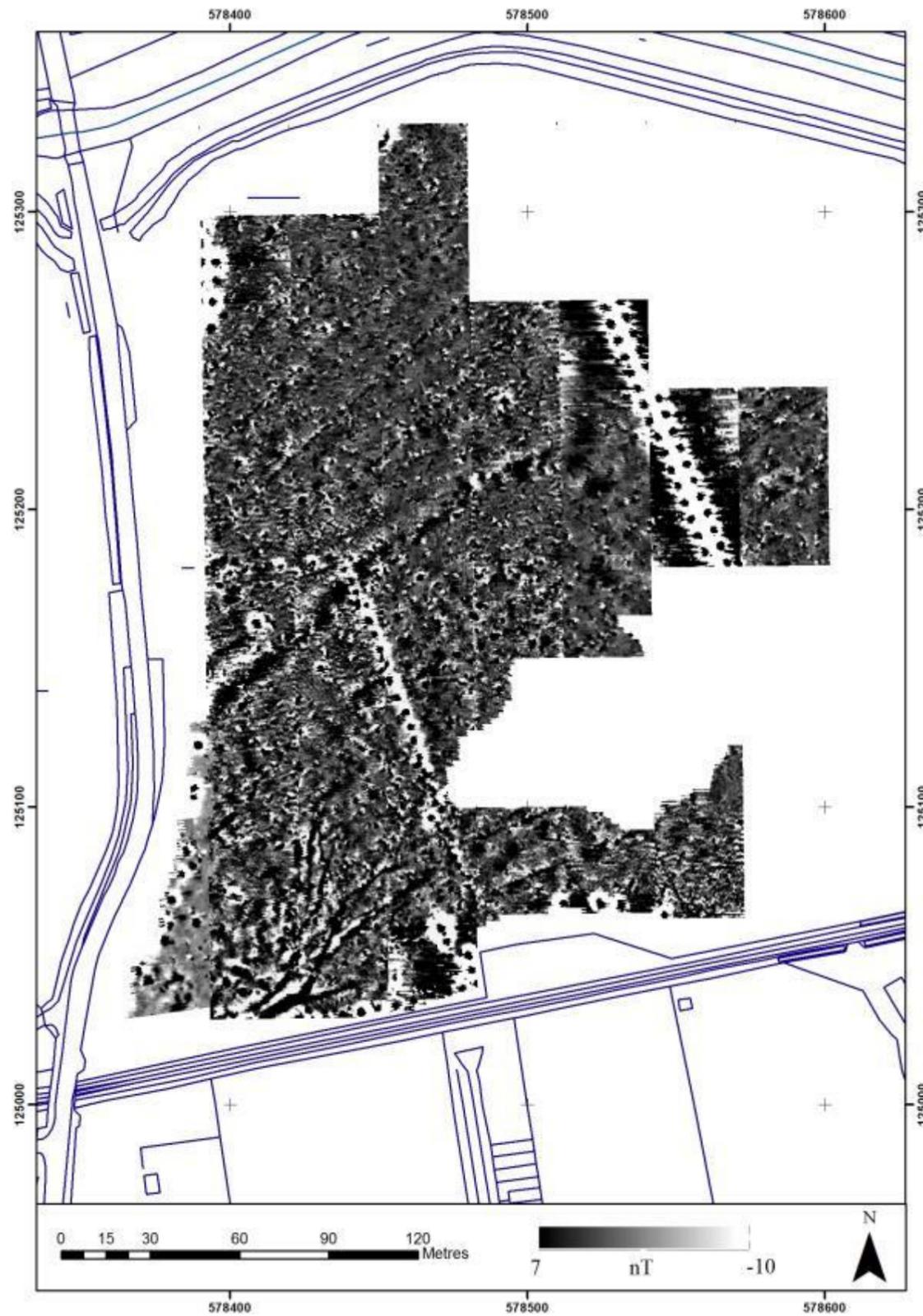


Figure 27 Greyscale image of the magnetometer survey results from the Romano-British site

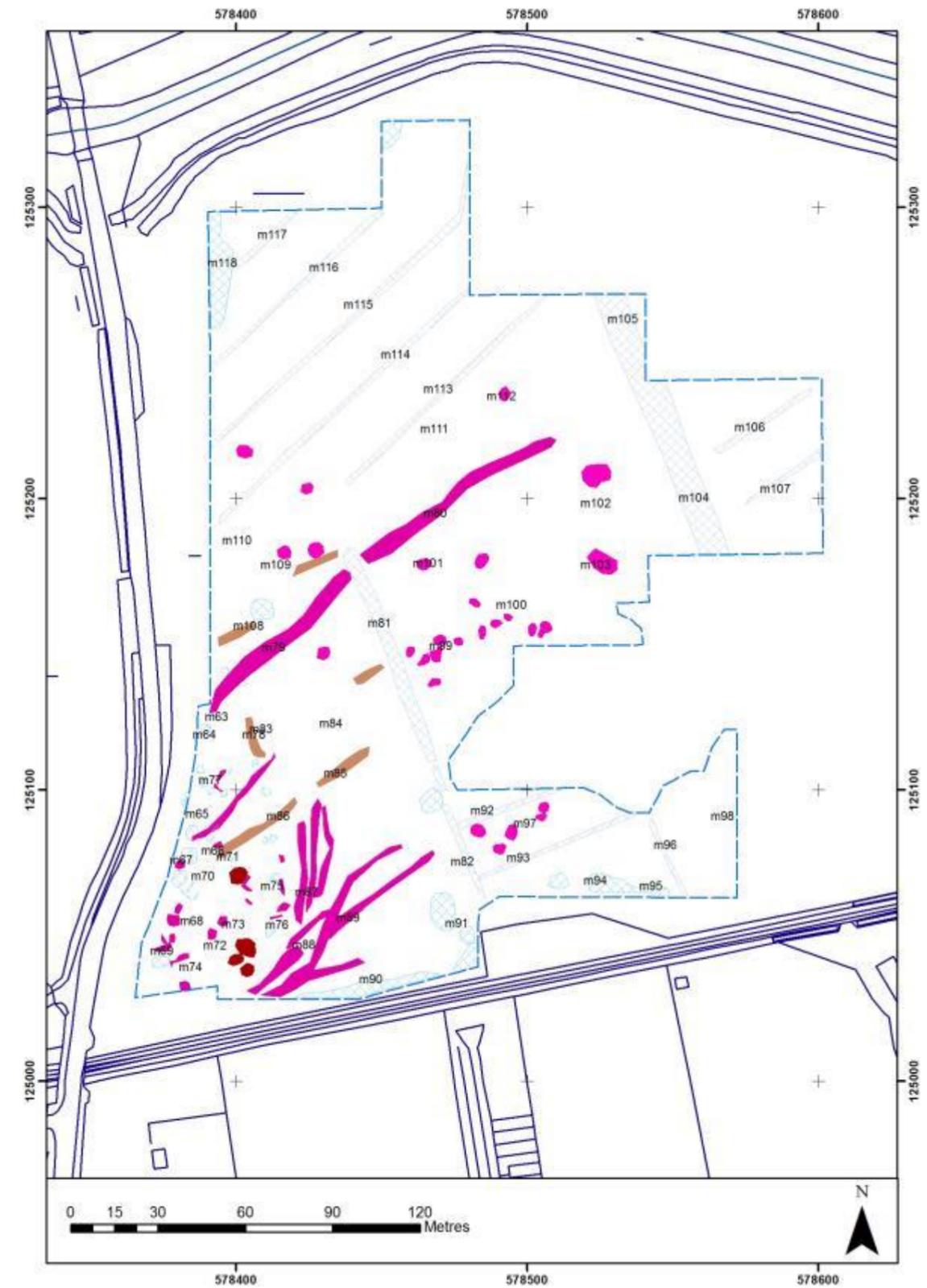


Figure 28 Interpretation plot derived from the magnetometer survey results from the Romano-British site



Figure 29 Greyscale image of the magnetometer survey results from Doke's Field

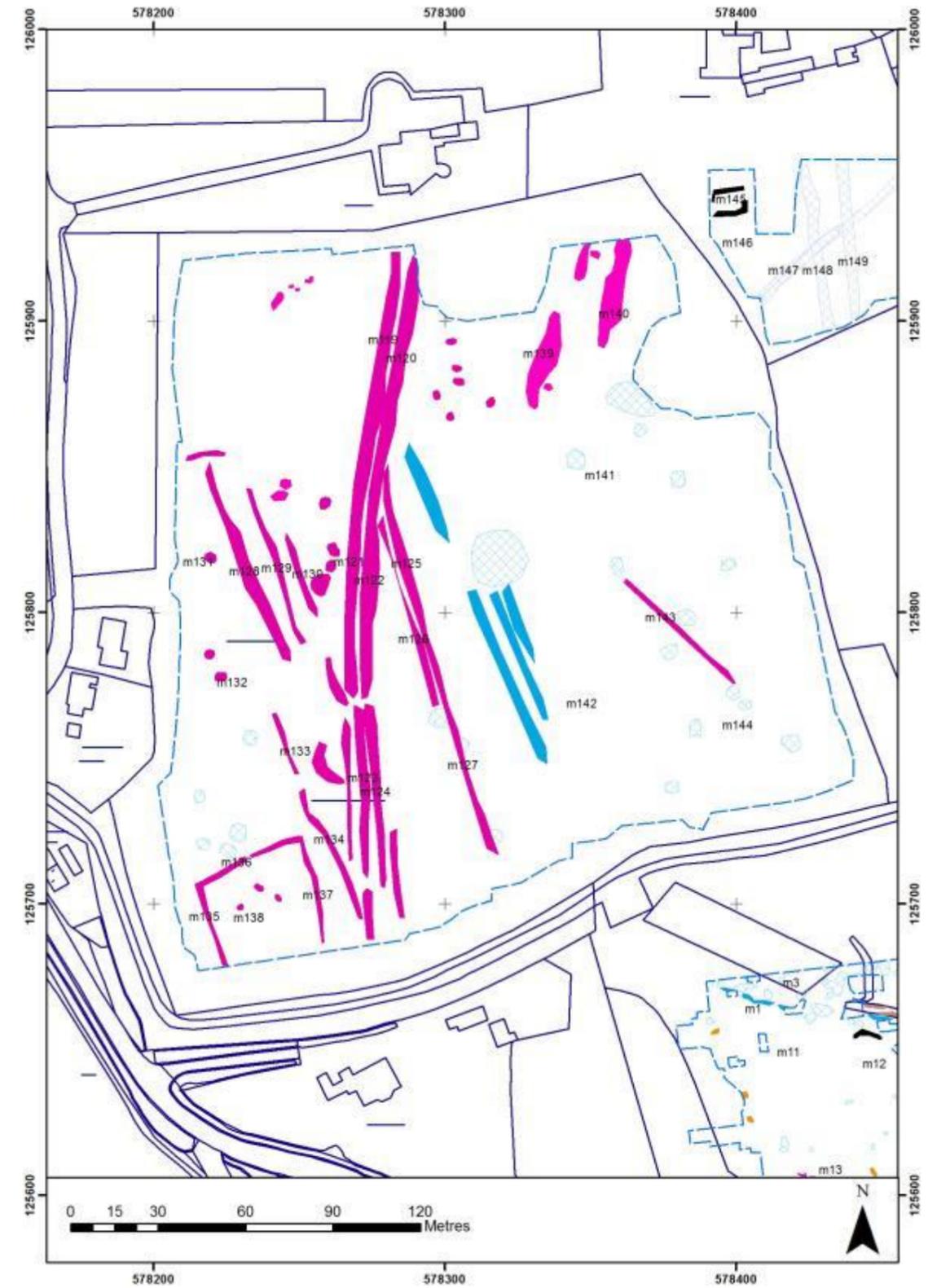


Figure 30 Interpretation plot derived from the magnetometer survey results from Doke's Field

This feature is cut by a modern dipolar linear anomaly [m81] and [m82] marking a drainage feature. Several linear anomalies [m83] and [m84] mark possible structures in the western part of the field, with a bank or similar feature [m85] and [m86] running from south-west to north-east. A series of linear dipolar anomalies [m87], [m88] and [m89] run from the edge of the field in a north-east direction, some for a distance of over 76m. These seem to indicate run-off from industrial features on the first terrace above the floodplain. A number of dipolar anomalies [m90] and [m91] mark modern ferrous material along the edge of the East Sussex and Kent railway. To the east two parallel linear dipolar anomalies [m92] and [m93] mark modern field drains. Several other drains and dumps of ferrous material [m94], [m95], [m96] and [m98] are visible in the south-eastern part of the survey area. Several discrete anomalies, positive in nature, indicate possible pits or kiln features [m97].

A number of discrete positive anomalies are also located between the pond and ancient river course to the north [m99], [m100], [m101], [m102] and [m103]. To the east of

these features a massive dipolar linear anomaly [m104] and [m105] together with two parallel dipolar linear anomalies [m106] and [m107] indicate drainage features.

To the west and north of the ancient channel two linear positive anomalies mark possible banks [m108] together with several discrete positive anomalies [m109] and [m110]. These anomalies spread further to the east [m111] and [m112]. All seem to indicate either pits or similar deposits. The northern part of the floodplain, up to the modern course of the Rother [m113] – [m117], is cut by field drains. A line of dipolar anomalies near the modern road [m118] mark a deposit of modern ferrous material.

The magnetometer survey results from Doke's Field (Figs 29 and 30) are dominated by a double linear dipolar anomaly [m119] and [m120] running from north to south across the field, for a distance of over 230m [m121] and [m122] marking the possible line of a Roman road. The feature has a break in it some three quarters along its length but continues [m123] and [m124] to the southern edge of Doke's Field. A fainter dipolar [m125] and negative [m126] and [m127] diverts

from the course of the Roman road, suggesting a later track or road following in part the line of the earlier road, then deviating to the south-east.

Three parallel positive linear anomalies [m128], [m129] and [m130] seem to mark terraces running along the western slopes of Doke's Field. A series of discrete positive anomalies [m131] and [m132] further to the west seem to indicate a series of possible pits or kilns along the edge of the ridge, and a further linear positive anomaly [m133] and [m134] marks the line of a ditch. A rectilinear enclosure ditch [m135], [m136] and [m137] measuring some 35m by 38m in size, with a series of discrete anomalies at its centre [m138] is visible in the south-western corner of the field.

Two broad positive bands of readings [m139] and [m140] run from the north suggesting either colluvium or ditch deposits. Several dipolar anomalies along the eastern side of the field [m141] indicate modern material, and three negative linear anomalies [m142] indicate cuttings or terraces in the centre of the field. A linear positive anomaly [m143] cuts across the field from north-west to

south-east, suggesting a narrow ditch, and several further discrete dipolar anomalies [m144] indicate modern ferrous material.

In the area of the Viewing Platform (Figs 31 and 32) a rectilinear positive anomaly [m145] indicates a possible structure measuring some 12m across. Several discrete anomalies [m146] seem to indicate pits, and a number of dipolar linear anomalies [m147], [m148] and [m149] indicate modern pipelines. Some linear positive anomalies along the edge of the platform [m150], [m151] and [m152] may indicate structural remains, however much of the remaining areas of the platform are covered with modern ferrous material [m153], [m154] and [m155].

In the cricket field to the west of the Bodiam Castle pub (Figs 33 and 34) a linear dipolar anomaly [m156] and [m157] running for a distance of 180m from north to south marks a major field drain. Several other large linear anomalies [m158], [m159] and [m160] and run into the major drain, also indicating field drains. A further large field drain [m161] and [m162] runs from north-west to south-east, with a series of smaller drains [m163] – [m170] running into it.



Figure 31 Greyscale image of the magnetometer survey results from the Viewing Platform

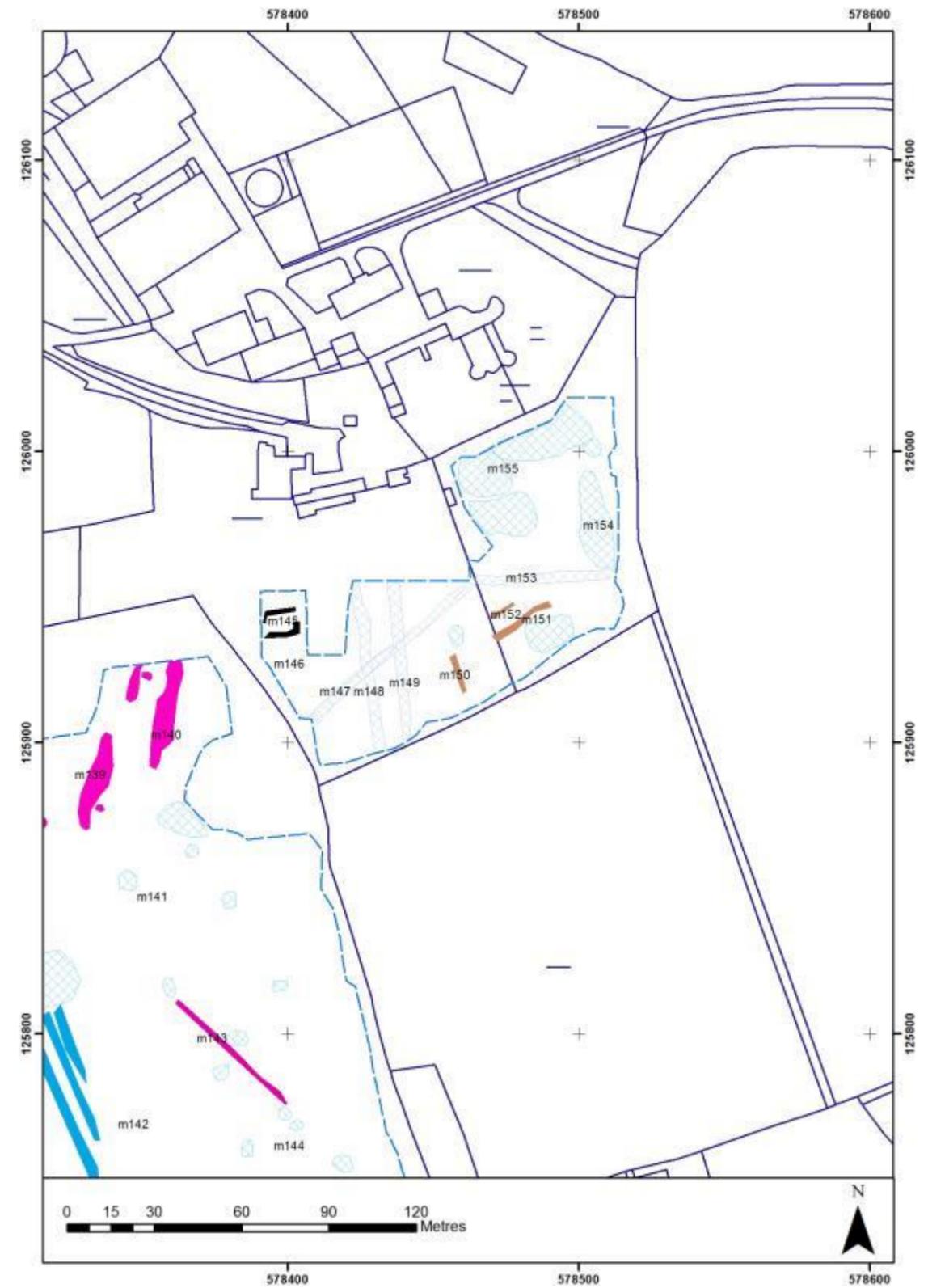


Figure 32 Interpretation plot derived from the magnetometer survey results from the Viewing Platform

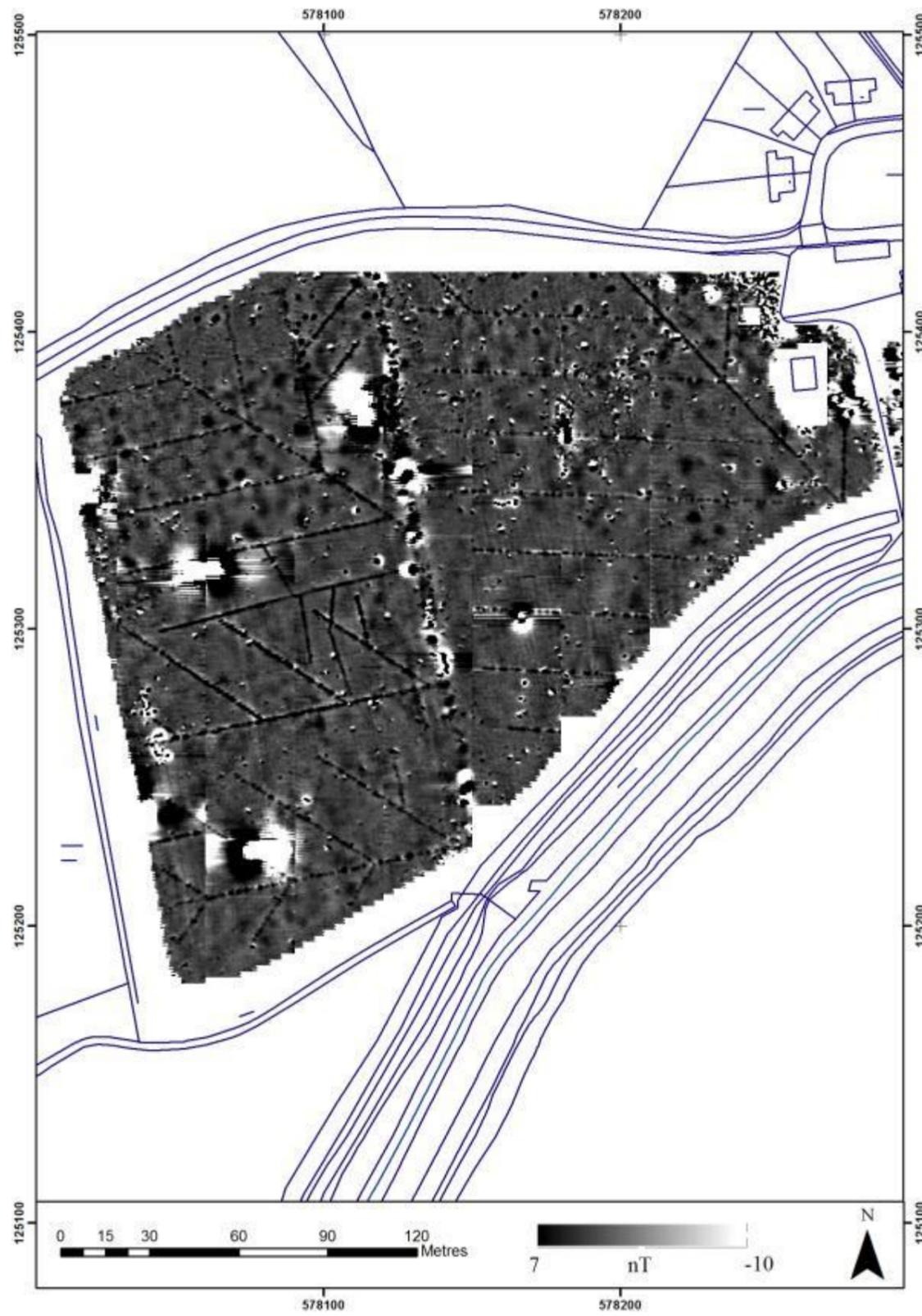


Figure 33 Greyscale image of the magnetometer survey results from the cricket field

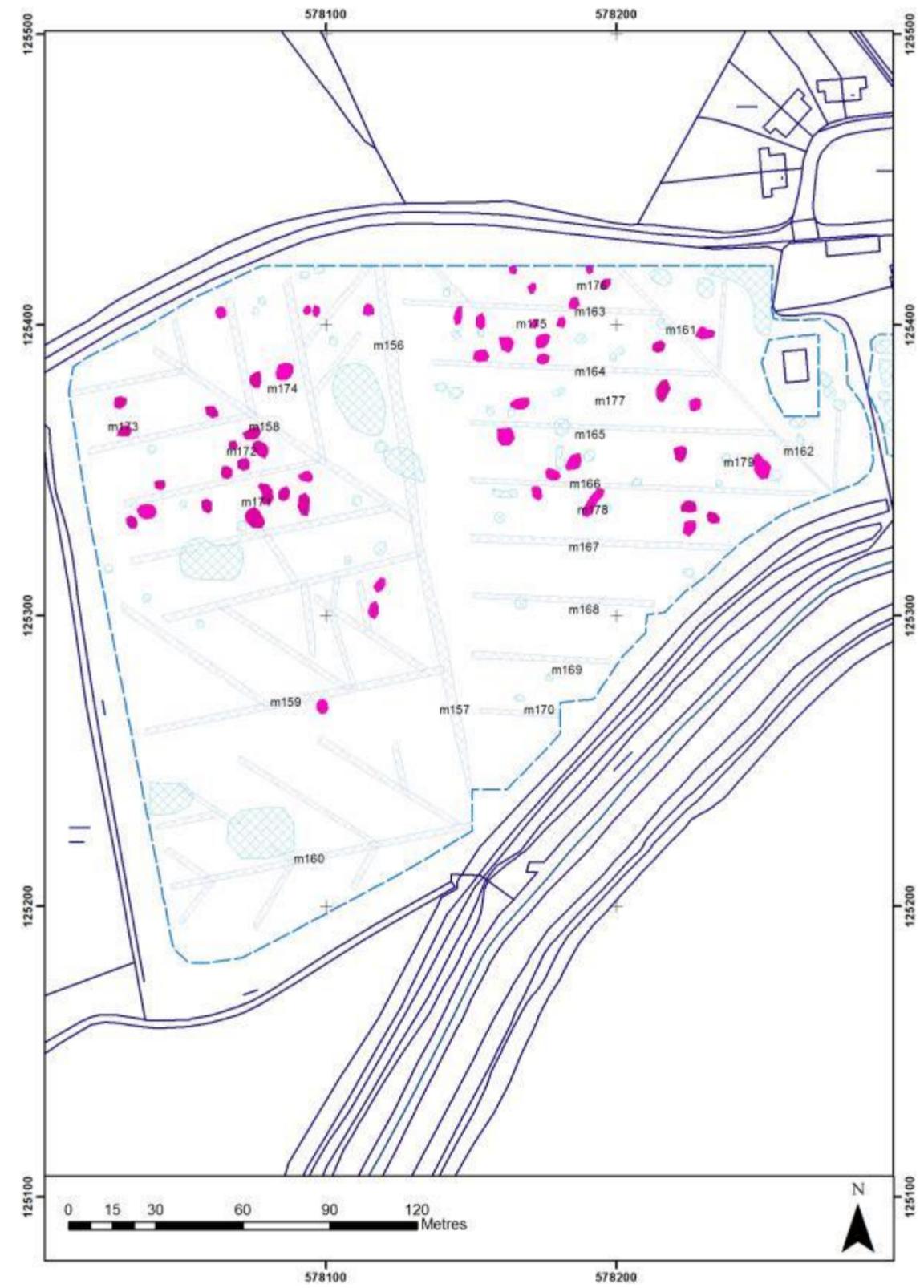


Figure 34 Interpretation plot derived from the magnetometer survey results from the cricket field

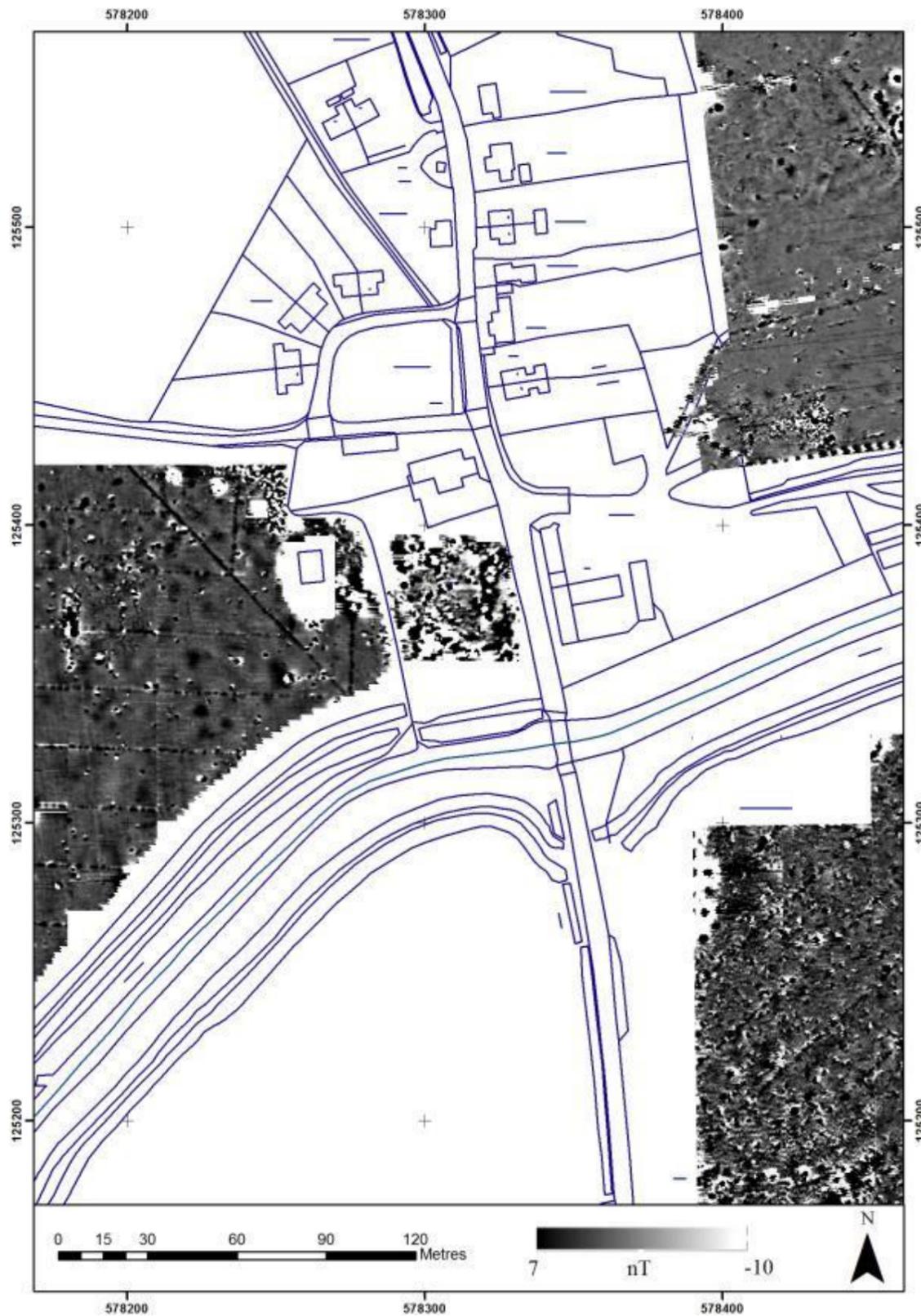


Figure 35 Greyscale image of the magnetometer survey results from the pub garden

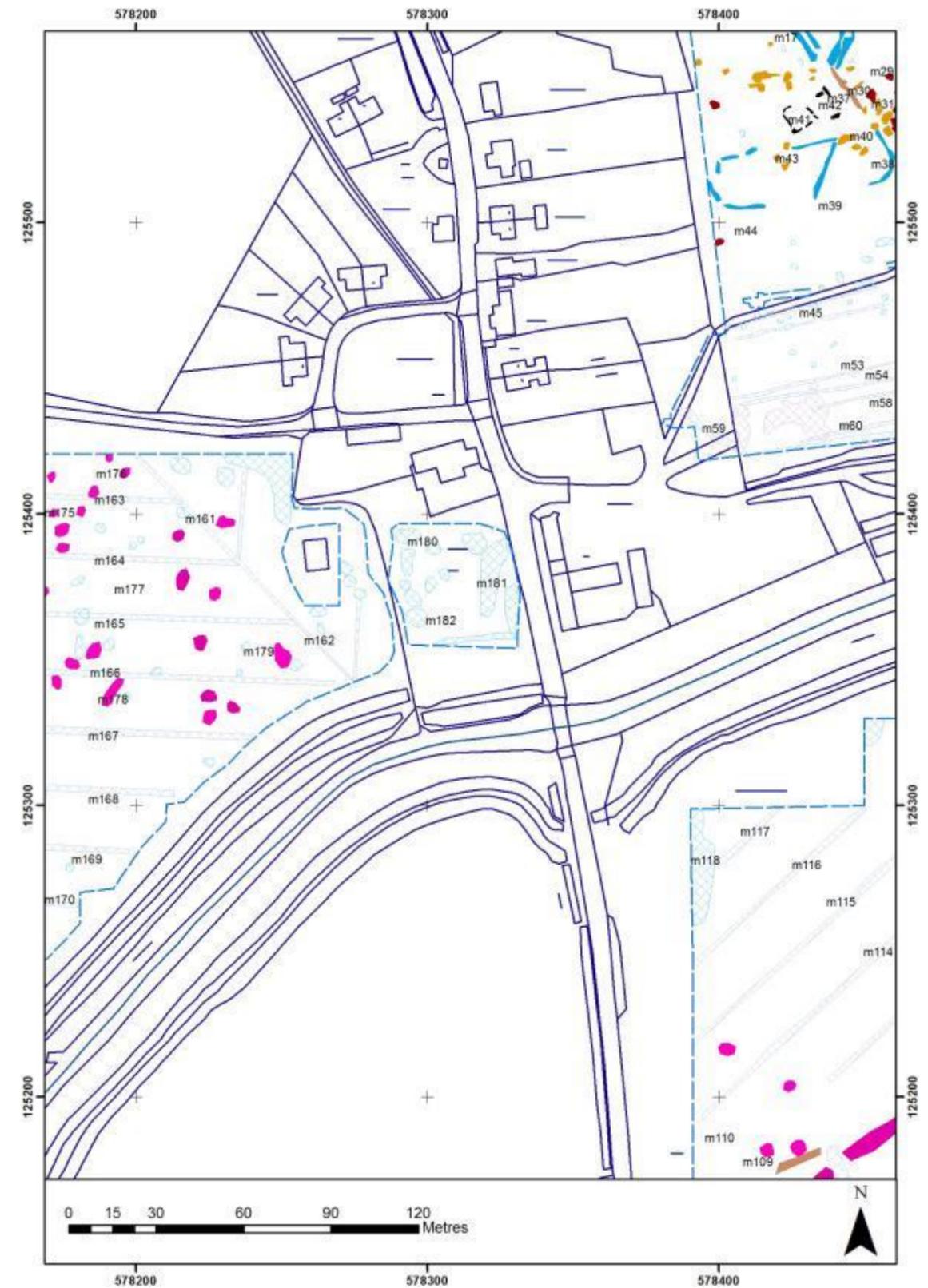


Figure 36 Interpretation plot derived from the magnetometer survey results from the pub garden

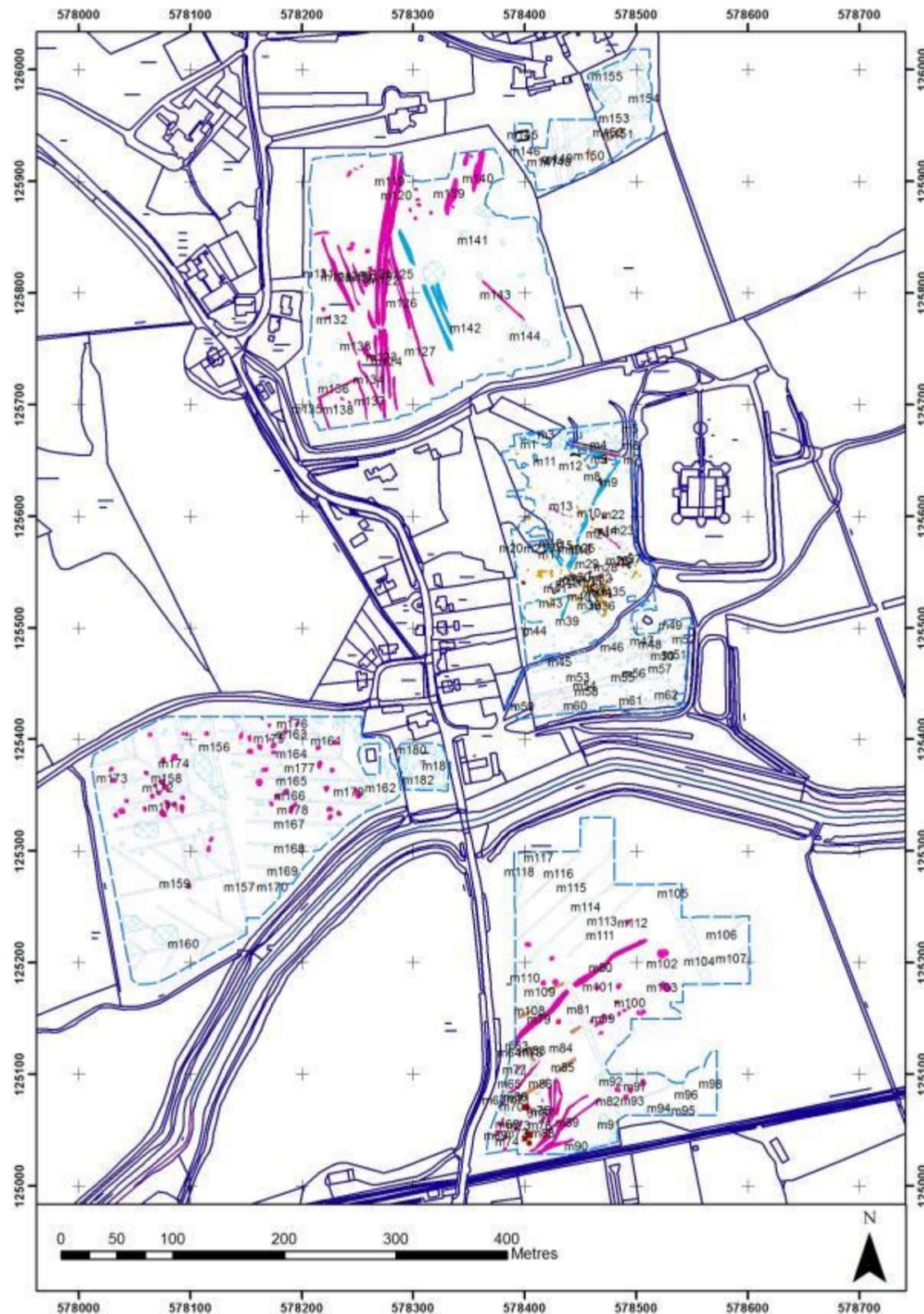


Figure 37 Interpretation plot derived from the magnetometer survey results for Bodiam Castle 2010 – 2012

In the north-western portion of the field a series of positive discrete anomalies **[m171]** – **[m174]** measuring 3-4m in diameter are visible. These seem to indicate pits of kilns, although investigation through hand augering suggests that they may be protrusions of peat underlying the alluvium of the river floodplain (see below). Similar anomalies **[m175]** – **[m179]** are visible along the northern and central parts of the field.

In the pub garden (Figs 35 and 36) a number of dipolar anomalies **[m180]** – **[m182]** mark modern pipelines and disturbance.

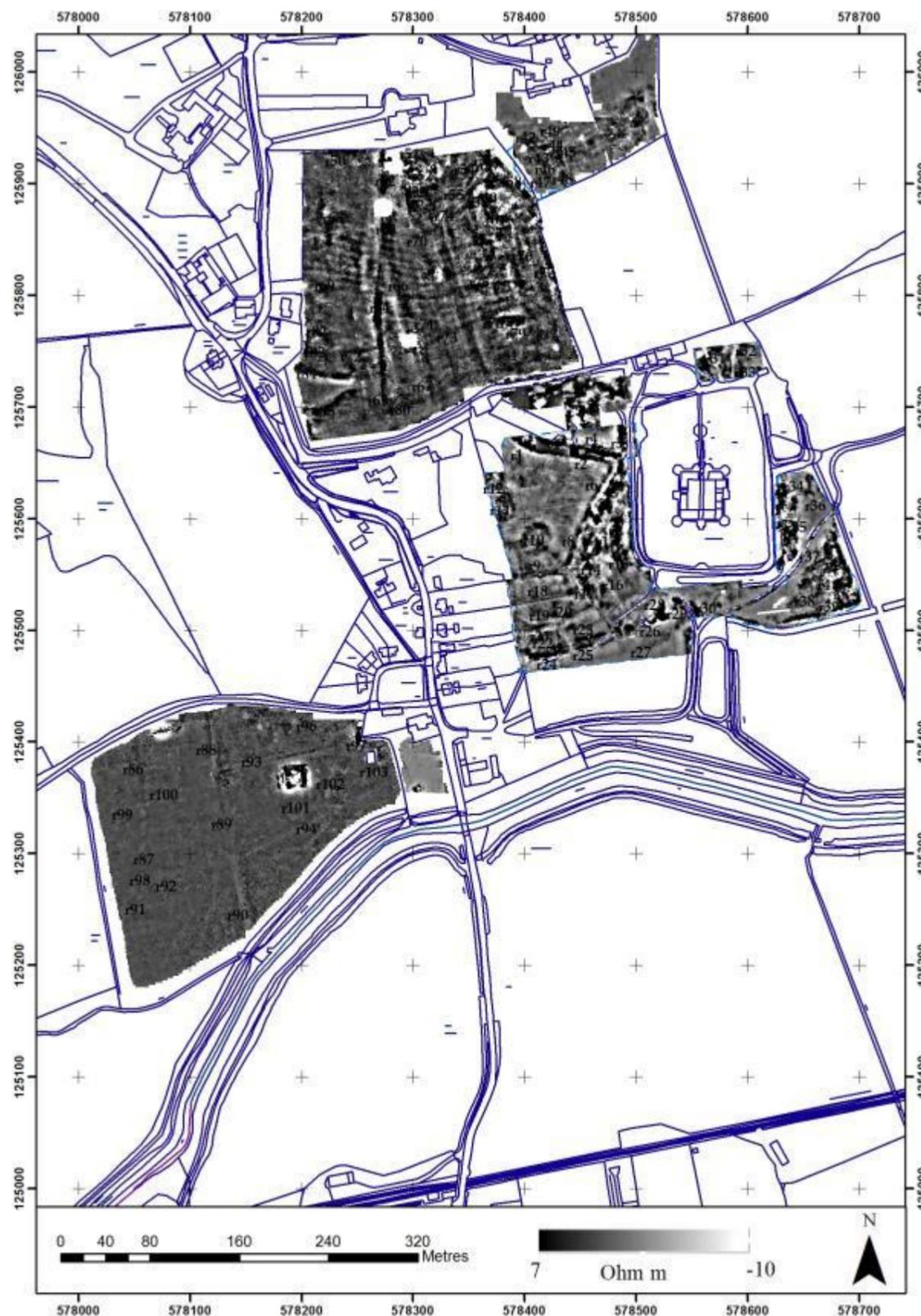


Figure 38 Greyscale image of the results of the resistivity survey from Bodiam Castle 2010 – 2012

3.4 The Resistivity Survey

Approximately 15 hectares of resistivity survey (Fig. 38) was conducted in the 2010-2012 seasons, comprising the area to the west and south of the castle, Doke's Field, the 'Viewing Platform', cricket field and pub garden. The area of the 'Cricket Ground' was not surveyed using this technique, as the standing water in the area adversely affected the results of the resistivity.

The area to the west of the castle (Figs 39 and 40) is dominated by a large high resistance feature [r1] measuring 14m across and running for a distance of 90m from west to east. The anomaly consists of two parallel high resistance bands, with a lower resistance band of readings between, marking the line of the cascade to the west of the castle. The area to the south of this anomaly [r2] is relatively quiet. A break occurs in the north side of the feature [r3], some 6m across, and matching a linear anomaly which runs to the northern edge of the survey area. A secondary high resistance linear anomaly [r4] runs parallel to the edge of the cascade for a distance of 24m.

A broad high resistance band of readings [r5] runs from north to south, meeting with the line of the cascade. The feature runs for a distance of 24m, and measures some 8m across, and appears to mark an area of material deposited during the creation of the castle moat (see features further to the south). The cascade feature turns to the south [r6] and runs for a distance of 105m. Several breaks occur on the external [r7] and internal [r8] parts of the feature, and the central band of low resistance readings is more pronounced. The nature of the results suggests an internal bank excavated in sections to create a ditch, with material also cast out along the outer edge of the ditch. The feature becomes less pronounced as it runs further south. It then turns to the west [r9] and runs for a distance of 46m to the edge of the results. Again the feature comprises what appears to be an external and internal bank, with the slightest trace of a ditch in between. The line of both banks is very broken. The bank and ditch features and the cascade encompass an area of some 0.8 hectares which appears free of any significant features in the resistivity, with the exception of a large ovate anomaly [r10] formed by a high resistance

band of readings 4.5m across, marking an area measuring 28m by 22m. A smaller high resistance anomaly is located to the south east. A series of high resistance features [r11] and [r12] mark the highest ground to the east of the rectory. These consist of several broad bands of high resistance, marking a rectilinear area immediately to the east of the modern fence line measuring 45m by 16m.

The area between the high ground and the castle moat is marked by a series of high and low resistance features. Several high resistance anomalies [r13] run parallel with the line of the large bank and ditch to the north, with corresponding low resistance anomalies, marking the possible line of a track or pathway. A low resistance anomaly [r14] runs from north to south downslope away from the higher ground for a distance of 55m. Several high and low resistance features [r15] curve around the south-western edge of the moat, suggesting either terracing or material deposited during the construction of the castle moat, in particular where the line of the moat appears to cut through the eastern side of the low ridge.

Two parallel low resistance linear features [r16] run from south east to north west for a distance of 24m. A further low resistance feature [r17] runs from north to south for a distance of 30m, marking a ditch running downslope along the back of the village tenements. The area to the west is marked by three parallel high resistance linear anomalies, showing the boundaries of the tenements for Bodiam village. The largest of these [r18] measures 60m by 20m, and has a large, faint rectilinear anomaly in its centre, measuring 25m by 10m. Adjacent to this to the south a second plot [r19] is visible of similar dimensions. Several high resistance anomalies [r20] are situated in the centre of the plot. A third tenement plot extends to the south [r21] with several high resistance anomalies and a low resistance linear feature [r22] marking a ditch. Traces of the tenement boundary can be seen further to the east [r23] where it joins the stronger anomalies marking the back of the tenement plots. The break in the topography on the edge of the river terrace above the 'Cricket Ground' is marked in the resistivity by a single [r24] and then double [r25] band of high resistance readings each measuring 30m in length, and appearing to mark the sands at the

terrace edge. The band of high readings continues to the east [r26] and is parallel to a fainter linear high resistance anomaly [r27] marking the lower break of slope on the edge of the 'Cricket Ground'. A broad band of high resistance readings [r28] marks the rise of land on which the World War II pillbox sits (Figs 41 and 42). This forms a clear right angle with the high resistance area immediately to the east [r29] and the high resistance readings [r30] to the east of the modern pathway. The small area surveyed to the north of the castle indicates the presence of two low resistance linear features [r31] and [r32] measuring 35m and 30m in length respectively, and suggesting channels where runoff from the ridge slopes to the north ran into the moat. A third discrete low resistance feature [r33] is also present.

A mixture of high and low resistance measurements [r34] and [r35] run in a band along the western edge of the area, marking the material forming the eastern dyke holding back the waters of the castle moat. Beyond this an area of moderate and low resistance values [r36] and [r37] is visible separating the castle moat from a further area of high resistance

features in the south eastern corner of the area. These consist of a surrounding area [r38] with a linear high resistance feature [r39] suggesting revetting in stone running from west to east for a distance of 78m. A similar high resistance feature [r40], associated with a rectilinear feature, runs from north to south further to the east. Both of these meet with a rectilinear anomaly [r41] measuring 20m by 15m.

In the area to the north of the cascade and south of Doke's Field the western part of the results [r42] shows very little as the soil was so dry at the time of survey that only high resistance measurements were collected. A rectilinear anomaly [r43] of low resistance shows a shallow pit or similar feature. A strong high resistance anomaly [r44] and [r45] suggests a bank or similar feature, with a similar anomaly [r46] immediately to the east. The remaining area is covered by high resistance anomalies [r47], [r48] and [r49] probably associated with sandy deposits close to the modern ground surface.

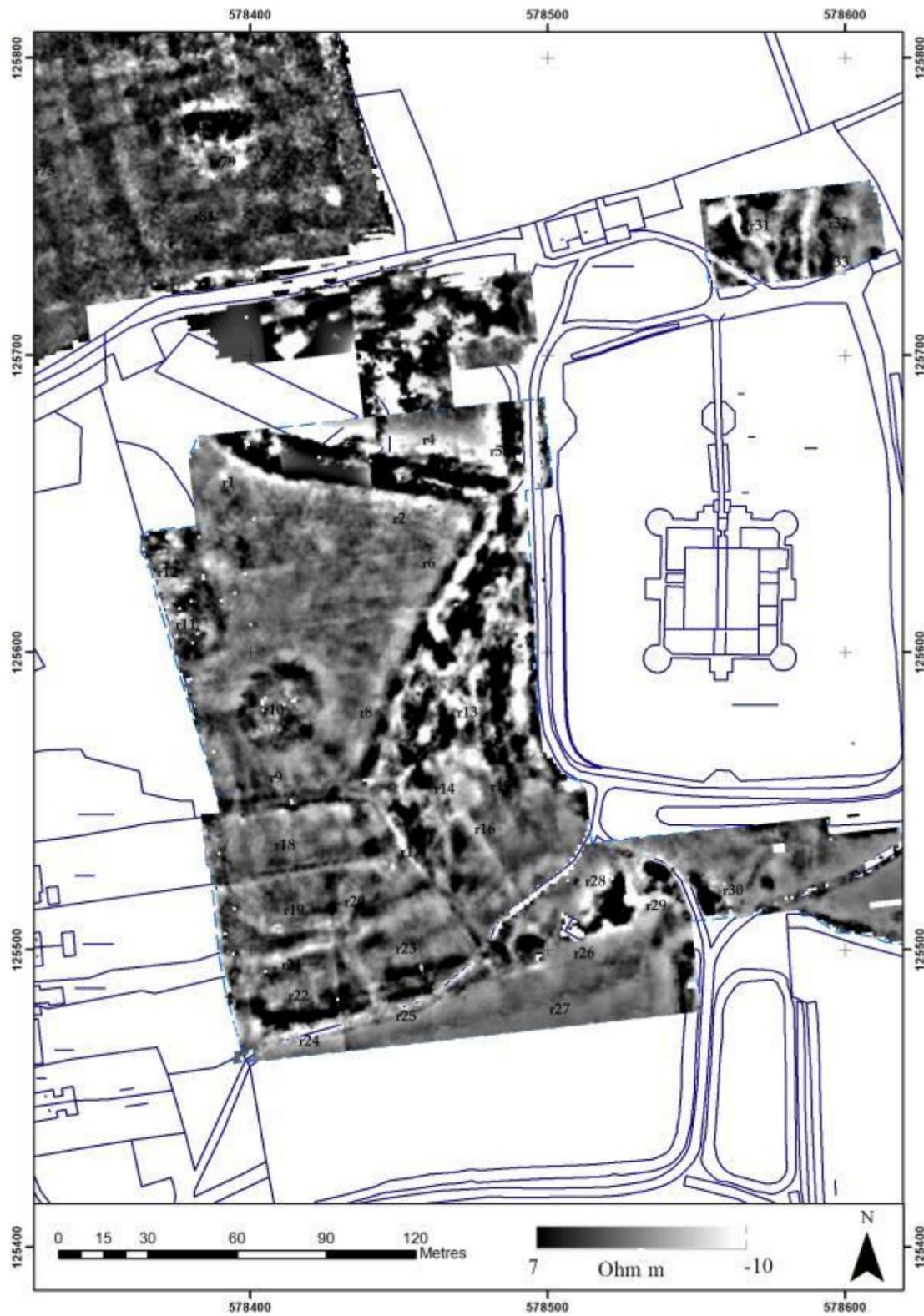


Figure 39 Greyscale image of the resistivity survey results from the vicinity of the Castle (west)

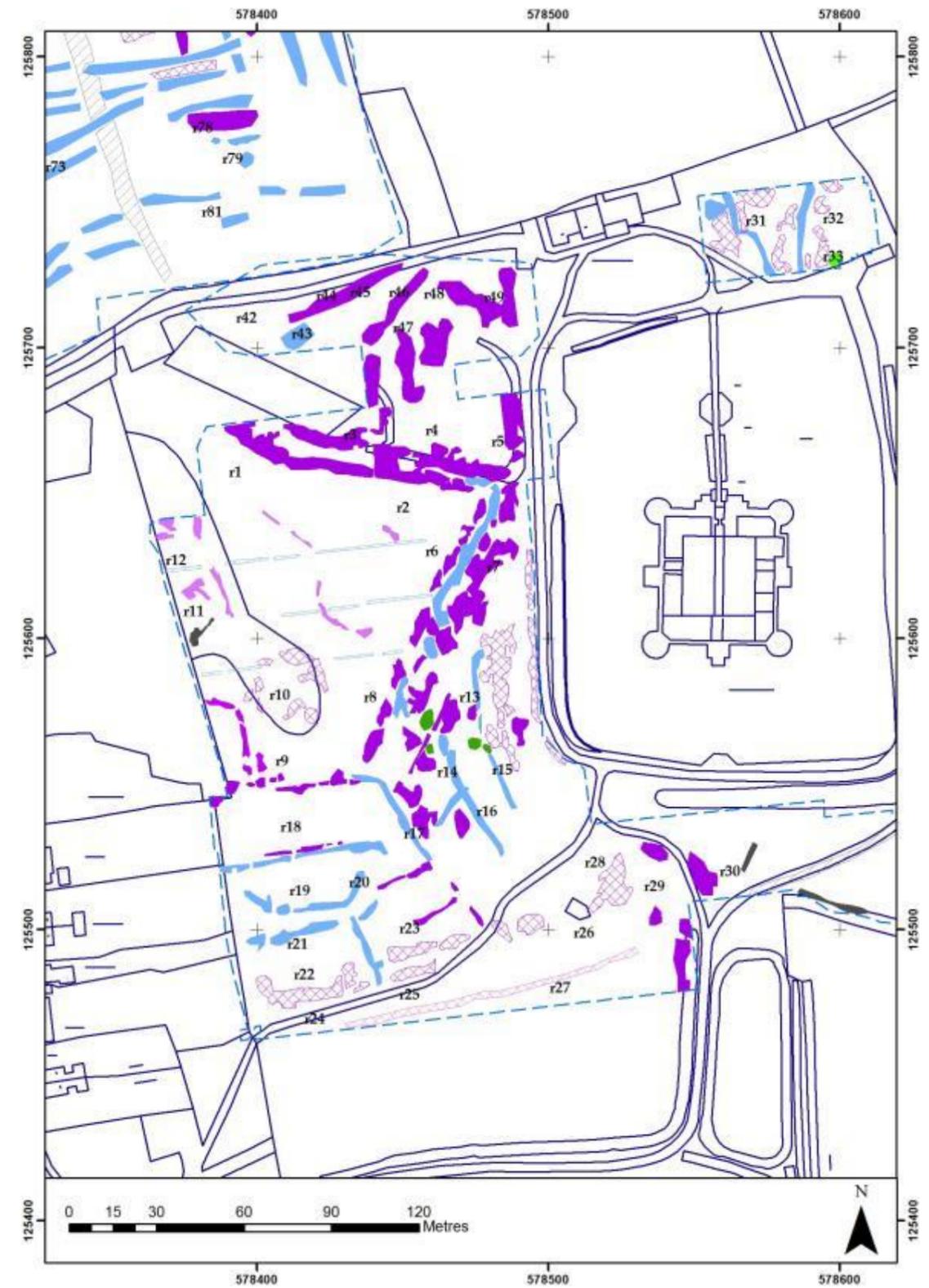


Figure 40 Interpretation plot derived from the resistivity survey results from the vicinity of the Castle (west)

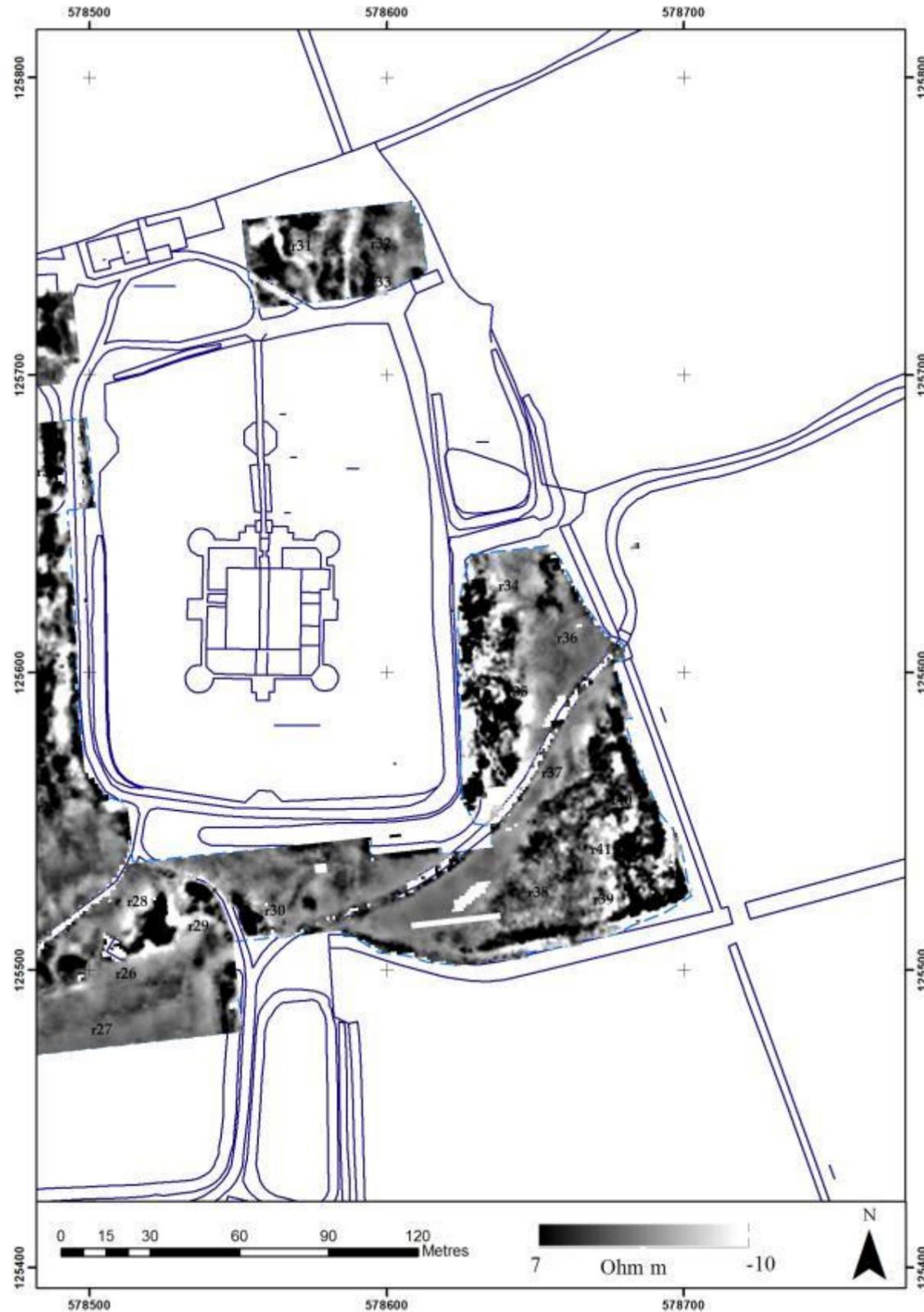


Figure 41 Greyscale image of the resistivity survey results from the vicinity of the Castle (east)

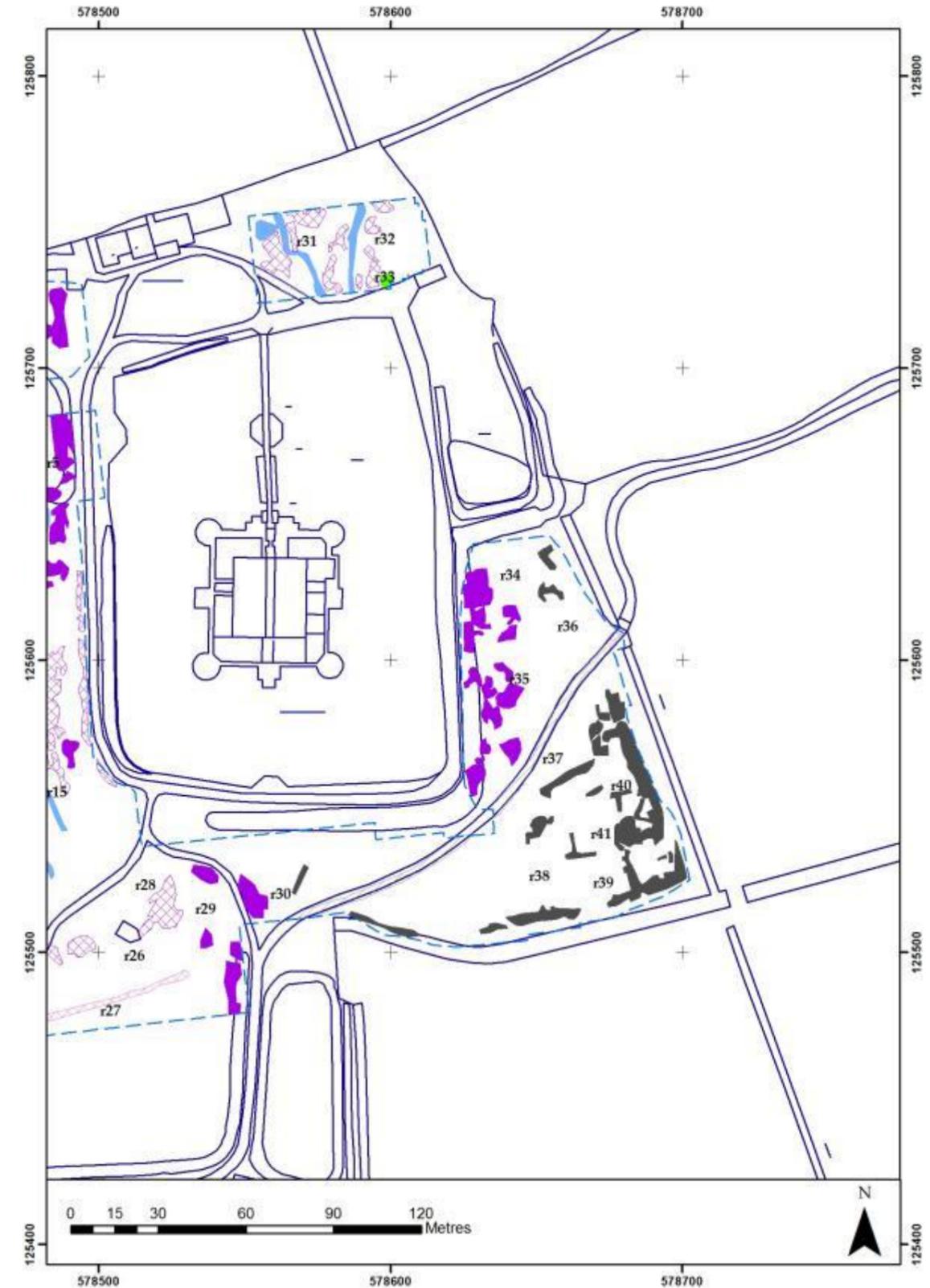


Figure 42 Interpretation plot derived from the resistivity survey results from the vicinity of the Castle (east)



Figure 43 Greyscale image of the resistivity survey results from Doke's Field



Figure 44 Interpretation plot derived from the resistivity survey results from Doke's Field



Figure 45 Greyscale image of the resistivity survey results from the cricket field

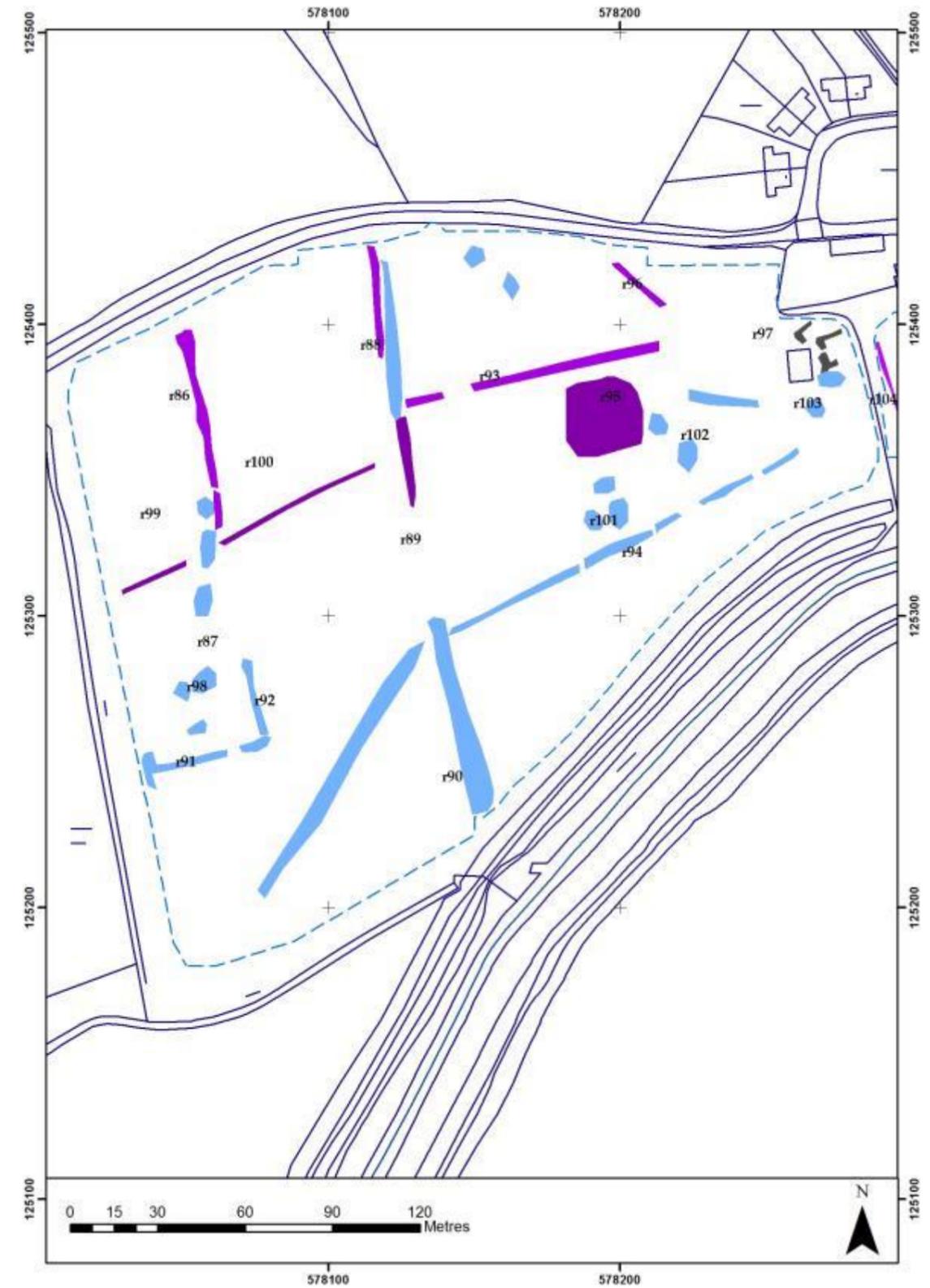


Figure 46 Interpretation plot derived from the resistivity survey results from the cricket field



Figure 47 Greyscale image of the resistivity survey results from the pub garden

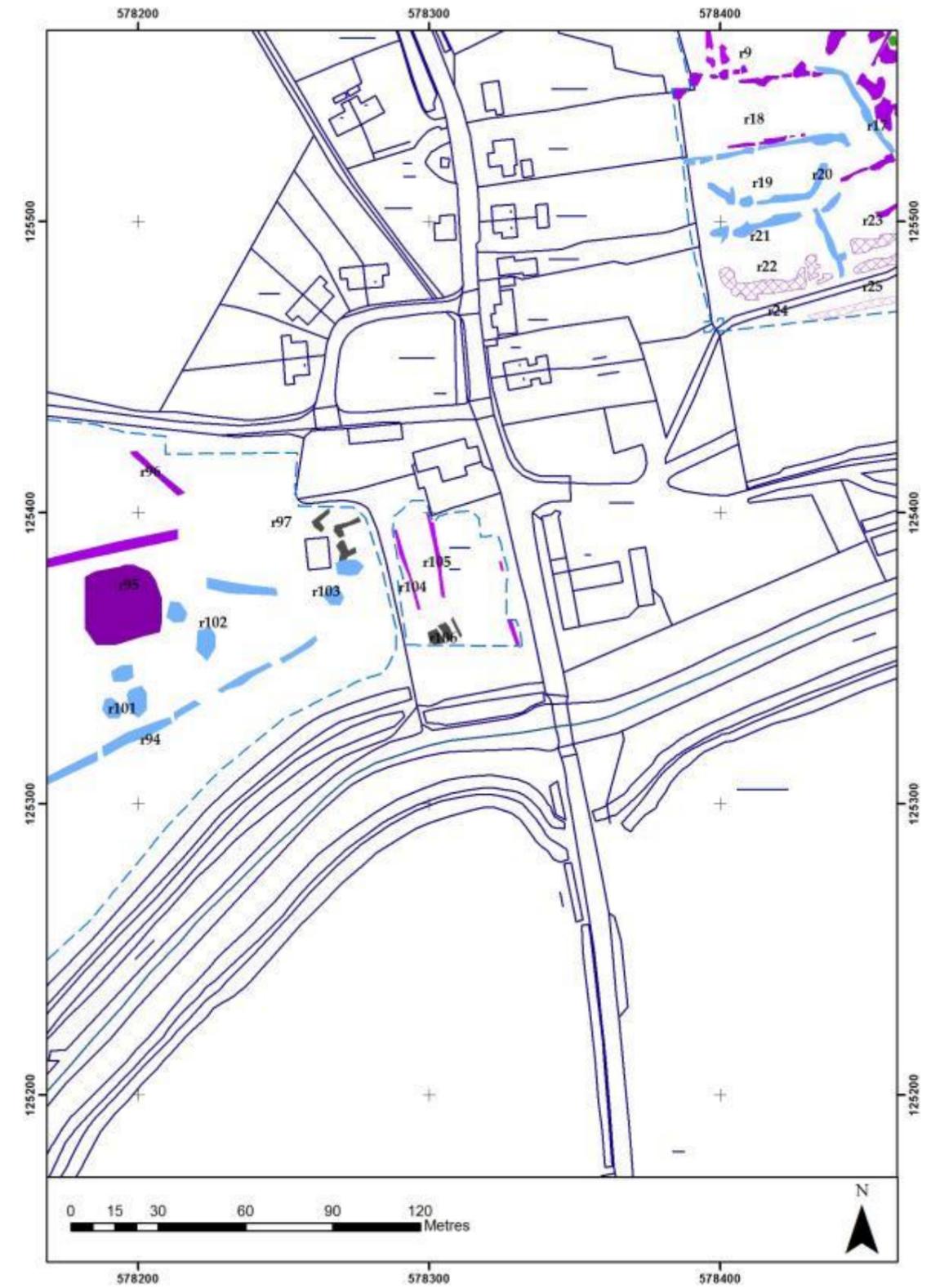


Figure 48 Interpretation plot derived from the resistivity survey results from the pub garden



Figure 49 Greyscale image of the resistivity survey results from the Viewing Platform

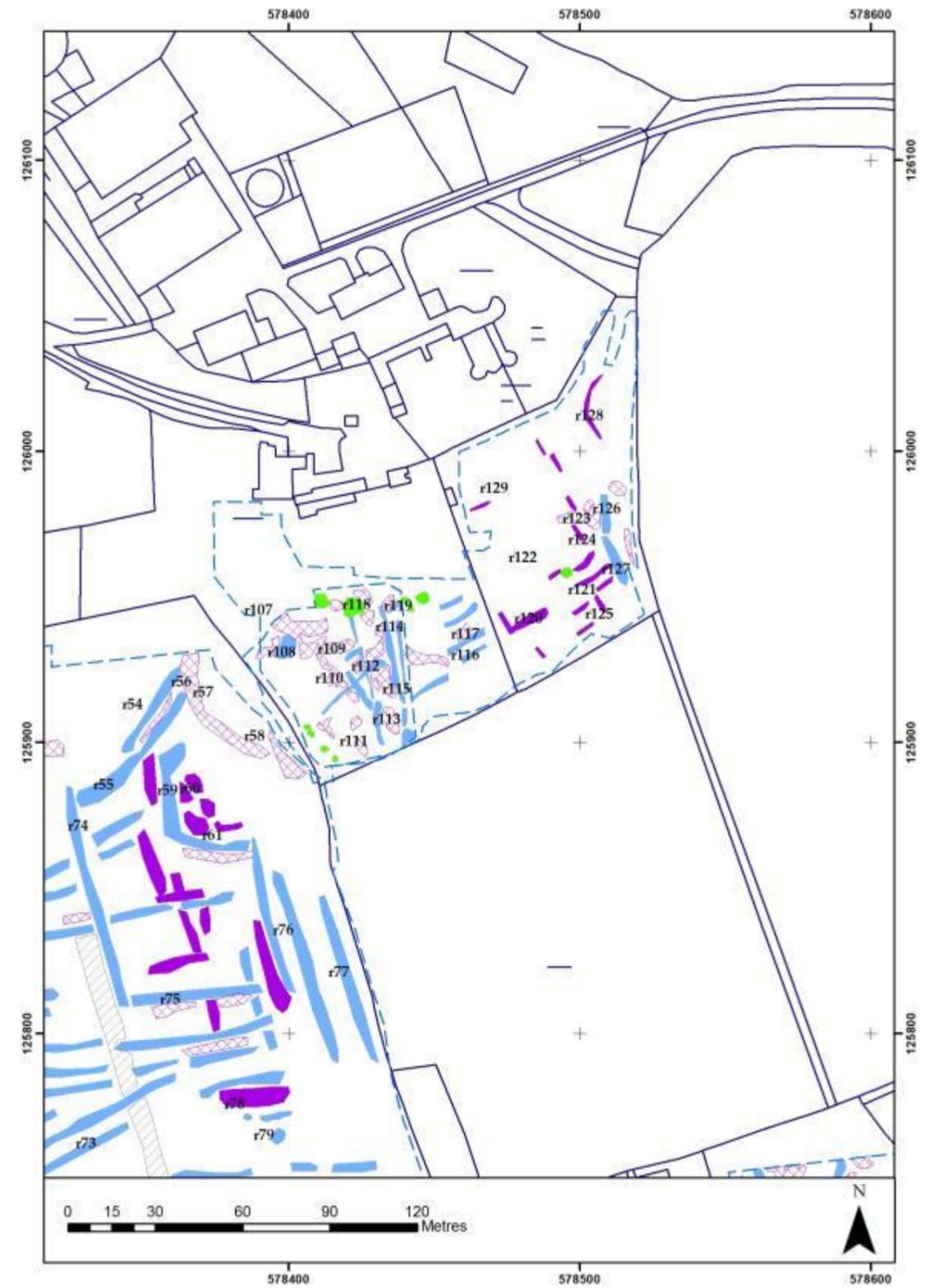


Figure 50 Interpretation plot derived from the resistivity survey results from the Viewing Platform

A number of features are visible in the resistivity survey results for Doke's Field (Figs.43 and 44). High resistance measurements mark the northern edge of the field [r50], and a series of linear high resistance anomalies [r51] and [r52] suggest possible structural remains on the high ground at the northern end of the field, surrounded by a low resistance ditch feature [r53]. Two low resistance curvilinear anomalies [r54] and [r55] mark terraces curving round the top of the field with a high resistance curvilinear anomaly [r56], [r57] and [r58] marking the possible western edge of the high ground of the Viewing Platform.

A second low resistance curvilinear anomaly [r59] together with high resistance responses [r60] and [r61] marks the top of the high ground in the north-eastern corner of the field. A band of high resistance readings [r62] – [r65] measuring some 227m in length and 6m across marks the line of a possible Roman road across the field. A second track [r66] and [r67] which deviates from the former is also visible.

Several high resistance terrace features [r68] run along the western side of the field from north to south.

However these are cut by a series of low resistance anomalies [r69], [r70], [r71], [r72] and [r73] each measuring 4-5m in width, and suggesting terracing or plough furrows running over the field. A low resistance linear anomaly [r74] runs from north to south, suggesting a ditch or similar feature contemporary or later than the terracing. This turns to the east [r75] demarcating a roughly rectangular area. Three similar features [r76] and [r77] run from north to south along the eastern edge of the field. Several short ditches and terraces [r78] and [r79] cover the south-eastern corner of the field, with two longer low resistance features [r80] and [r81] marking ploughed terraces. A small rectilinear high resistance anomaly [r82] and [r83] is located along the western edge of Doke's Field. Two high resistance anomalies [r84] and [r85] mark a funnel shape, possibly derived from natural sand deposits, perhaps showing an entrance into the field.

The resistivity survey results in the cricket field (Figs 45 and 46) indicate several interesting features, although the depth of alluvium in the field makes some of the results quite faint. A drainage feature [r86] runs from north to south across the field,

together with a series of low resistance discrete anomalies [r87] which may indicate pits. A second drainage feature [r88], [r89] and [r90] visible as low and high resistance responses shows a further field drain. A low resistance rectilinear anomaly [r91] and [r92] is visible in the western part of the field. Two drainage features run across the field from west to east. The first [r93] is high resistance, suggesting rubble infilling, and measures 90m in length. The second [r94] is low resistance, running for a distance of 140m, before turning and running towards the upstream course of the Rother. A high resistance discrete anomaly [r95] marks the cricket square. In the north-eastern part of the field a high resistance linear anomaly [r96] is visible, and a rectilinear [r97] anomaly marks a possible structure.

A number of low resistance discrete anomalies [r98] and [r99] mark possible pits in the western part of the field. These are also visible in the centre [r100] and to the east [r101], [r102] and [r103]. In the pub garden (Figs 47 and 48) two high resistance linear anomalies [r104] and [r105] mark field boundaries, and a rectilinear anomaly [r106] suggests remains of a possible structure.

On the Viewing Platform (Figs 47 and 48) the top western edge of the platform is marked by high resistance linear bands of readings [r107] and [r109] marking terrace edges with a low resistance deeper deposit [r108]. A linear high resistance anomaly [r110] runs from north to south with several discrete high resistance features, possibly indicating sandy natural deposits. The whole area is crossed by low resistance linear anomalies [r112] – [r115] marking both drainage channels and field boundaries. Several parallel linear anomalies [r116] and [r117] mark the easternmost part of the west of the platform. Several pit features [r118] and [r119] are located along the northern side of the platform.

The eastern part of the platform has a roughly rectilinear series of anomalies [r120] and [r121] marking an area of space [r122] some 35m by 25m. The eastern edge of this is defined by high resistance linear responses [r123] and [r124] and a smaller rectilinear feature [r125] is located on the southern edge of the platform.

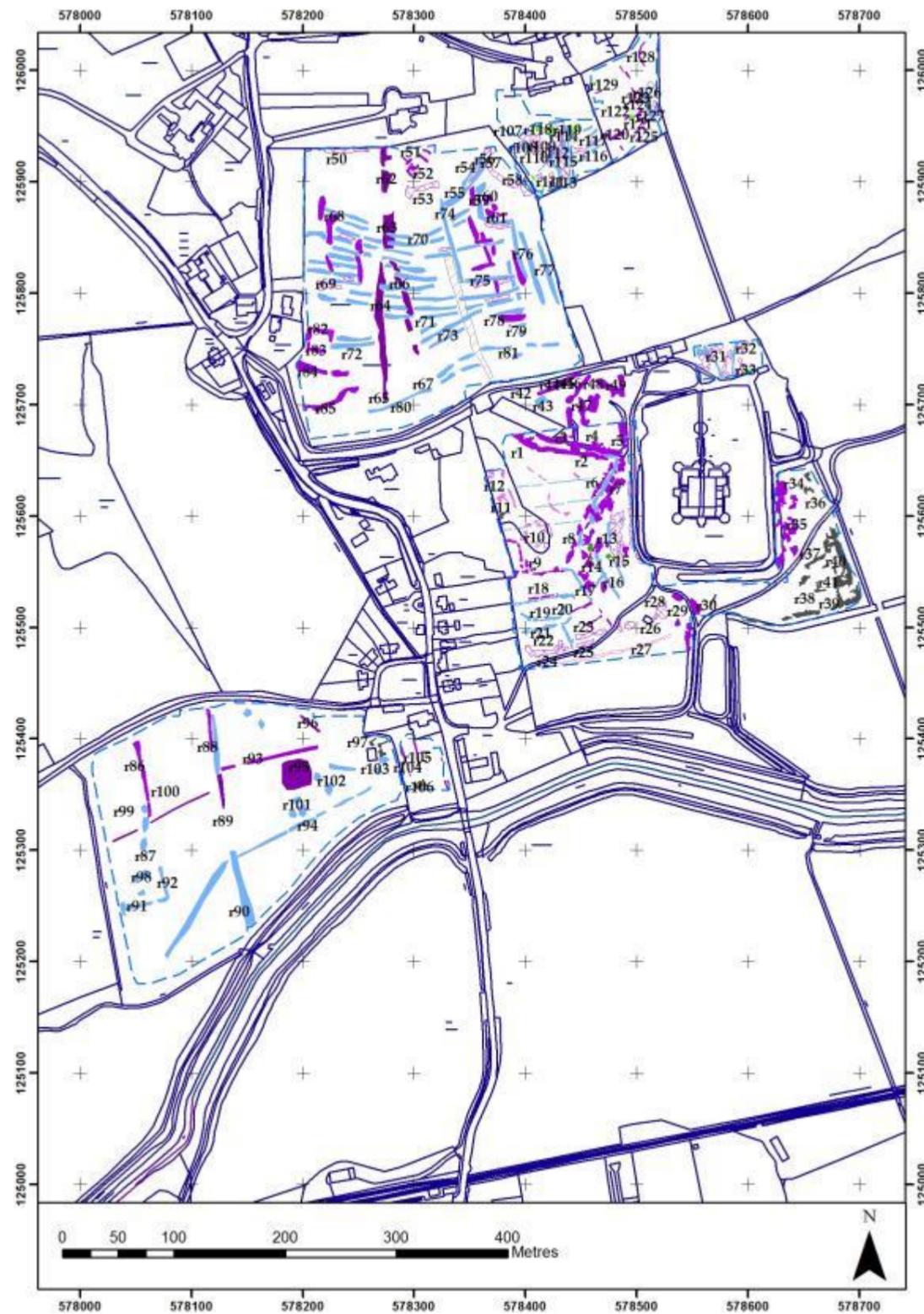


Figure 51 Interpretation plot derived from the resistivity survey at Bodiam Castle 2010 – 2012

A low resistance linear anomaly [r126] and [r127] marks a possible pathway through the area, and a faint curvilinear anomaly [r128] and linear anomalies [r129] are situated on the ridge, although the results seem to indicate a great level of erosion along the top of the ridge.

3.5 The GPR Survey Results

The GPR results to the west of the castle (Figs 52 and 53) corroborate the results of the both the resistivity and magnetometry, and indicate the presence of discrete high amplitude features and rectilinear anomalies. A rectilinear feature [g1] is located close to the boundary feature to the west, with several smaller anomalies [g2] and [g3] located alongside the castle moat. In the west of the survey area a small rectilinear anomaly [g4] some 5m across marks a possible structural feature, with several discrete anomalies [g5] marking the location of possible kiln or smelting features. A further rectilinear anomaly [g6] is also located close to the south west corner of the castle moat.

The GPR survey of the castle interior is contained in a separate archive report.

To the south-east of the castle (Figs 54 and 55), a number of anomalies appear in the GPR survey results which correspond with the results of the resistivity survey. A winding high amplitude anomaly [g21] and [g22] shows the hard standing of a modern footpath. Several high amplitude bands of readings are

located [g23] and [g24] in the vicinity of the bank surrounding the castle moat, suggesting stonework located in the embankment. A linear high amplitude anomaly [g25] and [g26] marks a possible wall or area of revetting adjacent to a modern drainage channel. This is matched by a similar feature running orthogonally to the south [g27] and a third feature [g28] the composition of which may indicate the remains of a structure.

In the cricket field (Figs 56 and 57) a high amplitude linear anomaly [g29] and [g30] running north-west to south-east, showing the line of a modern field drain, is cut by a second anomaly [g31] and [g32] marking a possible ditch or channel. A short linear anomaly [g33] is located to the east and a series of linear anomalies [g34] – [g38] show the location of field drains.

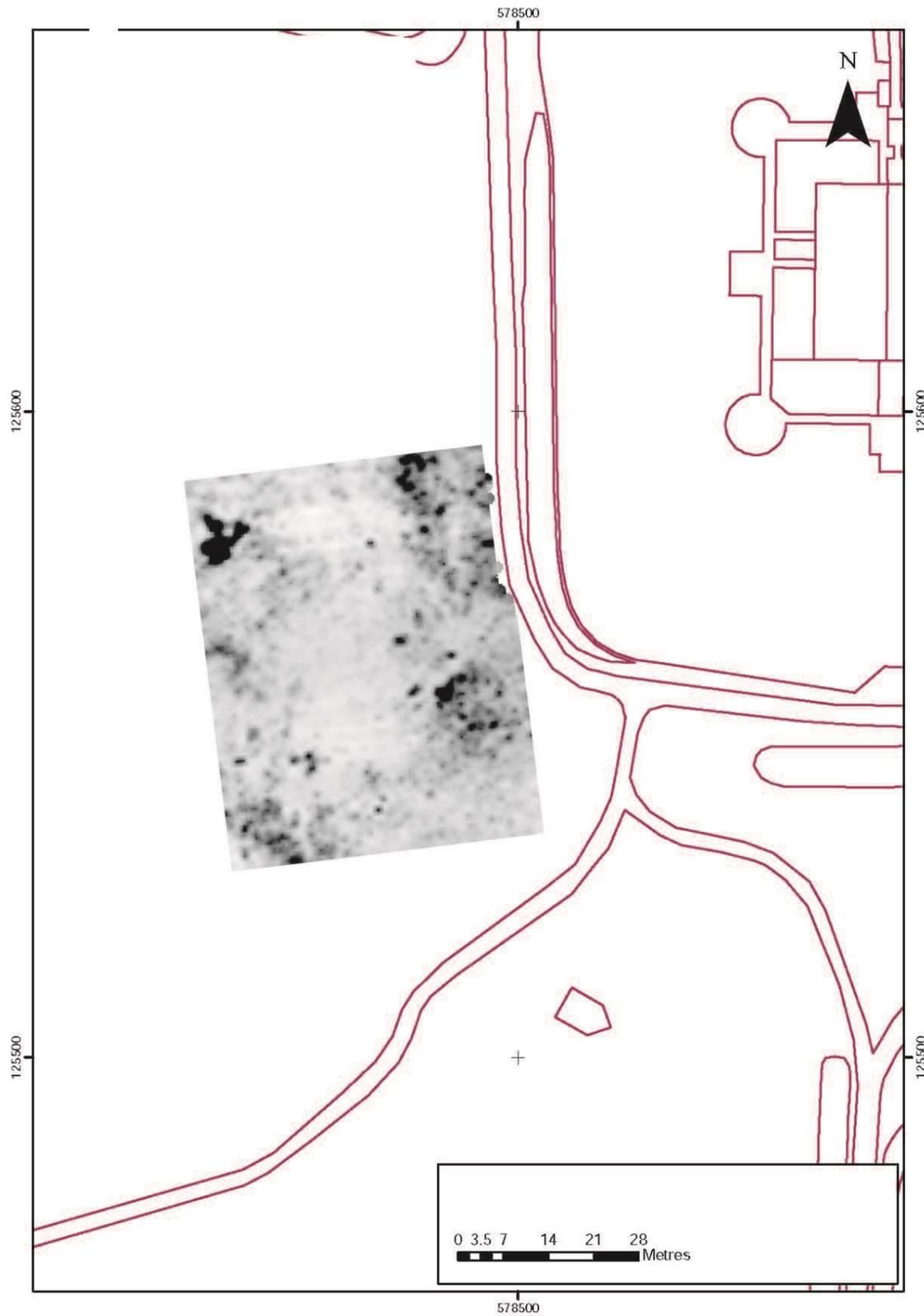


Figure 52 Ground Penetrating Radar results from the area to the south-west of Bodiam Castle



Figure 53 Interpretation plot derived from the Ground Penetrating Radar results from the area to the south-west of Bodiam Castle



Figure 54 Ground Penetrating Radar results from the area to the south-east of Bodiam Castle

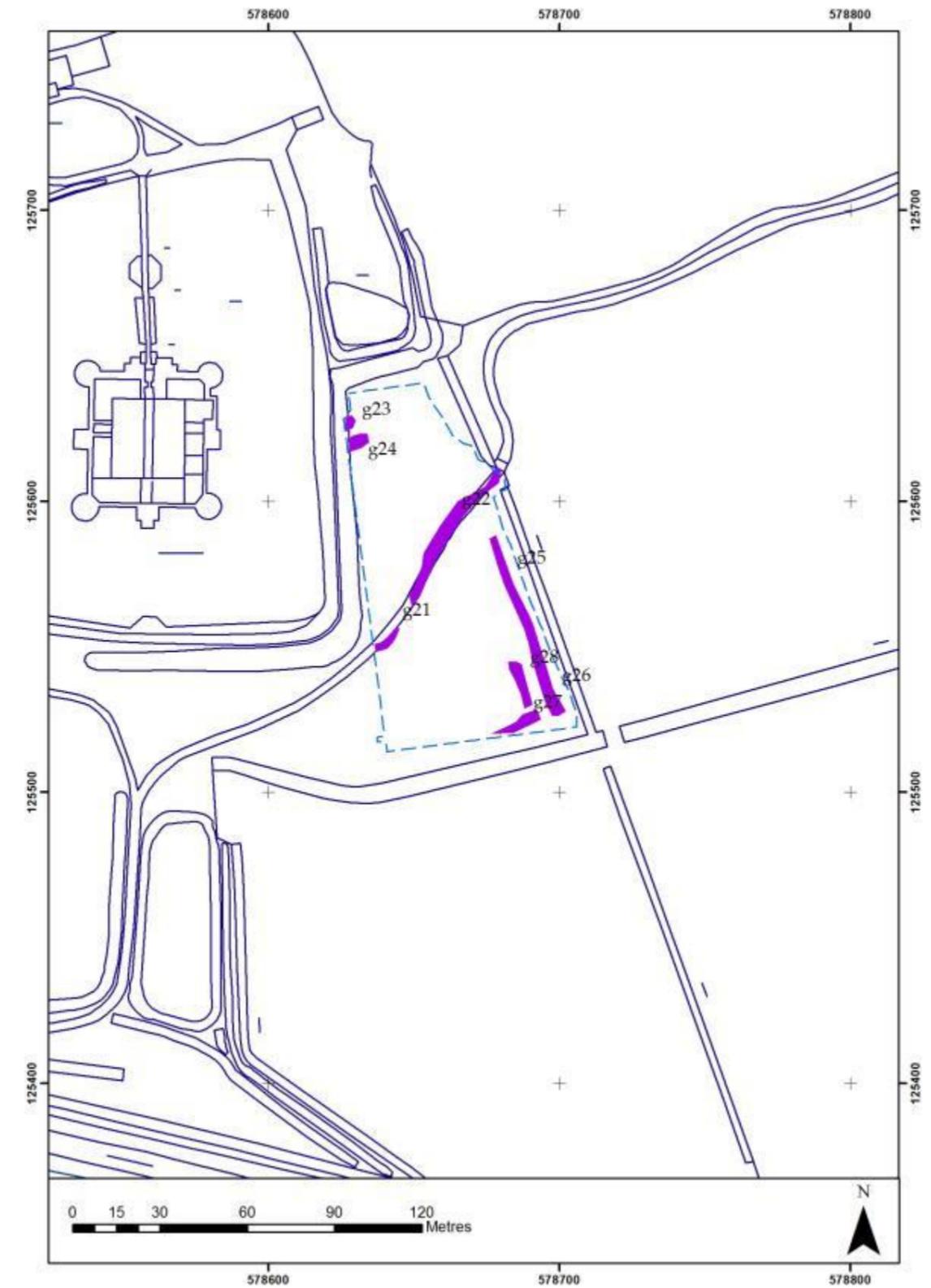


Figure 55 Interpretation plot derived from the Ground Penetrating Radar results from the area to the south-east of Bodiam Castle



Figure 56 Ground Penetrating Radar results from the cricket field

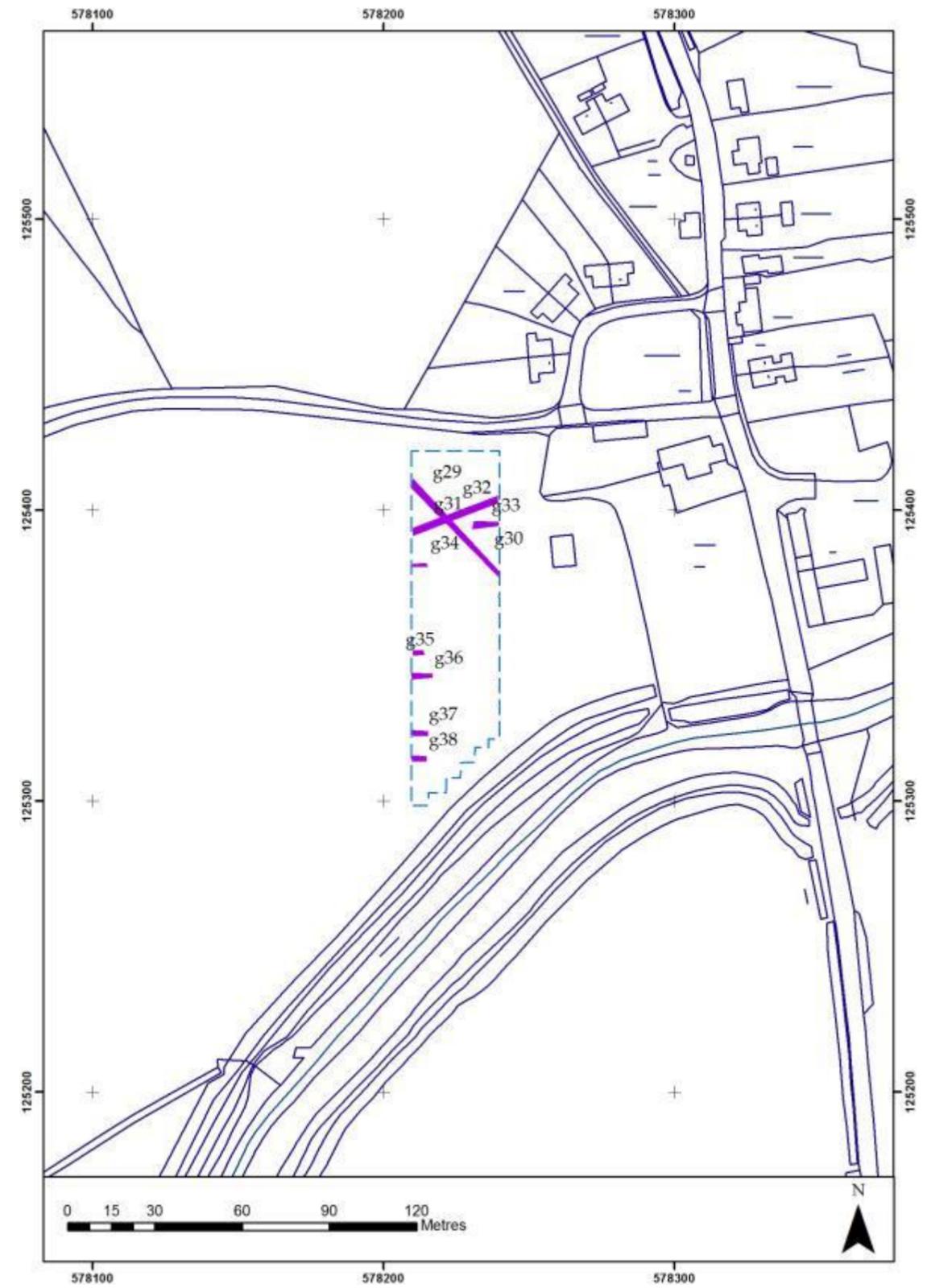


Figure 57 Interpretation plot derived from the Ground Penetrating Radar results from the cricket field

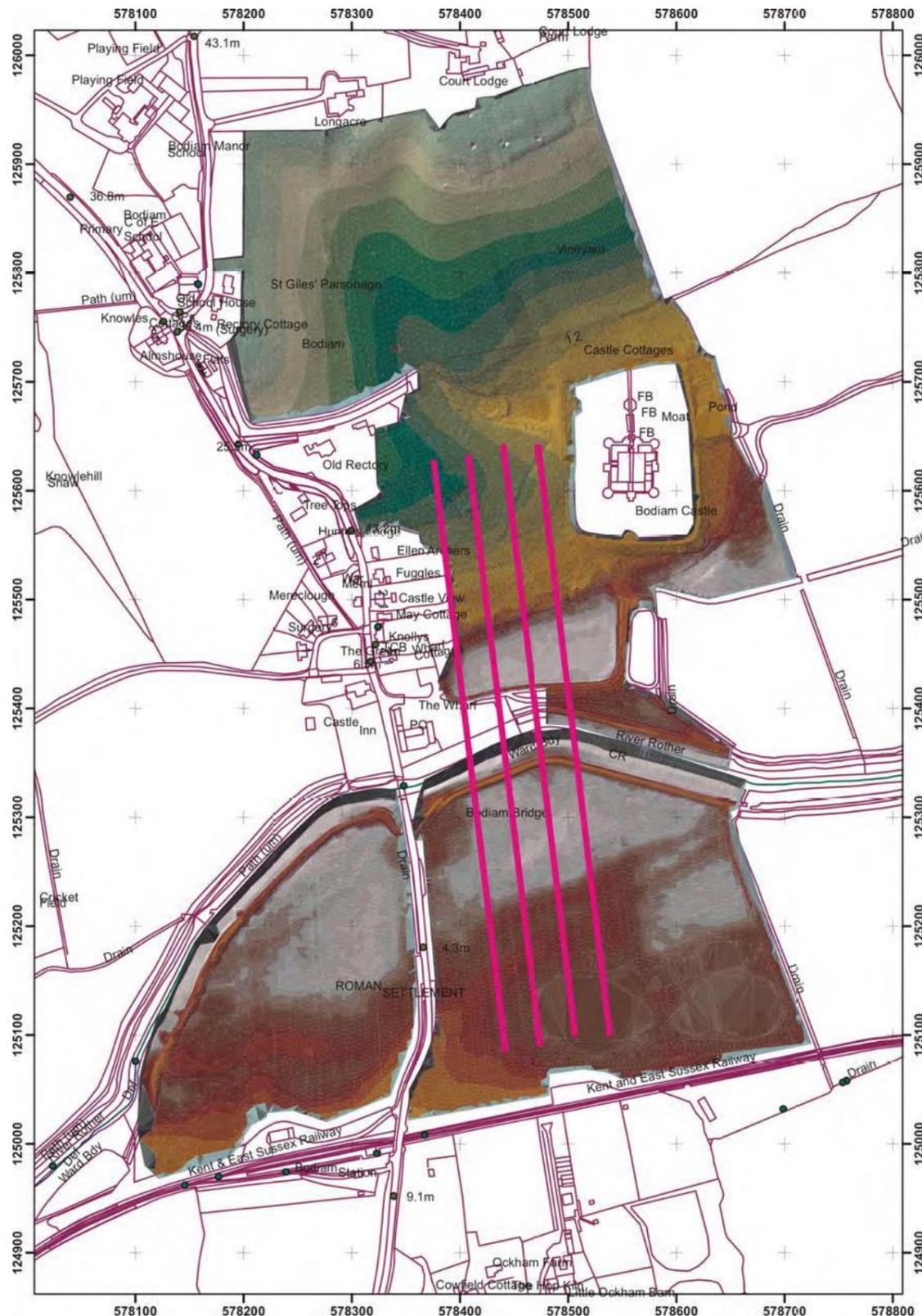


Figure 58 Location of the ERT profiles, from west to east E2000, E2030, E2060 and E2090

3.6 The Electrical Resistivity Tomography

Four electrical Resistivity tomography (ERT) profiles were conducted across the Rother valley (Fig. 58) stretching from north to south, and covering the ground between the main Hastings road and the eastern edge of the 'Cricket Ground'.

Profile E2000 (Fig. 59) shows a band of low resistivity [1] and [2] running across the major extent of the valley floodplain for over 300m, and to a depth of 8-10m. An underlying band of high Resistivity readings [3] is visible. A zone of higher Resistivity [4] runs across the floodplain in the centre of the profile. This is confined to the north by a broad area of low resistivity [5] measuring 90m across, a high resistivity area marking the area around the modern dyke to the south of the Rother, and low resistivity area marking the current channel of the river [6]. Along the northern part of the profile, underlying the 'Cricket Ground' and the terrace to the north, the resistivity measurements are high [7] and [8] marking the sands of the terrace.

The profile of data at E2030 shows a slightly higher resistivity area in the

southern part of the floodplain [9], and a broader low resistivity area [10] and [11] corresponding both to the ponds in the field, and to the floodplain as a whole. A higher resistivity zone [12] marks the slightly higher ground to the south of the modern dyke, and a low resistivity area [13] marks the current course of the river. The zone to the north of the Rother [14], [15] and [16] indicates the sands of the terraced ground.

Profile 3 (Fig. 60) at E2060 illustrates a more broken sequence of high and low resistivity values. Three higher resistivity areas [17], [18] and [19], each stretching for around 20m, mark variations in the ancient river deposits. A broader low resistivity area [20] marks the floodplain closer to the current channel of the Rother. A band of high resistivity [21] is situated under the 'Cricket Ground' and the high resistivity values continue to the north [22] and [23], marking the start of the terraces to the north of the Rother. The spread of measurements under the 'Cricket Ground' suggests that the terrace was partly obliterated by the creation of the level ground to the north east of the Wharf.

A similar pattern of measurements are visible in the profile E2090. An area of low resistivity readings [24] marks the southern part of the profile, and is broken by a narrow band [25] of higher values, then a broad area of high Resistivity [26] situated between 8 and 15m below the modern ground surface. A further deep area of high resistivity [27] is located closer to the Rother, and several deep high resistivity anomalies [28] are situated to the north of the modern river channel. High resistivity values [29] and [30] mark the terrace to the north, and also underlie the 'Cricket Ground'.

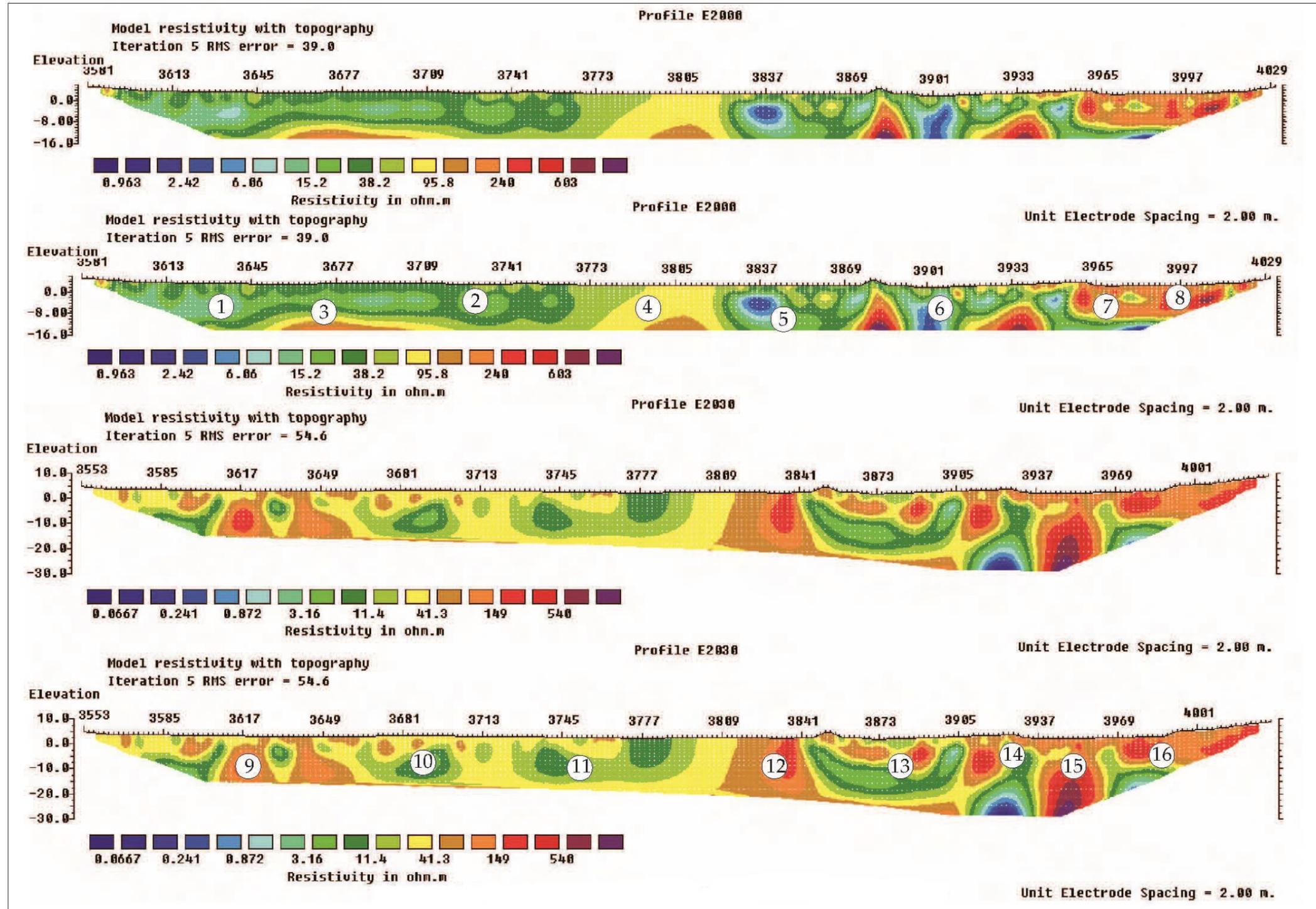


Figure 59 Images of profiles E2000 and E2030 from the ERT data (south end of profiles to left, north end to right)

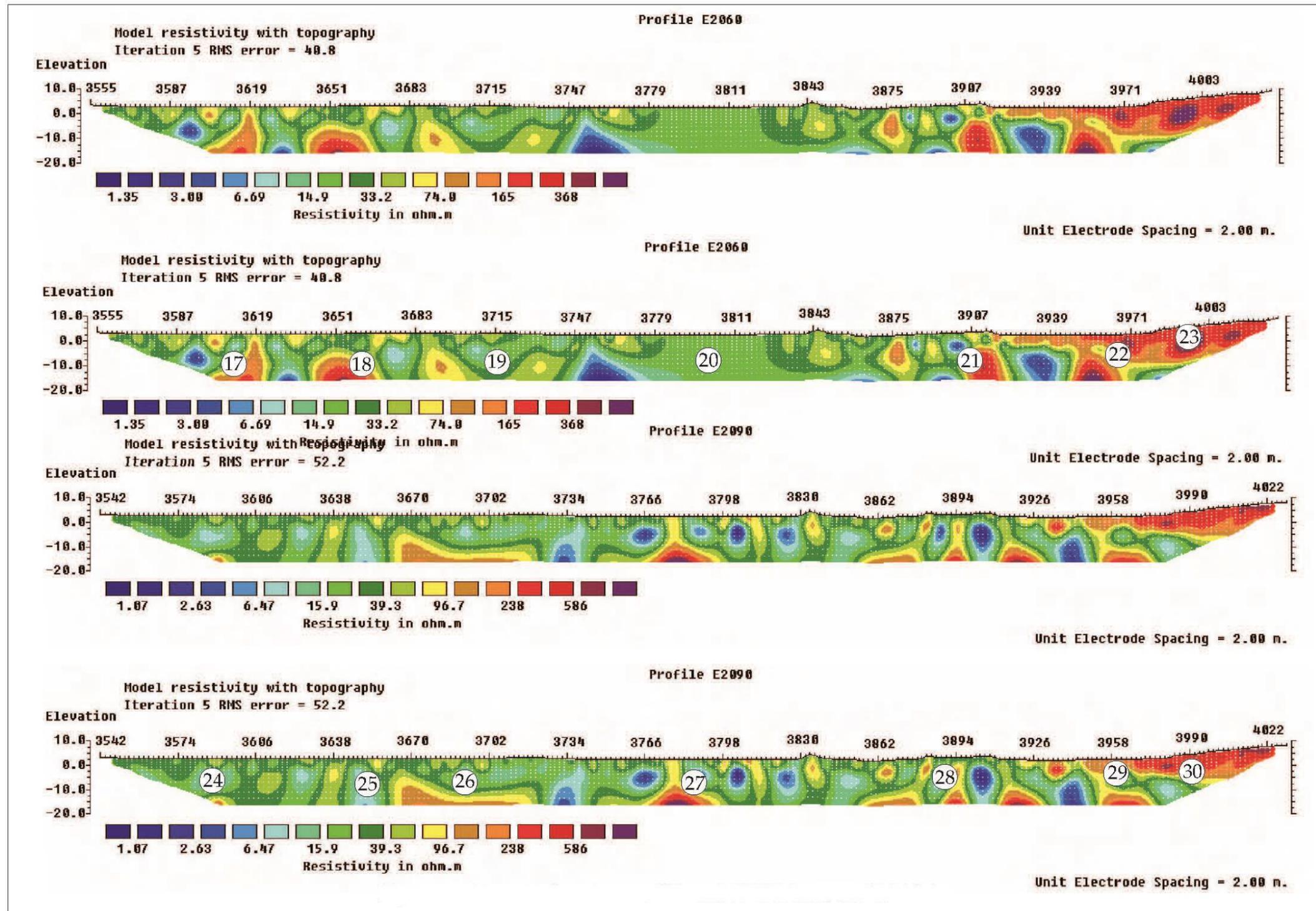


Figure 60 Images of profiles E2060 and E2090 from the ERT data (south end of profiles to left, north end to right)

4. Discussion

The results of the three seasons of survey work at Bodiam (Fig. 63) have provided new and interesting data relating to the interpretation of the castle and the surrounding landscape.

In terms of the castle, the results of the building survey show that some features on the plan of Curzon are not represented, such as the cupboard at basement level on the eastern tower side of the castle. However, the general layout and geometry of the castle plan as a whole respects that of the Ordnance Survey and other plans, with a change in the line of the causeway and the relative positions of the walls and towers in place.

Results of the topographic and geophysical surveys in the immediate environs of the castle indicate a substantial quantity of archaeological material and features relating to the development of the estate, and the changing settlement and environment relating to the river Rother. To the west of the castle the topography, resistivity and magnetometry all show the presence of a substantial bank and ditch

feature, running as a so-called cascade to the north [r1] – [r4] then cutting off the eastern part of the low ridge [r5]. The anomalies seem to represent two separate features, with the high resistance values where the cascade meets the bank and ditch also returning to the north suggesting that the bank and ditch feature may predate the cascade, and continue to the north. The resistivity survey results are as yet incomplete but the bank and ditch may conceivably continue to the north. The relationship between this feature and the tenements to the south [r16] and [r17] is also a matter for debate. The topography suggests that the features are all of similar type and merge, with the bank and ditch forming the back of the tenement plots with a dog-leg in the line of the feature. The resistivity in fact suggests that the bank and ditch become more broken to the south and disappear under the tenement boundaries, turning directly south as a series of discrete high resistance bands of readings. The resistivity shows that the medieval tenement boundaries cut the bank and ditch feature, signifying that the feature may predate the formation of the tenements. The presence of high resistance rectilinear anomalies in the tenement of Castle

View and Fuggles suggests the presence of buildings in the eastern portion of these tenements.

The anomalies in the resistivity on the higher slopes of the ridge [r10], [r11] and [r12] mark the presence of archaeological features. Those further to the north and west, rectilinear in form, suggest either that the garden of the Old Rectory extended further to the east than is now apparent, or that a number of buildings were situated in this area. The latter notion is more convincing, as there is no significant boundary line extending from north to south in the features, and the variations in measurements are rectilinear and suggest buildings. Feature [r10] is ovate, and may be formed from the presence of trees in a small copse on the ridge. However some of the variations in sediment suggested by the results are over 6m across, and the feature itself measures 28m by 22m. These may therefore represent natural changes in the geology on the ridge, or mark possible archaeological features. From the topographic survey, it is apparent that a possible road runs from Dokes's Field and down through the grounds of the Old Rectory. This may be a Roman road, and probably joins up with the line of

the modern road to Hastings. It would however be useful in future to survey within the grounds of the Old Rectory to locate the line of this feature.

The features between the bank and ditch and the moat of the castle warrant some attention. Results of the magnetometry indicate a significant concentration of ferri-magnetic and burnt features in this area [m26] and [m27]. Some of these suggest very distinctive kiln features, and in one instance a rectilinear structure associated with a kiln. Others are more suggestive of slag heaps of residue from firing and the remnants of other industrial activity. The location of these features seems to respect the presence of the tenement boundaries immediately to the west, and this may indicate that the industrial workings post-date the village tenements. If so, these may relate to the phase of construction for the castle at Bodiam, for the preparation of materials such as lime. Alternatively they may relate to later development of the estate and castle by individuals such as Curzon.

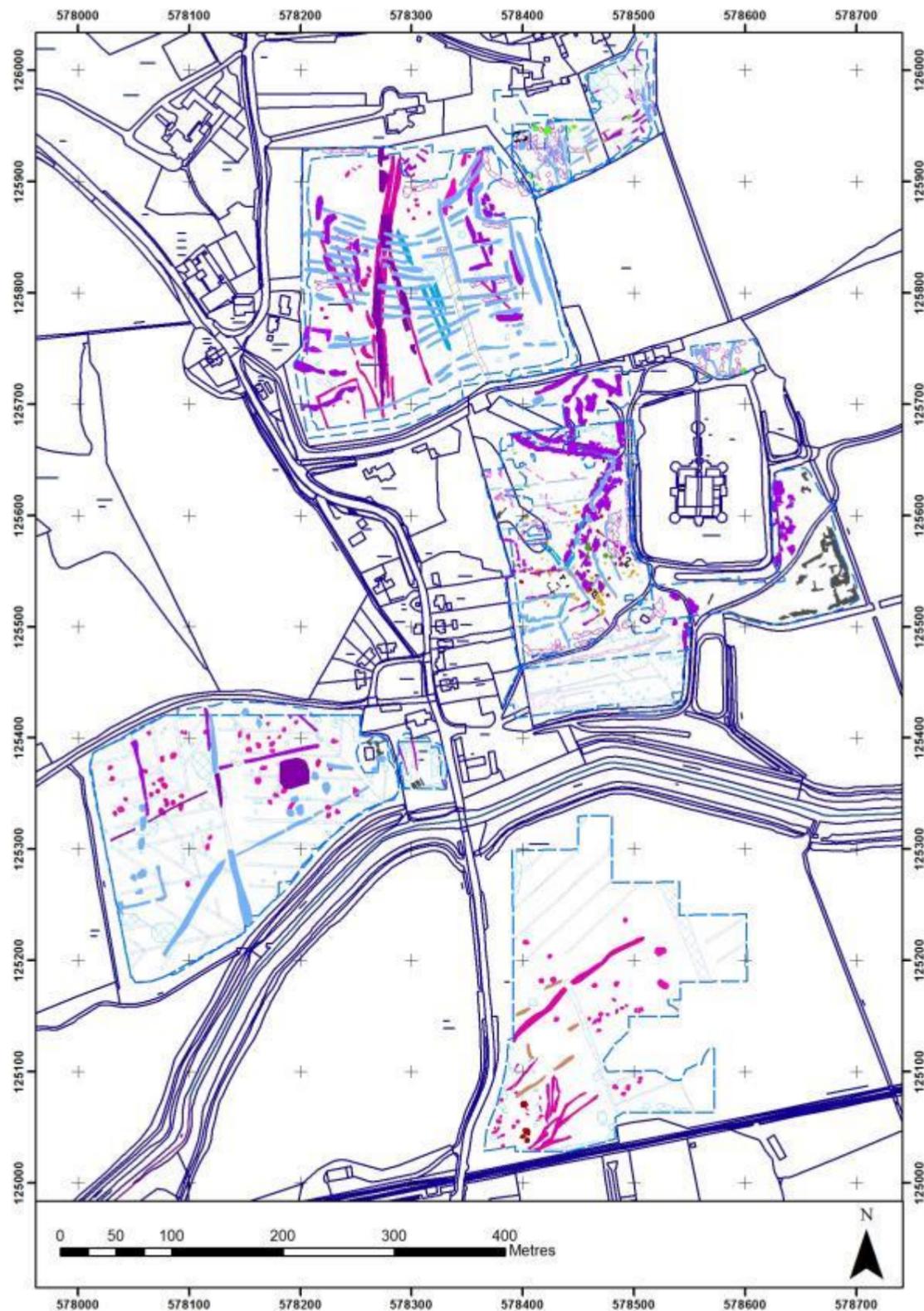


Figure 61 Map showing an overlay of the interpretations for the magnetometer and resistivity survey results

Other dipolar anomalies in the magnetometry, especially those located on the low ridge to the west of the castle may be associated with other kilns or firing of material, alternatively dump deposits of iron ore. One possibility is that they relate to iron smelting from the Iron Age and Romano-British period, located on the valley sides above the settlement. Similar features are reported on the south side of the Rother (Kaminski 1995, 200ff) and elsewhere in the Weald.

A significant concentration of anomalies is visible in the resistivity results to the south east of the castle [r38] – [r41], suggesting the presence of stone-built structures, and two revetted channels, one running from west-east, the other from north to south. The presence of the mill pond to the east of the castle, and the fall in the terrain as one proceeds south, would suggest that the anomalies mark the presence of a possible mill and mill race associated with the ponds at Bodiam. This data is reinforced by results of the 2011 GPR survey of these features, which also indicate the two revetments. The current hypothesis is that a mill building may have been located to the south of the castle, close to the

present location of the World War II pillbox. However the presence of these features in the survey results may indicate a lower and more easterly location for the mill.

Results from the area to the north and west of the castle are not as edifying as those from elsewhere in the vicinity. The presence of sands close to the ground surface, and the dry survey season conditions in 2011 and 2012 obscured some of the results in the immediate vicinity of the cascades [r42] – [r49]. This suggests sand having been upcast from the creation of the cascades. Some possible bank features do show up however.

The area of Doke's Field did provide some new and very interesting features. A significant road, probably Roman in date, does cut through the field [m120] – [m125], and [r62] – [r65]. A second and probably later road also deviates from this original line heading to the south-east. The former road seems to lie on an alignment which would carry it through to the bridge crossing the Rother, some 500m to the south.



Figure 62 Map showing the location of the hand auger samples from the 2012 season

In addition to the road a number of terraces, pits [m128] – [m132] and an enclosure [m135] – [137] are visible on the western side of the field, on the edge of the ridge located to the west of Doke's Field. Some of these anomalies may indicate Iron Age or Romano-British features, possibly associated with cemetery activity close to the line of the possible Roman road. The entire field is also covered by broad low resistance anomalies suggesting ploughed terraces. They appear to be later than the main road feature, and may represent cultivation of Doke's Field in the medieval period.

The Viewing Platform is a more complicated area to understand. Although the earthworks are substantial, and some resistivity and magnetometry features indicate archaeology on the platform. There is little articulation in their form, and the area has patently been cut by modern drainage. Some pits and rectilinear structural features are present, but it is difficult to place these in context with the presence of housing immediately to the north, and evidence of erosion on the highest point of the ridge.

Results of the topographic survey, resistivity, ERT and magnetometry to the north and south of the Rother indicate a number of features which may require further investigation. The previous courses of the Rother are clearly indicated in the results of the topographic survey (B'), (F') and (G'), and in the magnetometry [m79] and [m80] but a number of large waterlogged features are also located along the southern edge of the floodplain. The three broad low-lying areas may represent the presence of medieval ponds, but their size (in the region of 110m across) suggests that they may be associated with a harbour area or other feature to the south of the Rother. The presence of possible kiln features, and linear anomalies in the magnetometry [m72], [m73] and [m78] suggest the presence of an extensive settlement of Romano-British date along the low sand terrace to the south of the river. The results of the 2012 survey show runoff of ferrous material from the terrace overlooking the valley, and a number of rectilinear features, and possible industrial working on the plain.

The location of the Rother and the nature of the terrace to the north of the course of the river is also of

interest. The topography, together with the results of the ERT and resistivity seem to indicate that the terrace has at some stage been modified to create the flat low-lying area of the 'Cricket Ground'. It may be that the line of the river was changed slightly in the past, or that the area of the low ground was expanded slightly prior to the construction of flood defences along the Rother. The high resistivity readings of the terrace stretching under the 'Cricket Ground' show this particularly well.

In the cricket field to the north of the Rother a number of discrete positive anomalies at first suggested pit or kiln features along the edge of the floodplain. However evidence from hand augering samples, four of which were conducted in 2012 (Fig. 64), indicated alluvial deposits to a depth of 1.5-2.0m, overlying protrusions of humic peaty material in the locations of these anomalies. It is possible that the difference in magnetic susceptibility of these deposits means that the magnetic features are purely a product of the Bronze Age peat layers underlying the alluvium, and they are not evidence of later Romano-British or medieval activity. Two linear features

in the cricket field may suggest the presence of a leat or drainage feature running upstream of Bodiam Castle towards the mill ponds near the castle. The southernmost of these [r94] may be particularly of interest.

5. Conclusions

The result of the archaeological survey at Bodiam Castle between 2010 and 2012 produced a large number of interesting and exciting features both within the castle, and in the surrounding landscape. The presence of a road, possibly of Roman origin, running from north-south through Dokes' Field was noted, and the presence of a large-scale bank and ditch feature to the west of the castle was also indicated. The plan of the tenements of Bodiam village, and the presence of possible structures within was also discovered. The presence of possible industrial features and structures to the west of the castle was noted, and these may require further investigation. In addition a comprehensive map of the topography of the environs of the castle was produced. The possible presence of mill buildings was discovered to the south-east of the castle. In the floodplain of the Rother valley the presence of features relating to a possible Romano-British settlement were noted, together with large waterlogged features in the topography. Possible Romano-British features were located in the western part of Doke's Field, also to the north

and south of the Rother, and medieval ploughed terraces were found in Doke's Field. Some features of archaeological significance were found on the Viewing Platform.

6. Statement of Indemnity

Whilst every effort has been made to ensure that interpretation of the survey presents an accurate indication of the nature of sub-surface remains, any conclusions derived from the results form an entirely subjective assessment of the data. Geophysical survey facilitates the collection of data relating to variations in the form and nature of the soil. This may only reveal certain archaeological features, and may not record all the material present.

Acknowledgments

Considerable advice and assistance was received from a number of sources in the completion of this survey. Permission for work in the immediate vicinity of the ruins was kindly granted by the National Trust. Our thanks go to George Bailey at the National Trust for commissioning the survey, and to Caroline Thackeray for assistance during the organization of the survey. Warm thanks are also extended to the English Heritage inspector for East Sussex for permission to undertake the survey and for advice on the nature of the site, and to the county archaeologist Casper Johnson.

At the Universities of Southampton and North Western in Chicago the assistance of a number of people is acknowledged. In particular many thanks go to Prof. Matthew Johnson initiating the field project and for providing enthusiasm and a guiding hand throughout. The help of Jim Wood and Sandra Plumb is gratefully acknowledged. Warm thanks also go to Prof. David Hinton for his support. In the field the hard and conscientious work of Kathryn Catlin is also gratefully acknowledged.

Finally the survey work in the 2010-12 seasons could not have been completed without the hard work of the second,

third year and postgraduate students from the Universities of Southampton and North Western.

Appendix 1 Details of Survey Strategy

Dates of Survey: 23rd March – 15th April 2010; 14th – 25th March 2011; 3rd – 24th August 2012

Site: Bodiam Castle, East Sussex

Region: East Sussex

Surveyors: University of Southampton, UK, North West University, USA

Personnel: University of Southampton Students, Dominic Barker, James Cole, Timothy Sly, Kristian Strutt, David Underhill, Kathryn Catlin

Geology: Ashdown beds, Cretaceous sandstone

Survey Type 1: Resistivity

Approximate Area: 17 hectares

Grid Size: 30m

Traverse Interval: 1.0m

Reading Interval: 1.0m

Instrument: Geoscan Research RM15 Resistance Meter

Gain: x10

Amplitude: 0.1mA

Survey Type 2: Magnetometer

Approximate area: 15 hectares

Grid size: 30m

Traverse Interval: 0.5m

Reading Interval: 0.25m

Instrument: Bartington Instruments

Grad 601-2 fluxgate gradiometer

Resolution: 0.1 nT

Trigger: Encoder

Survey Type 3: GPR

Approximate Area: 1.0 hectare

Traverse Interval: 0.5m

Instrument: Sensors and Software/GSSI

Antenna: 500Mhz/200Mhz

Survey Type 4: Magnetic Susceptibility

Grid Size: 10m

Instrument: Bartington MS-2

Magnetic Susceptibility Meter

Approximate Area: 15 hectares

Survey Type 5: Topographic Survey

Approximate Area: 20 hectares

Instruments: Leica TCR 800 total stations, 520 series GPS

Survey Type 6: Building Survey

Instrument: Leica TCR 800 total station with TheoLT interface

Appendix 2 - Archaeological Prospection Techniques Utilised by APSS

The following appendix presents a summary of prospection methods, implemented by Archaeological Prospection Services of Southampton (APSS), to determine the extent and nature of sub-surface archaeological structures, remains and features. The methodology usually applied by APSS and the BSR places an emphasis on the integration of geophysical, geochemical and topographic survey to facilitate a deeper understanding of a particular site or landscape.

Geophysical Prospection

A number of different geophysical survey techniques can be applied by archaeologists to record the remains of sub-surface archaeological structures. Magnetometer survey is generally chosen as a relatively time-saving and efficient survey technique (Gaffney *et al.* 1991, 6), suitable for detecting kilns, hearths, ovens and ditches, but also walls, especially when ceramic material has been used in construction. In areas of modern disturbance, however, the technique is limited by distribution of modern

ferrous material. Resistivity survey, while more time consuming is generally successful at locating walls, ditches, paved areas and banks, and the application of resistance tomography allows such features to be recorded at various depths. APSS also implement close contour topographic survey over areas of prospection, to record any important relic of archaeological features in the present topography, but also provide vital information on the changing ground surface for the geophysical prospection results. A summary of the survey techniques is provided below.

Resistivity Survey

Resistivity survey is based on the ability of sub-surface materials to conduct an electrical current passed through them. All materials will allow the passing of an electrical current through them to a greater or lesser extent. There are extreme cases of conductive and non-conductive material (Scollar *et al.* 1990, 307), but differences in the structural and chemical make-up of soils mean that there are varying degrees of resistance to an electrical current (Clark 1996, 27).

The technique is based on the passing of an electrical current from

probes into the earth to measure variations in resistance over a survey area. Resistance is measured in ohms (Ω), whereas resistivity, the resistance in a given volume of earth, is measured in ohm-metres (Ωm).

Four probes are generally utilised for electrical profiling (Gaffney *et al.* 1991, 2), two current and two potential probes. Survey can be undertaken using a number of different probe arrays; twin probe, Wenner, Double-Dipole, Schlumberger and Square arrays.

The array used by APSS utilises a Geoscan Research RM15 Resistance Meter in twin electrode probe formation. This array represents the most popular configuration used in British archaeology (Clark 1996; Gaffney *et al.* 1991, 2), usually undertaken with a 0.5m separation between mobile probes. Details of survey methodology are dealt with elsewhere (Geoscan Research 1996).

A number of factors may affect interpretation of twin probe survey results, including the nature and depth of structures, soil type, terrain and localised climatic conditions. Response to non-archaeological features may lead to misinterpretation of results, or the masking of archaeological anomalies.

A twin probe array of 0.5m will rarely recognise features below a depth of 0.75m (Gaffney *et al.* 1991). More substantial features may register up to a depth of 1m. With twin probe arrays of between 0.25m and 2m, procedures are similar to those for the 0.5m twin probe array.

Although changes in the moisture content of the soil, as well as variations in temperature, can affect the form of anomalies present in resistivity survey results, in general, higher resistance features are interpreted as structures which have a limited moisture content, for example walls, mounds, voids, rubble filled pits, and paved or cobbled areas. Lower resistance anomalies usually represent buried ditches, foundation trenches, pits and gullies. In addition to the normal twin electrode method of survey, a Geoscan Research MPX15 multiplexer can be utilised with the Resistance Meter, allowing multiple profiles of resistivity to be recorded simultaneously, or resistance tomography to be carried out up to a depth of 1.5m. APSS generally survey, as with the twin electrode configuration, to a resolution of 1 or 0.1 Ω , with readings every metre or half metre.

Magnetic Survey

Magnetic prospection of soils is based on the measurement of differences in magnitudes of the earth's magnetic field at points over a specific area. Principally the iron content of a soil provides the basis for its magnetic properties. Presence of magnetite, maghaemite and haematite iron oxides all affect the magnetic properties of soils. Although variations in the earth's magnetic field which are associated with archaeological features are weak, especially considering the overall strength of the magnetic field of around 48,000 nanoTesla (nT), they can be detected using specific instruments (Gaffney et al. 1991).

Three basic types of magnetometer are available to the archaeologist; proton magnetometers, fluxgate gradiometers, and alkali vapour magnetometers (also known as caesium magnetometers, or optically pumped magnetometers). Fluxgate instruments are based around a highly permeable nickel iron alloy core (Scollar et al. 1990, 456), which is magnetised by the earth's magnetic field, together with an alternating field applied via a primary winding. Due to the fluxgate's directional method of functioning, a single fluxgate cannot be utilised on its

own, as it can not be held at a constant angle to the earth's magnetic field. Gradiometers therefore have two fluxgates positioned vertically to one another on a rigid staff. This reduces the effects of instrument orientation on readings.

Fluxgate gradiometers are sensitive to 0.5nT or below depending on the instrument. However, they can rarely detect features which are located deeper than 1m below the surface of the ground.

Archaeological features such as brick walls, hearths, kilns and disturbed building material will be represented in the results, as well as more ephemeral changes in soil, allowing location of foundation trenches, pits and ditches. Results are however extremely dependent on the geology of the particular area, and whether the archaeological remains are derived from the same materials. For fluxgate gradiometer survey, the Geoscan Research FM36 is used. Survey is carried out at 0.1nT resolution, with readings taken every 1m by 0.5m. Around 1.5 to 2 hectares are surveyed each day.

Topographic Survey

The modern ground surface or topography often contains important information on the conditions and

nature of an archaeological site, and the potential existence of structures buried beneath the soil (Bowden 1999). The changes in topography can also have a great influence on determining the nature of features in a geophysical survey. Therefore it is vital to produce a detailed and complete topographic survey as part of the field survey of any given site. This generally entails the recording of elevations across a grid of certain resolution, for instance 5 or 10m intervals, but also the recording of points on known breaks of slope, to emphasis archaeological features in the landscape.

Survey is usually undertaken by APSS using a total station or electronic theodolite, although Global Positioning Satellite systems (GPS) are also utilised, to record the survey points. Computer software are then used to produce Digital Elevation Models of the results. Normally, survey is carried out using a Leica total station, with readings taken every 4 metres, and also on the breaks of slope of important topographical features. The resolution can be increased where necessary. Up to 5 hectares per day can be covered.

Ground Penetrating Radar Survey

Ground Penetrating Radar (GPR) survey is based on the use of an electromagnetic radar wave propagated through the soil to search for changes in soil composition and the presence of structures, measuring the time in nanoseconds (ns) taken for the radar wave to be sent and the reflected wave to return. The propagation of the signal is dependent on the Relative Dielectric Permittivity of the buried material.

This technique has been applied successfully on a range of archaeological sites, in particular over substantial urban archaeological remains. GPR has been used by APSS at the Domus Aurea in Rome, at Forum Novum, and at Italica in Spain. Use of GPR is more time consuming than using magnetometry. It is more appropriate to apply this method to target particular areas of interest at an archaeological site where magnetometry or resistivity have already been applied, or where there is a potential for deeper archaeological deposits.

APSS operates a Sensors and Software radar system, configured for use with a Smartcart frame and console. This utilises a 500 Mhz

antenna, which allows propagation of radar waves down to a depth of approximately 3-4m depending on the nature of the sub-surface materials.

Integrated Survey Methodology

The survey work carried out by Southampton is always produced as part of an integrated survey strategy, designed to affiliate all of the geophysical survey techniques to the same grid system, which would be used for geochemical soil sampling and surface collection. Surveys are normally based on an arbitrary grid coordinate system, tied into a national system or to a series of hard points on the ground corresponding to points on a map. A set of 30m grids are then set out to provide the background for the magnetometry, resistivity, and other survey techniques which will complement the results, for instance fieldwalking and geochemical sampling.

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