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ARCHAEOLOGICAL EVALUATION REPORT:

GEOPHYSICAL SURVEYS AT TATTERSHALL CASTLE, LINCOLNSHIRE

Planning Reference: N/A
NGR: TF 21098 57542
AAL Site Code: TACA 09

Report prepared for the National Trust

By
Allen Archaeology Limited

Report Number 2009057

November 2009

The Authority on Archaeological Planning Services

GRID NINE
ARCHAEOLOGICAL GEOPHYSICS

Lincolnshire County Council

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Date	11th January 2010

Reference: Geophysical Survey at Tattershall Castle

Dear Mark,

Please find enclosed copies of the Geophysical and VES Survey Reports for Tattershall Castle for your records. The surveys have picked up some potentially very interesting archaeology, with a good case for the presence of the Outer Moat in the Tiltyard and additional buildings within the Outer Ward. There also appears to very clear structural remains in the northeast corner of the Churchyard. So it looks as though there is a clear continuation of the College Buildings there.

I hope you find both reports interesting, they have certainly caused a good deal of excitement at Tattershall and we hope to develop on the work further.

I have also enclosed a copy of the Assessment Report for the Tattershall Finds Collection, which should accompany the much weightier catalogue I passed on to Beryl earlier in the year.

With good wishes,

Rachael

Rachael Hall
Archaeologist
East Midlands Region

Lincolnshire County Council
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Cover image: Magnetic surveying in Tattershall Meadows, looking north-west towards the Keep

Summary

- An extensive geophysical survey was undertaken of the National Trust's land-holding at Tattershall Castle. The Survey commissioned by the National Trust comprised magnetometry, earth resistance and a Vertical Electrical Section (VES) throughout the castle grounds. An auger survey in the Meadows was also undertaken to complement the geophysical survey.

- The earth resistance survey has identified a number of probable structures within the Inner and Outer Ward that are likely to be associated with Tattershall Castle. The survey within the Churchyard has also clearly identified structural elements of the College that was built under the orders of Ralph Lord Cromwell following his death in 1456.

- The magnetometer survey appears to have confirmed that the Outer Ward was fully encircled by the Outer Moat and has identified former boundaries and paths shown on the 1891 First Edition Ordnance Survey map. The survey has also suggested that additional fish ponds may have existed in the Meadows, and has shown a known former bank may have extended further northwards, perhaps as far as the Tiltyard.

1.0 Introduction

1.1 Geophysical surveys, comprising earth resistance and magnetometry, were undertaken at Tattershall Castle in Lincolnshire by Grid Nine Geophysics in partnership with Allen Archaeology Limited for the National Trust. The survey was undertaken for a number of reasons; to help inform future conservation management of the site; aid understanding and interpretation of the site and help establish the wider setting of the castle. Part of the survey was undertaken as a public engagement opportunity, encouraging members of the public to partake in the survey with the results broadcast 'live' at the site.

1.2 The site works and reporting conform to current national guidelines, as set out in the Institute for Archaeologists '*Standards and guidance for archaeological evaluations*' (IfA 1994, revised 2001 and 2008) and the English Heritage document '*Geophysical Survey in Archaeological Field Evaluation*' (English Heritage 2008). A project brief was also produced for the works by the National Trust (Hall 2009).

2.0 Site Location and Description

2.1 The village of Tattershall is within the county of Lincolnshire, 12.3km south-south-west of Horncastle and 18.2km north-west of the centre of Boston. The castle is located at the south-west end of the settlement, adjacent to the A153 Sleaford Road. Tattershall Castle is centred on NGR TF 21098 57542, and occupies low lying land to the west of the River Bain, at approximately 6m above Ordnance Datum.

2.2 The local solid geology is the Ampthill Clay Formation (British Geological Survey 1995). The drift geology varies across the site; to the east of the Tiltyard are deposits of alluvium and to the west are Lower River Terrace Deposits. The local pedology comprises naturally wet, very acid sandy and loamy soils (NSRI 2009).

3.0 Planning Background

3.1 The geophysical survey was commissioned to provide information regarding the archaeological resource within the castle grounds to help inform future conservation management at the site, and lies outside the planning process.

3.2 The work was carried out under a Section 42 Licence, required for geophysical survey on Scheduled Ancient Monuments, issued by English Heritage.

4.0 Archaeological and Historical Background

4.1 There is some evidence for prehistoric activity in the landscape surrounding the castle grounds. This includes single finds such as a Neolithic polished stone axe head found in 1957 c.400m to the south-east on the river bank (Lincolnshire Historic Environment Record (hereafter LHER) Reference: 40176) and a further Neolithic stone axe from gravel pits approximately 400m to the south-west (LHER Reference: 40158).

4.2 More substantial evidence for prehistoric activity was identified during the Witham Valley National Mapping Programme by English Heritage in 2005 (LHER Reference: 46443). The survey highlighted a ring ditch, probably representing a round barrow of later Neolithic or Bronze Age date, c.450m to the north-west of the site.

4.3 Tattershall is first mentioned in the Domesday Survey of 1086 as being under the ownership of Eudo, son of Spirewic (Morgan and Thorn 1986). At the time of the survey the settlement was known as Tatesala, from the Old English meaning '*Tāthere's nook of land*' (Cameron 1998).

4.4 A detailed history of the castle has already been prepared earlier this year (Oxford Archaeology 2009), so will not be repeated here.

5.0 Methodology

5.0.1 A Level II Evaluation survey (Gaffney and Gater 2003) using fluxgate gradiometer, earth resistance and a trial of Vertical Electrical Section (VES) was chosen as the most appropriate type of surveys for the site. Although there can be no preferred recommendation of which technique to use until the merits of the individual site have been assessed, magnetometer survey should usually be the prime consideration (English Heritage 2008). Earth resistance was deemed the most suitable for detecting buried structural remains within the grounds of the castle as such remains are known to normally respond well to the technique.

5.0.2 The response to magnetic surveying over a solid geology of clay is very variable, but can often be poor. The response to magnetic surveying over Alluvium and Lower River Terrace Deposits is known to be average to poor depending on the depth of burial of features below the deposits (English Heritage 2008; Gaffney and Gater 2003; Clark 1996).

5.0.3 The response from these geologies to earth resistance surveying is more difficult to quantify as there are many variables that can affect the survey, although they usually respond reasonably well (Gaffney and Gater 2003; Clark 1996).

5.0.4 The combination of the solid and drift geologies found at this site are not particularly well represented in the English Heritage Geophysical Survey Database (hereafter EHGSD). A search of the EHGSD for surveys over similar geologies showed only 12 previous surveys on these geologies, most of which were in Lincolnshire. These mostly reported successful results.

5.0.5 The basis of earth resistance surveying is that electric currents are fed into the ground and the resistance to the flow of these currents is measured. Where they encounter buried wall foundations high resistance readings are normally recorded, whereas soil-filled ditches often provide low resistance readings. By mapping zones of high and low resistance it is possible to identify, for example, the layout of buildings or the size and orientation of a ditched enclosure.

5.0.6 The earth resistance survey was carried out using a TR Systems Earth Resistance Meter using a standard 0.5m array and an on-board automatic data logger.

5.0.7 Magnetic surveying measures very small changes in the Earth's magnetic field which can be created by manmade or geological changes in the magnetic properties of the soil and/or underlying geology. Magnetic surveying can usually detect magnetically enhanced features such as areas of anthropogenic activity (for example pits, ditches, hearths and kilns), but also will react to buried 'modern' items such as nails, agricultural equipment fragments, wire fences and generally any ferrous material in the immediate area.

5.0.8 The magnetic survey was carried out using a Bartington Grad601-2 Dual Fluxgate Gradiometer with an onboard automatic DL601 data logger. This instrument is a highly stable magnetometer which utilises two vertically aligned fluxgates, one positioned 1m above the other. This arrangement is then duplicated and separated by a 1m cross bar. The 1m vertical spacing of the fluxgates provides for deeper anomaly detection capabilities than 0.5m spaced fluxgates. The dual arrangement allows for rapid assessment of the archaeological potential of the site. Data storage from the two fluxgate pairs is automatically combined into one file and stored using the onboard data logger.

5.0.9 The trial VES survey was carried out using TR Systems 20 Electrode VES equipment.

5.1 Summary of Survey Parameters

5.1.1 Earth Resistance

Instrument:	TR Systems Earth Resistance Meter
Sample interval:	1.0 m
Traverse interval:	1.0 m
Traverse separation:	1.0 m
Traverse method:	Zigzag
Electrode spacing:	Standard 0.5 m
Processing software:	TR Systems 'Resistivity' processing software
Surface conditions:	Maintained short grass
Area surveyed:	0.83 hectares
Surveyors	David Charles Hibbitt AIfA and Angela Hazel Hibbitt
Survey assistant:	Kevin Booth
Data interpretation:	David Charles Hibbitt AIfA and Mark Allen BSc MIfA

5.1.2 Fluxgate Magnetometer

Instrument:	Bartington Grad601-2 Dual Fluxgate Gradiometer
Sample interval:	0.25m
Traverse interval:	1.00m
Traverse separation:	1.00m
Traverse method:	Zigzag
Resolution:	0.1 nT
Processing software:	ArchaeoSurveyor 2.4.0.X
Surface conditions:	Meadow
Area surveyed:	4.62 hectares
Surveyors	David Charles Hibbitt AIfA and Angela Hazel Hibbitt
Survey assistants:	John Goree and Kevin Booth
Data interpretation:	David Charles Hibbitt AIfA and Mark Allen BSc MIfA

5.2 Data Collection and Processing

5.2.1 Each site was marked out using tapes, measuring from known fixed boundaries. The collection of magnetic data using a north – south traverse pattern is preferable for a magnetic survey, as enhancements to the magnetic field caused by buried features is mapped increasingly stronger the closer the traverse direction can get to a magnetic north – south direction (Scollar et al. 1990). On this occasion magnetic data was collected using NS and EW alignments due to the orientation of the survey grids. Data was collected by making successive parallel traverses across each grid in a zigzag pattern. Several key points of the survey grids were tied in to known/fixed features and these are recorded in the surveyor's site notes.

5.2.2 The grids used for the earth resistance survey were orientated based on the areas to be surveyed, as there are no issues with the traverse direction when undertaking an earth resistance survey with the standard twin probe array. Data was collected by making successive parallel traverses across each grid in a zigzag pattern. Several key points of the survey grids were tied in to known/fixed features and these are recorded in the surveyor's site notes.

5.2.3 The data collected from the survey has been analysed using the current version of ArchaeoSurveyor 2 (2.4) and the current version of TR Systems 'Resistivity' software. The resulting data set plots are presented with positive nT/m values and high resistance as black and negative nT/m values and low resistance as white.

5.2.4 The data sets have been subjected to processing using the following filters:

- De-stripe (also known as Zero Mean Traverse or ZMT)
- Clipping
- Interpolation (earth resistance data only)

5.2.5 The de-stripe process is used to equalise underlying differences between grids or traverses. Differences are most often caused by directional effects inherent to magnetic surveying instruments, instrument drift, instrument orientation (for example off-axis surveying or heading errors) and delays between surveying adjacent grids. The destripe process is used with care as it can occasionally have an adverse effect on linear features that run parallel to the orientation of the process.

5.2.6 The clipping process is used to remove extreme datapoint values that can mask fine detail in the data set. Excluding these values allows the details to show through.

5.2.7 Plots of the data are presented in raw linear greyscale, processed linear greyscale and trace plot form with any corrections to the measured values or filtering processes noted, and as a separate (English Heritage 2008) simplified graphical interpretation of the main anomalies detected.

6.0 Earth Resistance Results (See Figures 2 – 7)

6.1 The Inner Ward (Figure 5)

6.1.1 The survey has revealed several areas of high resistance that suggest a range of buildings or rubble spreads, with several linear anomalies likely to reflect further structural remains. Anomalies [1] and [2] in particular suggest structural remains, although anomaly [2] may, in part, be caused by near surface tree roots and their localised de-watering effect. The high resistance anomaly [3] is at the west end of the survey and is also suggestive of structural remains beneath the turf. This latter anomaly may be evidence of the former Hall and Chamber that are believed to have existed within the Inner Ward (Oxford Archaeology 2009: Figure 6).

6.1.2 The broad linear anomaly [4] may represent a former wall or path, possibly connected with the structure likely to be associated with anomaly [3]. Towards the central area of the inner ward is a rectilinear area of high resistance [5] that is also likely to reflect former building remains. Linear high resistance anomalies [6] and [7] are possibly walls or paths that may be related to anomaly [5].

6.1.3 There are two low resistance anomalies identified, anomalies [8] and [9]. These may be associated with a drainage or water-retention system within the Inner Ward, although any interpretation is deemed speculative at this stage.

6.1.4 The stone slabs that are laid on the ground in the Inner Ward were the focus for a Vertical Electrical Section survey (VES) to create a vertical section of resistance data across the feature (see Appendix 1). The VES survey shows high resistance anomalies on either side of the stone, suggesting that building remains may exist to a depth of approximately 1m below the existing ground surface. Beneath this, and centred on the stone slabs was a large rectangular low-resistance anomaly that was approximately 6m wide and over 2m deep, extending to 3.13m below the modern ground surface. Although the survey only provides a narrow slice of data through the deposits, the low resistance may be associated with a water-filled chamber, such as a water tank for the castle.

6.2 The Outer Ward (Figure 5)

6.2.1 The surveys in this area have produced a number of high resistance anomalies likely to be associated with a range of buildings that are evidenced by several visible wall foundations. Anomaly [10] was located at the east end of the survey, in the location of a low mound amongst trees. This particularly high resistance anomaly may be evidence of localised heating (e.g. a former fireplace) or a concentration of stone, perhaps indicating a buried structure. Surrounding [10] is a broadly rectangular area of high resistance [11] which may possibly be the response to a floor surface or rubble spread, although the de-watering effect likely to occur from the surrounding trees may have contributed to this anomaly. Further west there are additional rectilinear areas of high resistance [12] – [14], and again these may reflect rubble spreads or floor surfaces. In addition, a linear element to anomaly [14] may represent the remains of an associated wall.

6.2.2 Two further linear high resistance anomalies [15] are probably walls or paths associated with a structure represented by [14]. Anomaly [16] appears to show a small rectangular structure and this is likely to be associated with the visible remains immediately to the west, believed to be a gatehouse.

6.3 The Stables (Figure 6)

6.3.1 As with the previously discussed earth resistance surveys, this area has produced many high resistance anomalies likely to be associated with structures. The amorphous area of high resistance [17] at the north-east end of the survey area is highly likely to represent rubble spreads immediately to the west of an adjacent bridge. The small areas of high resistance [18] and [19], together with two linear high resistance anomalies [20] may also represent a former structure; however it should be noted that if this is the case then it is likely to pre-date the extant stables building as it follows a different alignment.

6.3.2 With regard to the stables, a very high resistance anomaly [21] is shown immediately to the south-west of the extant structure. This particularly resistant anomaly may be the base to an external staircase or the highly compacted area in front of a door, with the latter perhaps being the most likely. The low resistance linear anomaly [22] appears to be a narrow trench, probably a drain or the course of a service possibly associated with the stables.

6.3.3 Further to the south is an area of rectilinear high resistance [23]. Within this area is faint patterning suggestive of further structural remains or rubble spreads. The linear high resistance anomaly [24] may represent a path or wall running parallel with the moat, but may also be the response to sloping ground. The amorphous area of high resistance [25] at the south end of the survey area is likely to be associated with the outer moat bank, but the possible presence of building remains should not be discounted. The low resistance amorphous anomaly [26] is very likely caused by an adjacent tree, where roots will be retaining more moisture than the surrounding soil.

6.4 **The Churchyard** (Figure 7)

6.4.1 Churchyard surveys normally provide poor surveys due to ground disturbance and obstructions, however in this case the resistance survey proved successful. The high resistance amorphous anomaly [27] lies immediately to the south of the known remains of Tattershall College, which were investigated in 1967-8 (Oxford Archaeology 2009). The anomaly almost certainly reflects additional elements of the previously exposed college buildings, most likely a structure or structures to the west of the college quadrangle.

6.4.2 The curvilinear high resistance anomaly [28] to the south of the church may be a buried wall or path, and it appears to enclose or surround an area of 'noise' [29]. These two anomalies may possibly represent an earlier unknown structure in the churchyard.

6.4.3 Based on its location, the amorphous high resistance area [30] is likely to be the responses to disturbed ground due to burials, whilst the high resistance amorphous area [31] correlates with an existing monument and an area of particularly hard ground noted during the survey that resisted the insertion of the probes. This may indicate buried grave slabs, rubble spreads or even variations in the geology. The low resistance anomalies [32] – [34] lie within an area noted for waterlogging and moisture issues (Mr David Mullenger *pers. comm.*). The low resistance anomaly [35] is probably demonstrating a similar but less obvious problem area on the south side.

6.4.4 Low resistance anomaly [36] is identified as a well-worn patch of ground leading to a door in the church, and low resistance anomaly [37] correlates with a gap in the wall and a further worn path leading to a second burial plot. Both features are likely to be retaining more moisture than the surrounding ground which would lead to a low resistance response.

7.0 **Magnetometer Surveys** (Figures 2 and 8 – 9)

7.1 **Car Park** (Figures 8 – 10)

7.1.1 There was significant background disturbance to the magnetometer survey of the car park due to the surrounding fence, metalling of the ground surface, and a parked car (shown as green cross-hatching on Figure 9).

7.1.2 The two parallel linear anomalies [m1] and [m2] were positive anomalies that follow the line of a boundary and a track known as 'Causeway Walk', which is depicted on the 1891 First Edition Ordnance Survey map of the site (Figure 10). Anomaly [m1] is likely to correspond with the boundary, and its strong response may indicate that the boundary was a brick wall. Anomaly [m2] follows 'Causeway Walk' which ran from Market Place to the north, crossing a footbridge across the Horncastle Canal, before heading broadly southwards onto the western bank of the River Bain. Anomalies [m8] – [m10] in the Tattershall Meadows (see Section 7.2.4 below) are also likely to reflect further elements of this and other paths.

7.1.3 The sinuous positive anomaly, [m3] although quite visible in the plot, demonstrates low magnetic susceptibility of only 1 nT/m and probably represents a subtle geological variation rather than an archaeological origin. The amorphous area of dipolar responses [m4] is caused by ferrous detritus typical of a car park/public area.

7.2 Tattershall Meadows (Figures 2 and 8 – 12)

7.2.1 The magnetic survey has produced a wealth of magnetic anomalies throughout the meadows. Some interference is visible in the data (shown as green cross-hatched areas on Figure 9). This is caused by boundary fences, hedgerows and the general ferrous detritus that tends to collect along these boundaries. The widespread amorphous areas of varying magnetic intensity (shaded in yellow on Figure 9) are likely to represent subtle magnetic variations in the soil or geological variations.

7.2.2 The two amorphous areas of intense magnetic variation [m5] and [m5a] correlate with several structures shown on early Ordnance Survey maps and so are likely to be rubble spreads. These structures are visible on the First Edition Ordnance Survey map of 1891 (Figure 10), and still visible on a later Ordnance Survey map dated 1951. The rectilinear response [m6] also appears to relate to the complex of structures that existed to the east of the Church, shown on Figure 10.

7.2.3 Amorphous anomaly [m7] correlates with bushes, nettles and generally disturbed ground close to the Tiltyard wall. It is likely that a certain amount of ferrous detritus will have collected along this boundary leading to may of the responses in this area.

7.2.4 A number of positive magnetic linear and curvilinear anomalies have been detected throughout the survey area. The curvilinear anomalies [m8] – [m10] are almost certainly the response to a public footpath, shown on the 1891 Ordnance Survey map as 'Causeway Walk' (Figure 10) and the general scattering of dipolar responses along these would substantiate this interpretation.

7.2.5 Anomaly [m11a] and [m11b] is also shown on the 1891 map, although on this occasion it reflects a series of former field boundaries dividing the floodplain to the south-east of the castle.

7.2.6 The series of curvilinear positive anomalies [m12] – [m16] at the south-east corner of the survey may reflect former courses of the River Bain, given their location. This interpretation should be treated with caution however, as these responses are very strong, with magnitudes between 15 and 30 nT/m, which is suggestive of magnetically enhanced material from an anthropogenic rather than natural process.

7.2.7 Also towards the south-east end of the survey, anomaly [m17] appears to continue the line of a known earthwork that ran north-north-east to south-south-west, to the east of the fish ponds. This earthwork was probably a flood bank built to protect the fish ponds from flooding by the River Bain to the east.

7.2.8 The ephemeral double-linear anomaly [m18] is unusual and does not appear on any previous mapping for the site. On balance it is likely that this probably relates to geological variation rather than an archaeological response. A further unusual anomaly was noted further to the north (Anomaly [m19]). On this occasion, the L-shaped feature is likely to reflect the location of a service, based on the strong positive and negative response exhibited.

7.2.9 The three anomalies [m20], [m21] and [m22] are known fish ponds, and each have a magnitude of around 10 nT/m. Anomaly [m23] also appears to be a former fishpond that is only partially visible as an earthwork. Sinuous linear anomaly [m24] may be evidence of a connecting channel between ponds [m22] and [m23]; however this is unclear from the data.

There is suggestion of another pond in the amorphous area [m25] to the west although this is solely based on the general shape and potential relationship with the three known ponds.

7.2.10 The positive anomalies [m26] – [m29] all appear to represent pit-like features with a magnitude of around 10 nT/m. This relatively high magnitude would suggest a fill of higher magnetic susceptibility than the surrounding soil, possibly as the result of habitation or industrial activity close by.

7.2.11 Negative magnetic linear anomalies [m30] – [m32] may represent former field boundaries, the remains of cultivation trends or subtle geological variations. Negative anomaly [m33] is more difficult to interpret, but may be geological in origin rather than anthropogenic.

7.2.12 Staff from Allen Archaeology Ltd volunteered to undertake an auger survey in the meadows on Saturday 18th July 2009. The augering was undertaken to provide information on the below-ground deposits in the floodplain outside of the scheduled area.

7.2.13 The first transect was located at the southern end of the meadows, and ran east-south-east to west-north-west from the River Bain bank across the floodplain (Figure 11). The transect showed that the natural sand and gravel was shallowest to the west (c.0.44m below the modern ground surface) sloping down gradually to 1.2m eastwards before dropping sharply towards the river. The topsoil was approximately 0.3m deep across the profile, sealing a compact brown clay at the west end of the survey that may be of archaeological interest. Towards the river the sequence became more complex with clays with freshwater shells present in the upper profiles, suggesting flood deposits. These overlay a series of wet, sticky and organic clays that are likely to represent former river deposits. The easternmost auger point (A1.1) reached 1.75m below the ground surface (0.91m OD) but did not hit natural sand, indicating the river deposits extended below this point.

7.2.14 Auger transect 2 was a single point to investigate one of numerous dipolar anomalies identified during the magnetometry survey (Figure 12). The augering showed the topsoil was shallow, approximately 0.2m deep, sealing a light orange/brown alluvial silty sand. This in turn sealed the natural yellow sand at 3.0m OD (0.29m beneath the modern ground surface).

7.2.15 The third transect was positioned running north – south immediately to the west of the River Bain bank to assess an area of magnetic disturbance noted during the magnetometer survey, which was also a prominent mound running from the river towards Holy Trinity Collegiate Church. Surprisingly, the southernmost of the auger points (A3.1) showed that only 0.16m of topsoil sealed the natural sand and gravel at 3.89m OD (Figure 12). Ten metres further north, at the highest point of the raised area, the shallow topsoil sealed a brown silty sand with small fragments of brick present that proved very difficult to auger through. This horizon is very likely a demolition horizon associated with the nearby structures shown on the 1891 map (Figure 10). The ground surface then dropped sharply as the augering progressed northwards, being one metre lower than Auger point 3.2 at the most northerly point (A3.4). Here a 0.26m deep topsoil was found to seal a 0.94m deep grey/brown clay with abundant charcoal flecks, fragments of brick and crushed chalk, again likely associated with demolished structures in the vicinity. Below this was a series of clays and silts evidencing former channel deposits sandwiching a peat horizon at 1.29m OD. A further peat containing waterlogged wood that was over 0.3m deep was encountered at 0.95m OD.

7.3 The Tiltyard (Figures 8 – 10)

7.3.1 Particularly interesting is a series of clear parallel linear negative magnetic anomalies [m34] towards the western end of the Tiltyard. These almost certainly reflect the line of the original Outer Moat which was created by Ralph Lord Cromwell in the 1430s – 40s, and then backfilled to create the Tiltyard, possibly in 1594 (Oxford Archaeology 2009).

7.3.2 There is a suggestion for a circular positive (2 nT/m) anomaly [m35] in the west half of the Tiltyard. If real, this must post-date the backfilled Outer Moat, represented by anomaly [m34], and therefore is likely to be post-16th century in origin, perhaps reflecting a hitherto unknown element of the formal gardens that are believed to have replaced the Tiltyard. Another possible is that it may reflect a circular worn area representing a training or exercise area for horses.

7.3.3 The small rectilinear positive magnetic anomaly [m36] immediately to the west of [m35] may also form elements of former garden features, as it also appears to overlap and therefore post-date the probable former moat. Alternatively based on its form and size it may be evidence for a former structure, with the positive reaction perhaps indicative of a brick rather than stone construction.

7.3.4 A concentration of pit-like responses, as well as dipolar responses [m37] is likely to have been caused by a combination of animal activity (burrows) and recent disturbance caused by modern services (access covers were noted in this area during the survey). Several further areas of noise have been mapped, [m38] and [m39] which are also likely to be the result of animal activity. The two linear anomalies [m40] and [m41] are probably the result of service trenches, although [m40] may be archaeological in origin. The pit-like response [m42] may also be anthropogenic, although it is more likely to be the result of animal burrowing noted in the area during the survey.

7.3.5 An abundance of large and small dipolar responses have been recorded scattered randomly throughout the magnetic data sets. The characteristic dipole response of pairs of positive and negative 'spikes' suggests near-surface ferrous metal or other highly fired material (Clarke 1996).

8.0 Conclusions

8.1 Both the earth resistance and magnetometer surveys have proved very successful in providing additional information regarding the archaeological resource within the castle grounds and surrounding area.

8.2 The earth resistance and VES surveys in the Inner Ward have provided particularly interesting results. Here, spreads of rubble and probable building remains have been identified, possibly around a central courtyard in the middle of the grassed area. A particularly responsive area on the west side of the Inner Ward shows the location of one or possibly two structures, most likely associated with the former Hall and Chamber that are believed to have existed here (Oxford Archaeology 2009).

8.3 A VES or Vertical Electronic Section was taken across the Inner Ward grassed area, running parallel to the castle frontage, and centred on several horizontal stone slabs that are visible. Although the results appear very clear it should be noted that the survey shows only a slice through the underlying deposits, and that further sections will add significantly to the data set. The section appears to show from the ground surface downwards up to approximately 1m of high resistance data, probably associated with structures and rubble spreads within the Inner Ward. Several low resistance anomalies at the top of this sequence may reflect earth-filled treeboles, former pits or ditches. Interestingly, beneath the stone slabs there is a low resistance anomaly, perhaps indicative of a soil-filled void or shaft. This directly overlies a large rectangular anomaly of lower resistance to the surrounding deposits. Although this may be of geological origin, an alternative hypothesis is that it is a water or soil filled structure that survives approximately 1m below the modern ground surface.

8.4 The Outer Ward earth resistance survey has also provided good evidence for structures beneath the turf. These are mainly confined to the north of the existing path and fit very well with extant upstanding walls. Probable structural remains to the south of the modern path are likely to be associated with visible remains that are believed to be part of a gatehouse.

8.5 The resistance survey of the Stables area of the Outer Ward has also revealed strong evidence for buried structures. These include a spread of high resistance data immediately to the west of a bridge, and a possible structure to the south of the Stables. Further potential high resistance anomalies to the east of the Stables may reflect building remains, however the alignment of the linear anomalies would suggest that they may predate the Stables themselves.

8.6 The Churchyard was also subject to an earth resistance survey, again with significant results. The most interesting of these was a large high resistance anomaly at the north-east end of the survey, adjacent to the Bowling Green. This almost certainly is evidence of Tattershall College which was partially investigated in the 1960s (Oxford Archaeology 2009). The remains identified in the survey probably form part of a structure or structures to the west of the college quadrangle. Further structural remains may be present to the south of the existing church; however the results are not clear.

8.7 The magnetometry survey in the Car Park was not expected to provide any meaningful results due to the likelihood of ferrous litter and background interference. It was therefore surprising that two linear anomalies were clearly identified in the dataset. These appear to relate to a boundary and pathway that are visible on the 1891 map, running from Tattershall Market Square, across a footbridge over Horncastle Canal, down towards the river (Figure 10).

8.8 The magnetometry and augering have provided interesting results in the Tattershall Meadows. The geophysical survey has identified areas of magnetic variation that are likely to be associated with former structures depicted on the First Edition Ordnance Survey map (Figure 10). Also visible on the 1891 map were several field boundaries at the southern end of the survey that were also identified by the survey, along with the former fish ponds and a former bank that probably functioned to protect the fishponds from flooding by the river. The survey has also identified other anomalies that may reflect additional hitherto unknown ponds, and possible palaeochannels in the south-east corner of the field.

8.9 The augering has also provided landscape information of interest to the project. Surprisingly the highest point at which the natural sand was encountered was adjacent to the river in Auger point 3.1 (at 3.89m OD). Immediately to the east of the Tiltyard the sand was encountered at 3.0m OD and further south in the Meadows the sand dropped sharply from west to east from 3.1m OD to below 1.81m OD. This shows that to the east of the Tiltyard there was a spur of higher ground running westwards from the river to the church and castle buildings. Indeed, it may be this topographical feature that has given the village its current name (see section 4.3 above).

8.10 This higher and drier ground was utilised for buildings in the past, as shown on the 1891 Ordnance Survey map (Figure 10). The destruction of these buildings has resulted in an accumulation of material beneath the topsoil, reducing the gradient of the slope to the north. Beneath this demolition material former channel deposits were encountered at approximately 2.0m OD, with two peat horizons also encountered at some depth, indicating former ground surfaces at 1.29m OD and 0.95m OD. These are likely to be of some age, and are probably of prehistoric date. Dating these deposits would require a programme of scientific dating (radiocarbon dating) of samples from additional augering. To the south of this spur of higher ground the west – east transect showed typical flood deposits sealing channel deposits that were very deep at the south-east corner of the field, adjacent to the modern river.

8.11 The magnetometry survey in the Tiltyard has proved particularly interesting in that it appears to have identified the former line of the 15th century Outer Moat that was probably backfilled around 1594 (Oxford Archaeology 2009). If this is the case then it is particularly important as it would indicate that the Outer Ward was indeed fully enclosed by the moat, something that has never previously been proven. Overlying the backfilled moat is an unusual circular anomaly. It is possible this is evidence of a former garden feature, although a further possibility is that it is a training circle for horses (extended use would result in a compacted circular path that may show in the geophysical survey). A further rectangular anomaly may reflect a former building or garden feature at the west end of the Tiltyard.

9.0 Effectiveness of Methodology

9.1 The evaluation methodology employed was appropriate to the scale and nature of the proposed development. Magnetometry surveying was the prospection technique best suited to the identification of archaeological remains in the Car Park, Tattershall Meadows and Tiltyard, and earth resistance was best suited to the identification of buried structural remains within the castle grounds. Other techniques would have required justification (English Heritage 2008) and may have proved too time consuming or cost-prohibitive. The auger survey has also provided information on the former topography of the landscape.

10.0 Acknowledgements

10.1 Allen Archaeology and Grid Nine Geophysics would like to thank Rachael Hall, The National Trust East Midlands Archaeologist for this commission and assistance throughout the project and the staff at Tattershall Castle, in particular the Operations Manager Stuart Crow and Mr David Mullenger, Tattershall Church Warden.

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The following Ordnance Survey maps of the area were viewed on-line at www.old-maps.co.uk (site accessed 28/09/09):

1889 Ordnance Survey map, Lincolnshire 1:10,560
1891 Ordnance Survey map, Lincolnshire 1:10,560
1905 Ordnance Survey map, Lincolnshire 1:2,500
1906 Ordnance Survey map, Lincolnshire 1:10,560
1951 Ordnance Survey map, Lincolnshire 1:10,560

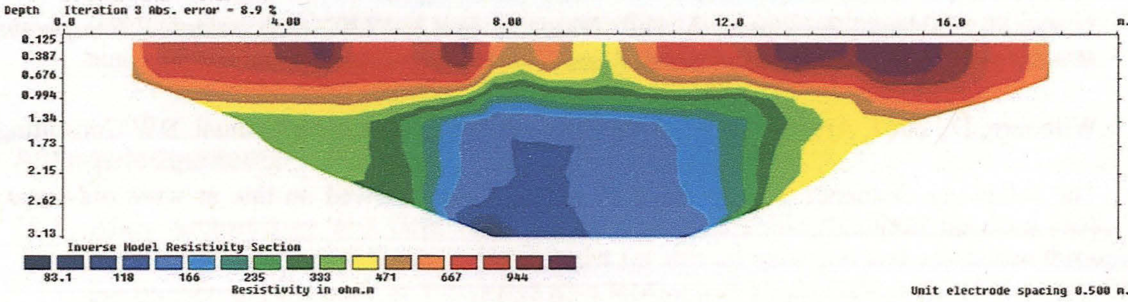
Appendix 1: Trial of Vertical Electrical Section (VES) on the Inner Ward

This technique measures the electrical resistivity of the subsurface in a similar way to a standard earth resistance survey. Rather than mapping electrical resistance over an area however, it is capable of producing a vertical electrical section (VES), also referred to as a resistivity profile.

Electrodes were laid out at 1 metre intervals in a line. The resistivity was measured and mapped by selecting successive four electrode subsets at increasing separations. The wider the electrode spacing, the 'further' into the ground the readings can be made.

Shown below are the provisional results from the single traverse across the Inner Ward. The stone slabs in the centre of the Inner Ward were positioned around the 10 metre mark, and the traverse was roughly parallel to the castle (Figure 2).

Initial results suggest a reasonably large low resistance rectangular anomaly exists below the stone slabs, suggesting the slabs may be a type of marker or capping to a subterranean feature. However, caution is advised with any interpretations as one VES can only provide a very narrow, restricted view. Further work is needed to ascertain the form and nature of this low resistance anomaly prior to any considered interpretations.



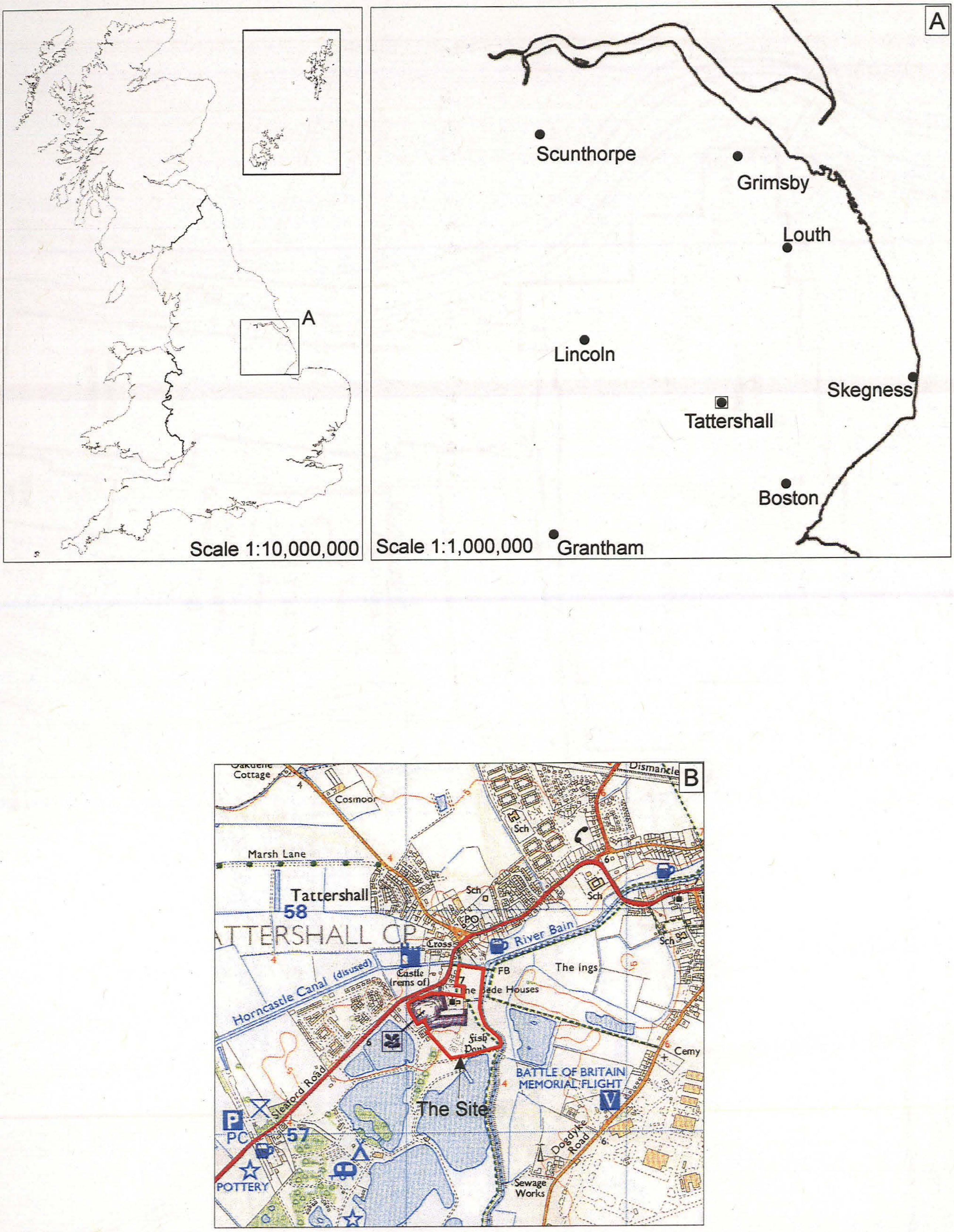


Figure 1: Site location at scale 1:25,000, with site shown in red.

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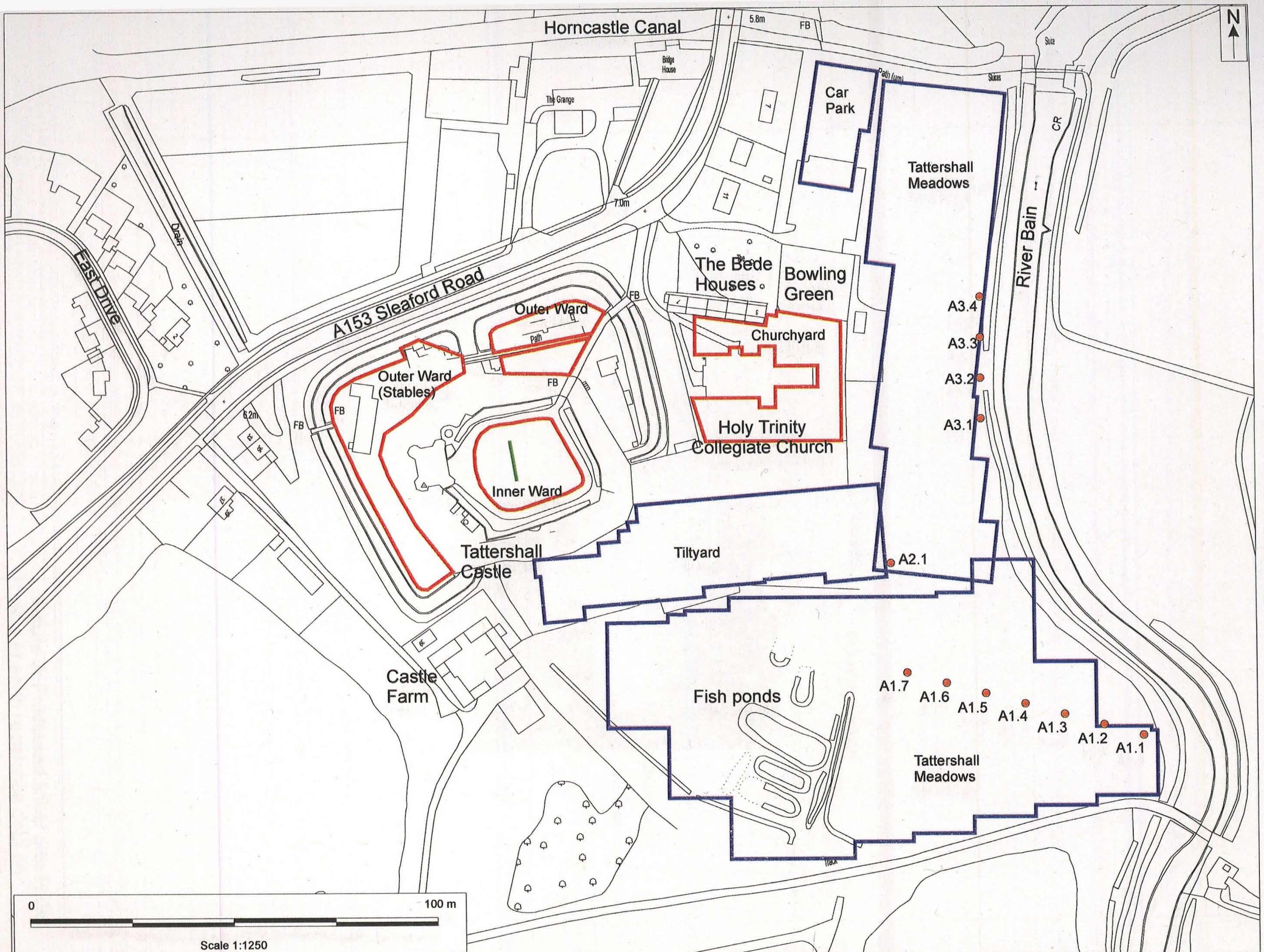

Figure 2: Location of surveys on Ordnance Survey base mapping at scale 1:1250. Earth resistance survey areas shown in red and magnetometer survey areas shown in blue. VES survey shown as green line and auger points as orange circles.

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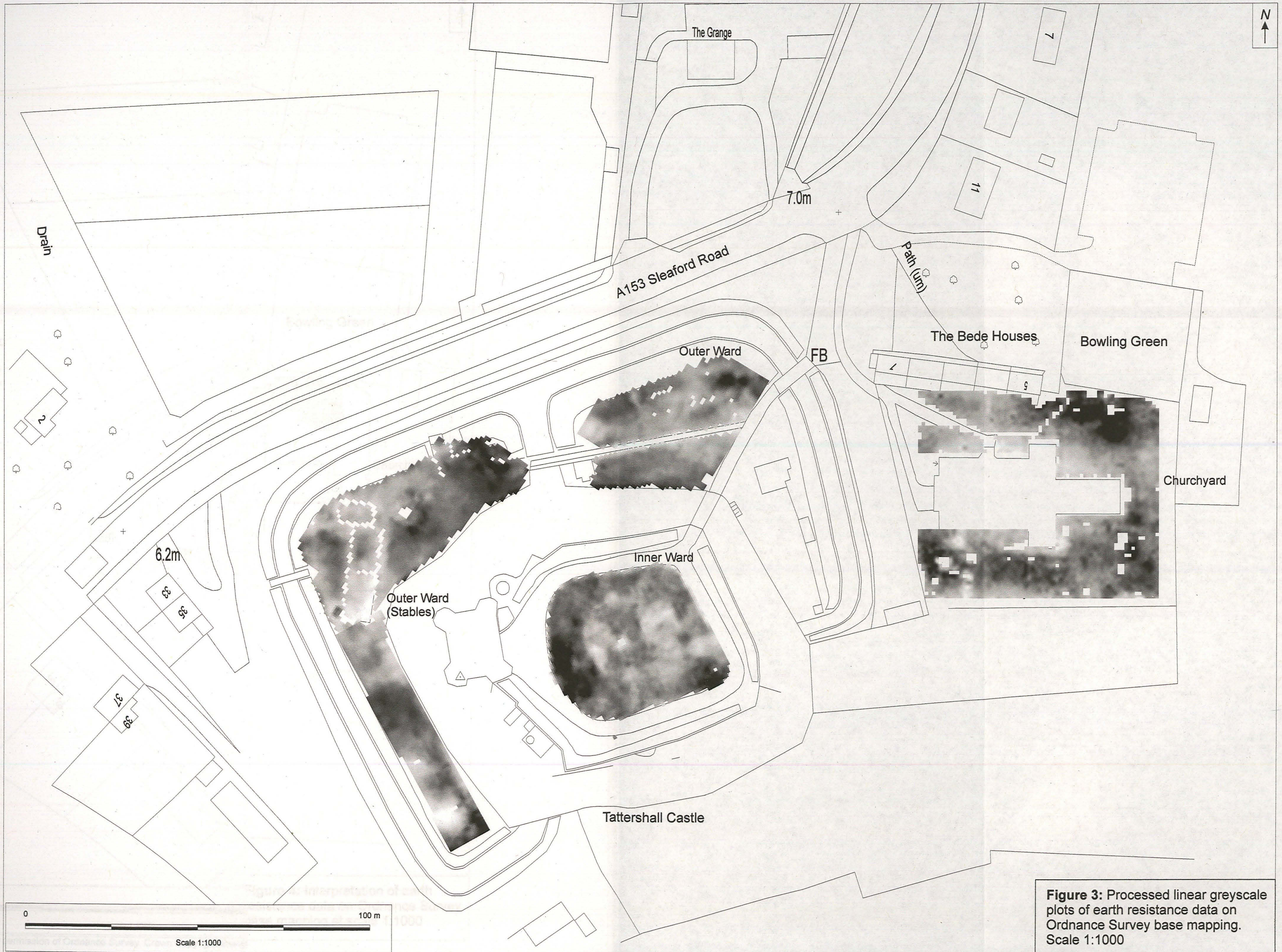

Figure 3: Processed linear greyscale plots of earth resistance data on Ordnance Survey base mapping. Scale 1:1000

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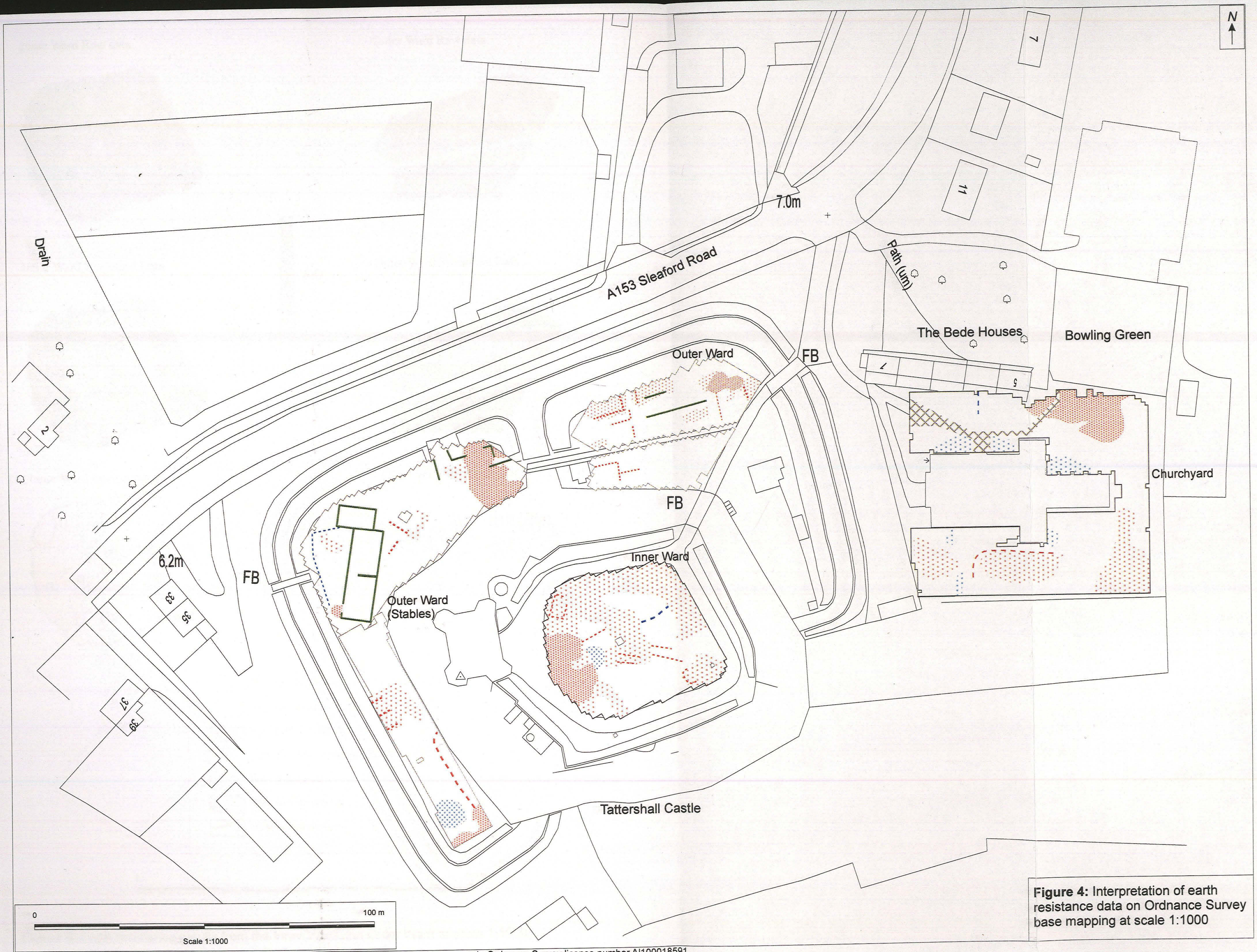

Figure 4: Interpretation of earth resistance data on Ordnance Survey base mapping at scale 1:1000

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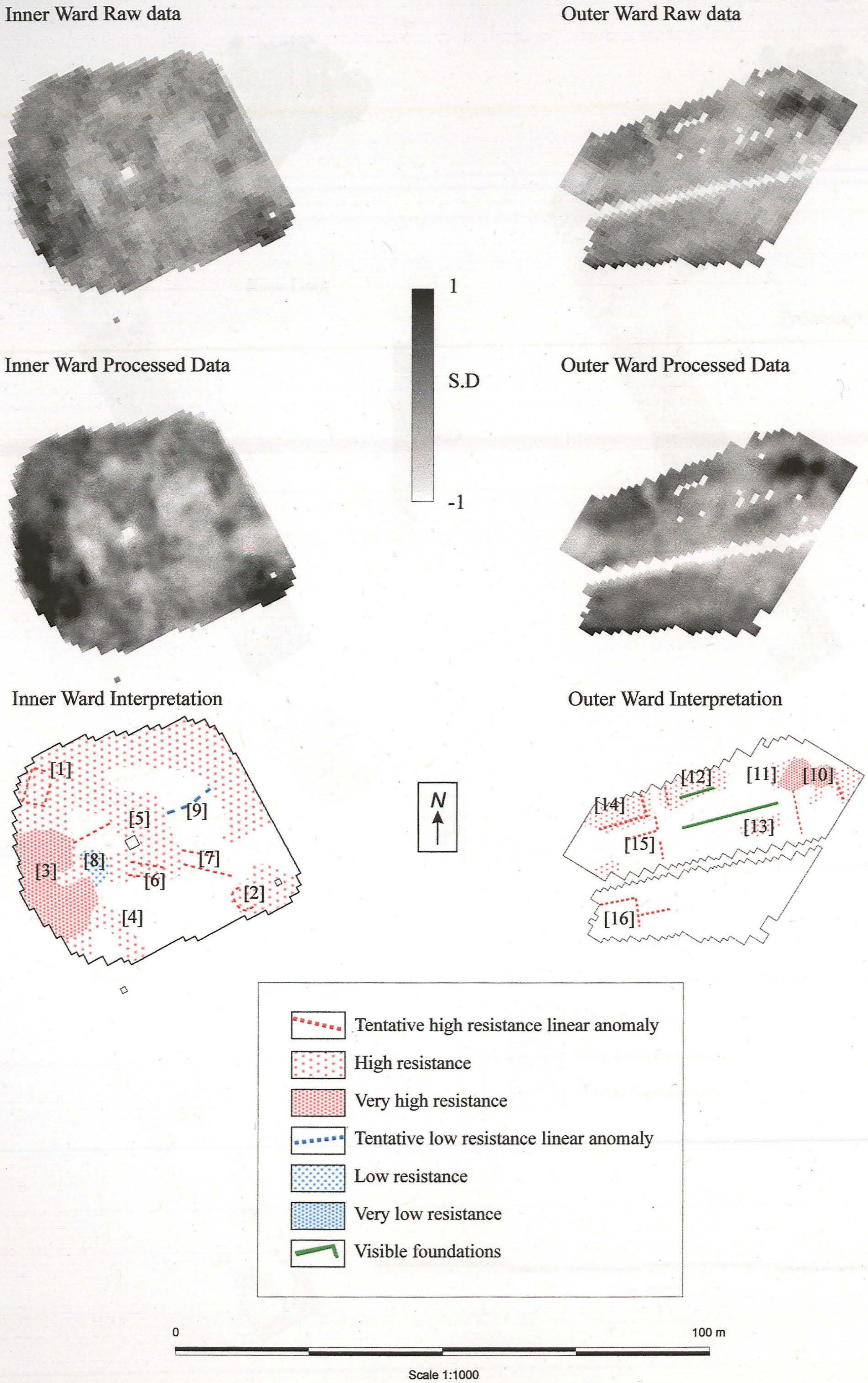

Figure 5: Earth resistance results from the Inner Ward and Outer Ward at scale 1:1000

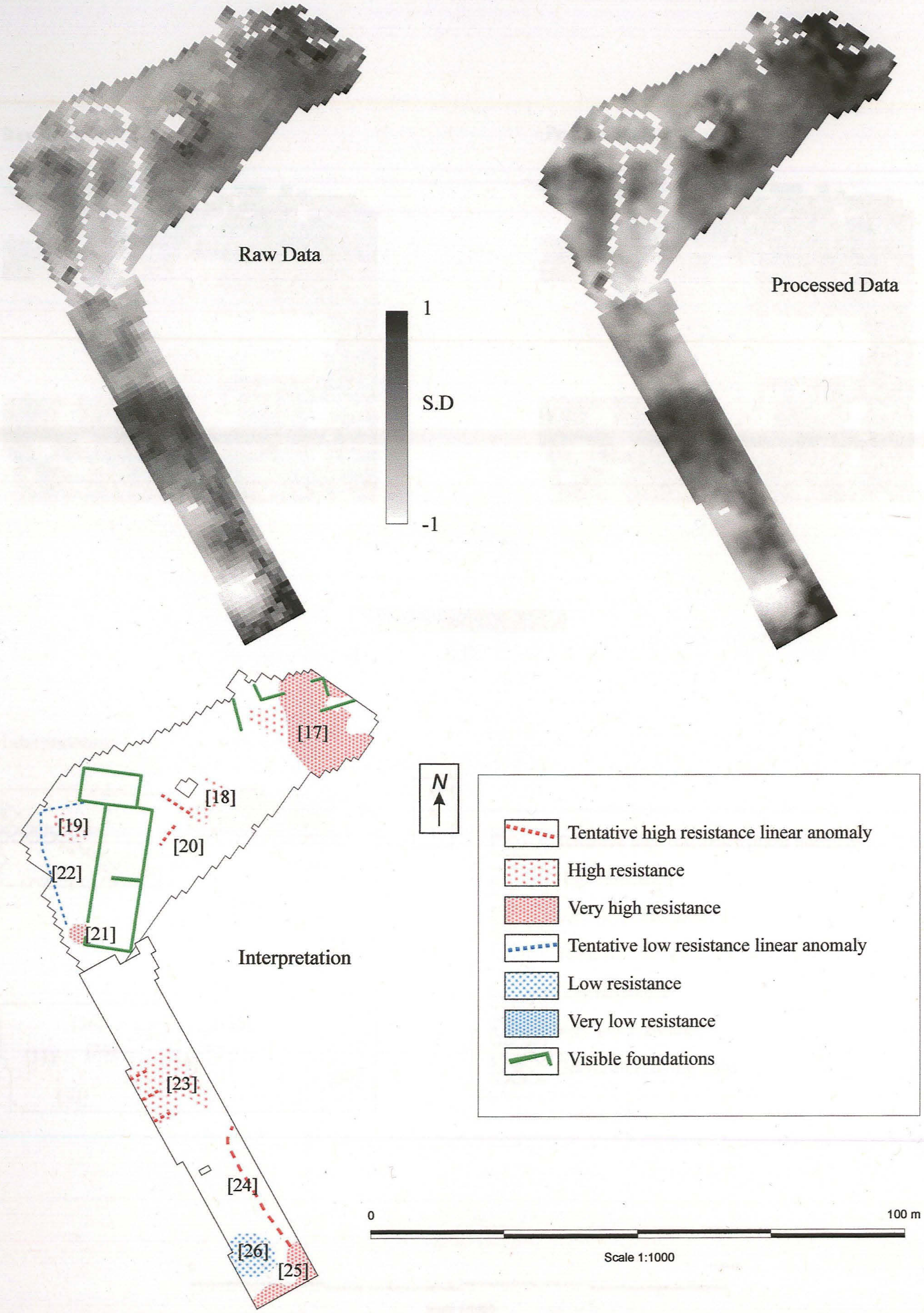

Figure 6: Earth resistance results from the Outer Ward (Stables) area at scale 1:1000

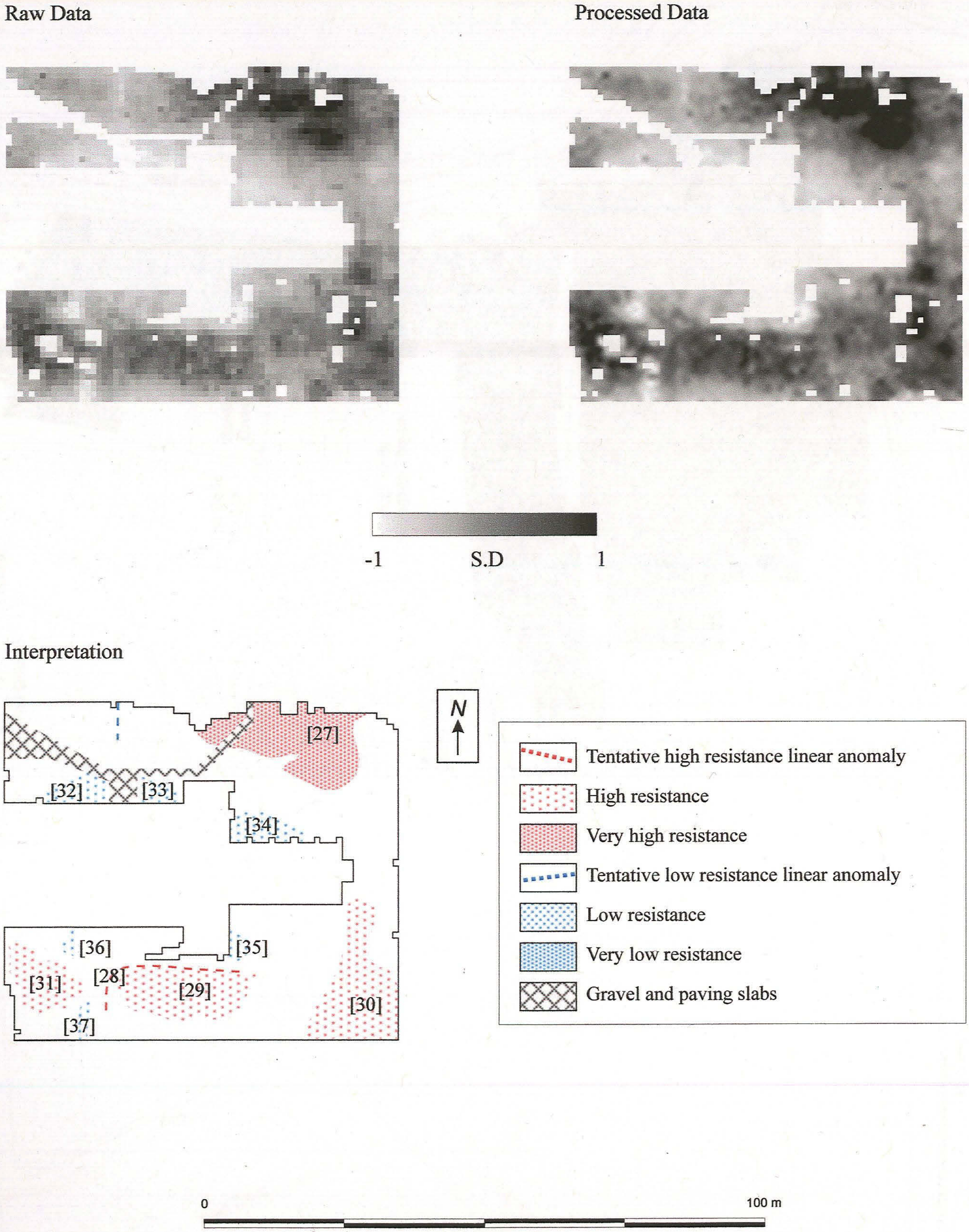

Figure 7: Earth resistance results from the Church Yard at scale 1:1000

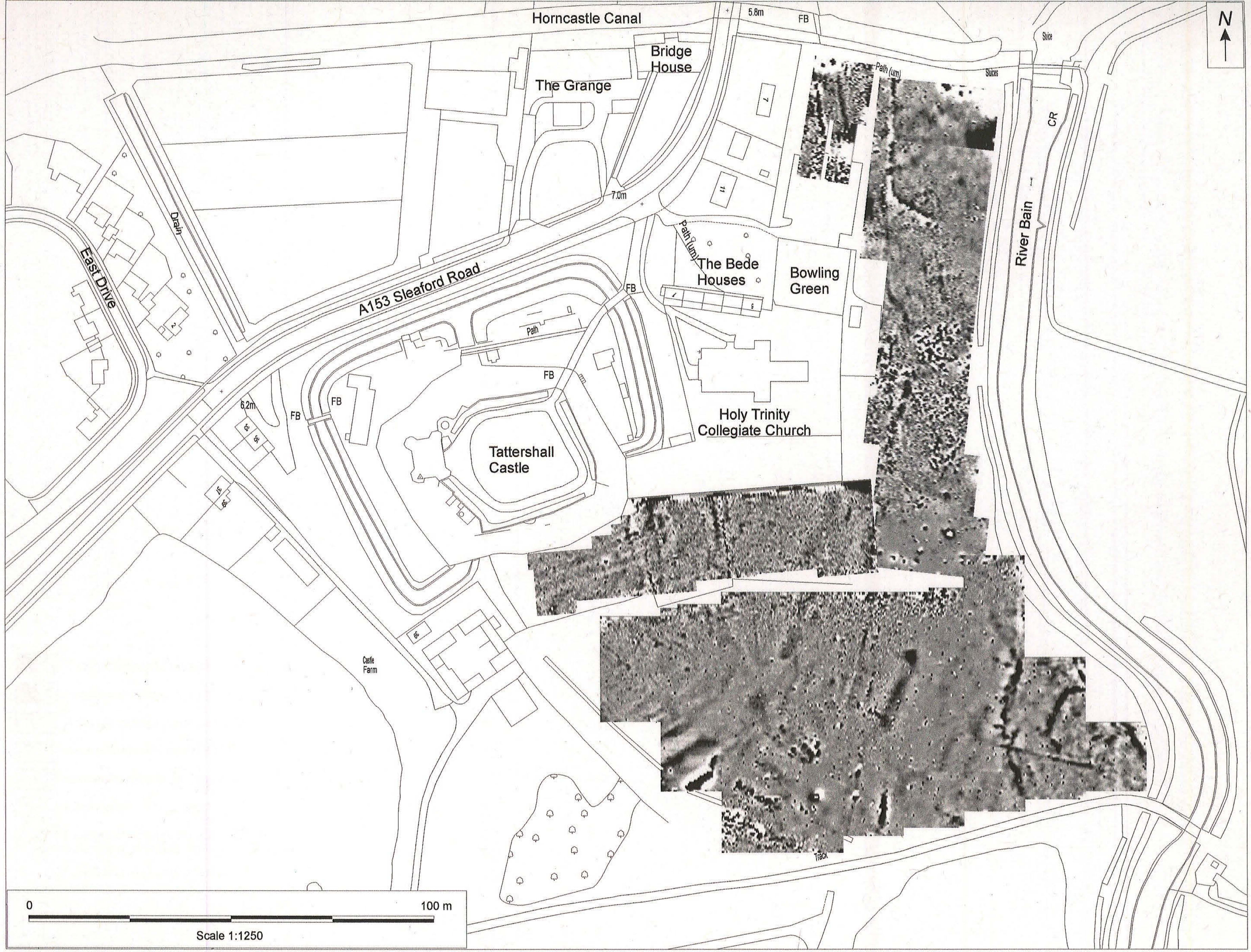

Figure 8: Processed linear greyscale plots of magnetic data on Ordnance Survey base mapping at scale 1:1250

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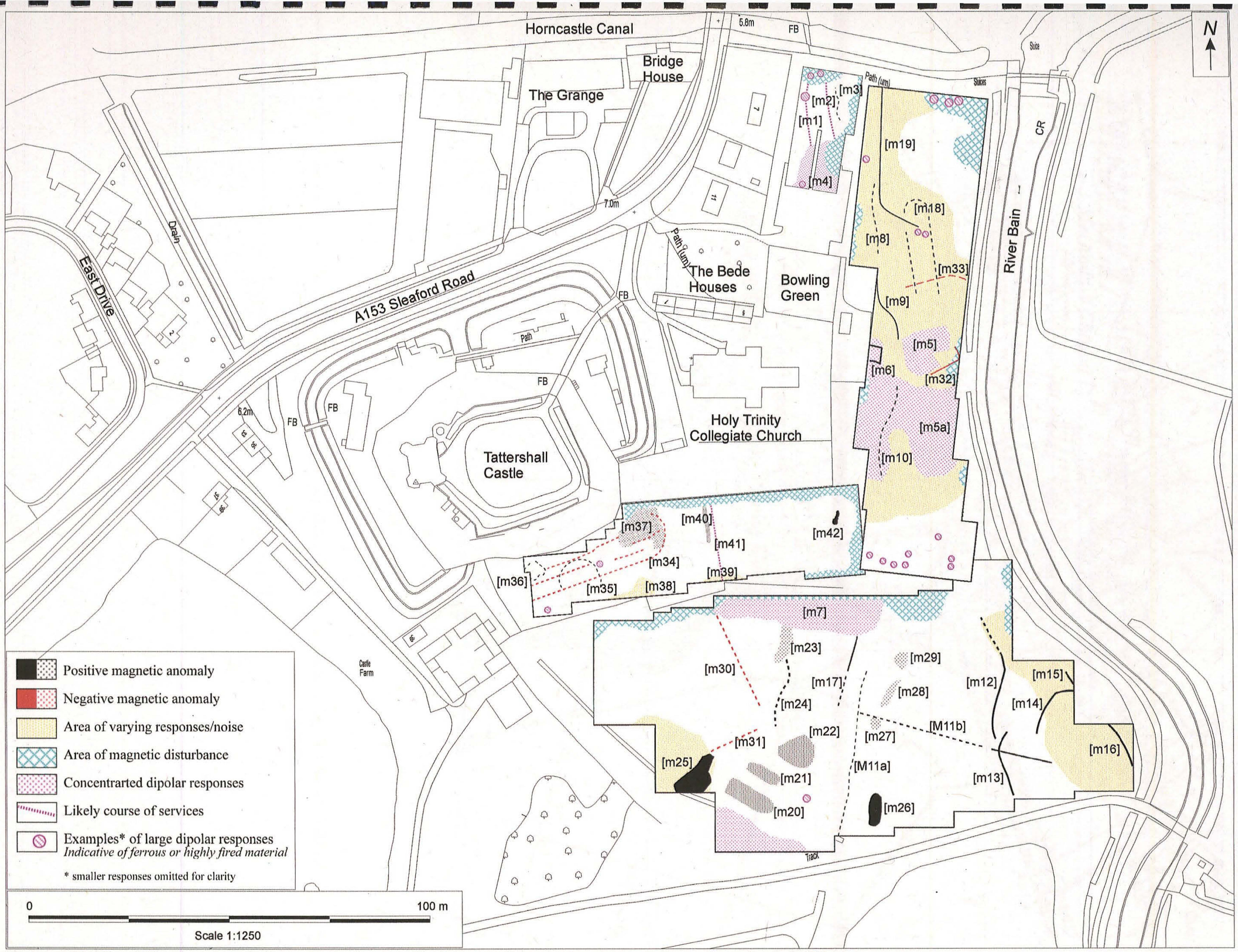

Figure 9: Simplified magnetic interpretation on Ordnance Survey base mapping at scale 1:1250

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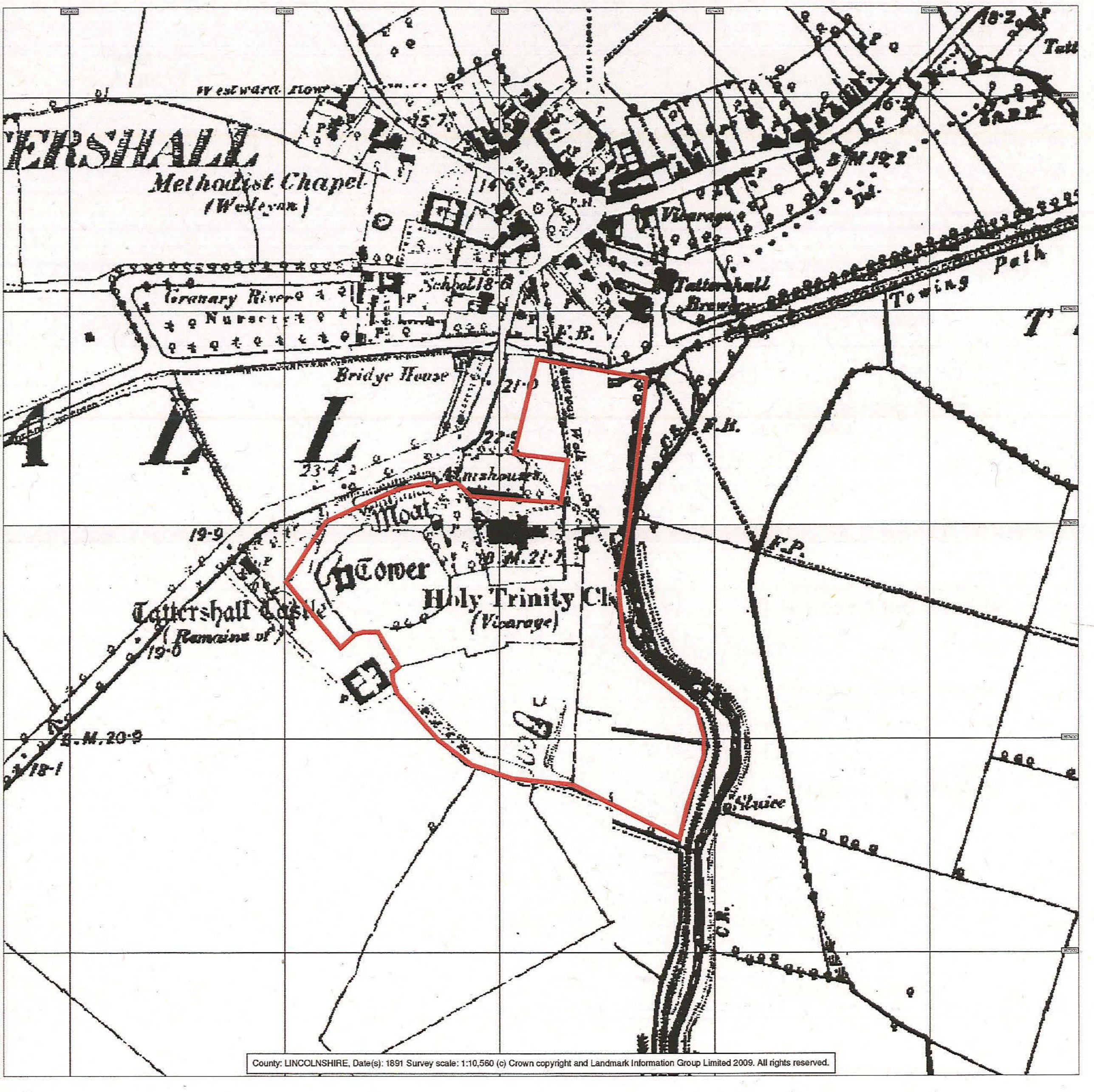

Figure 10: First Edition Ordnance Survey map of 1891 showing the areas surveyed outlined in red. Not to scale

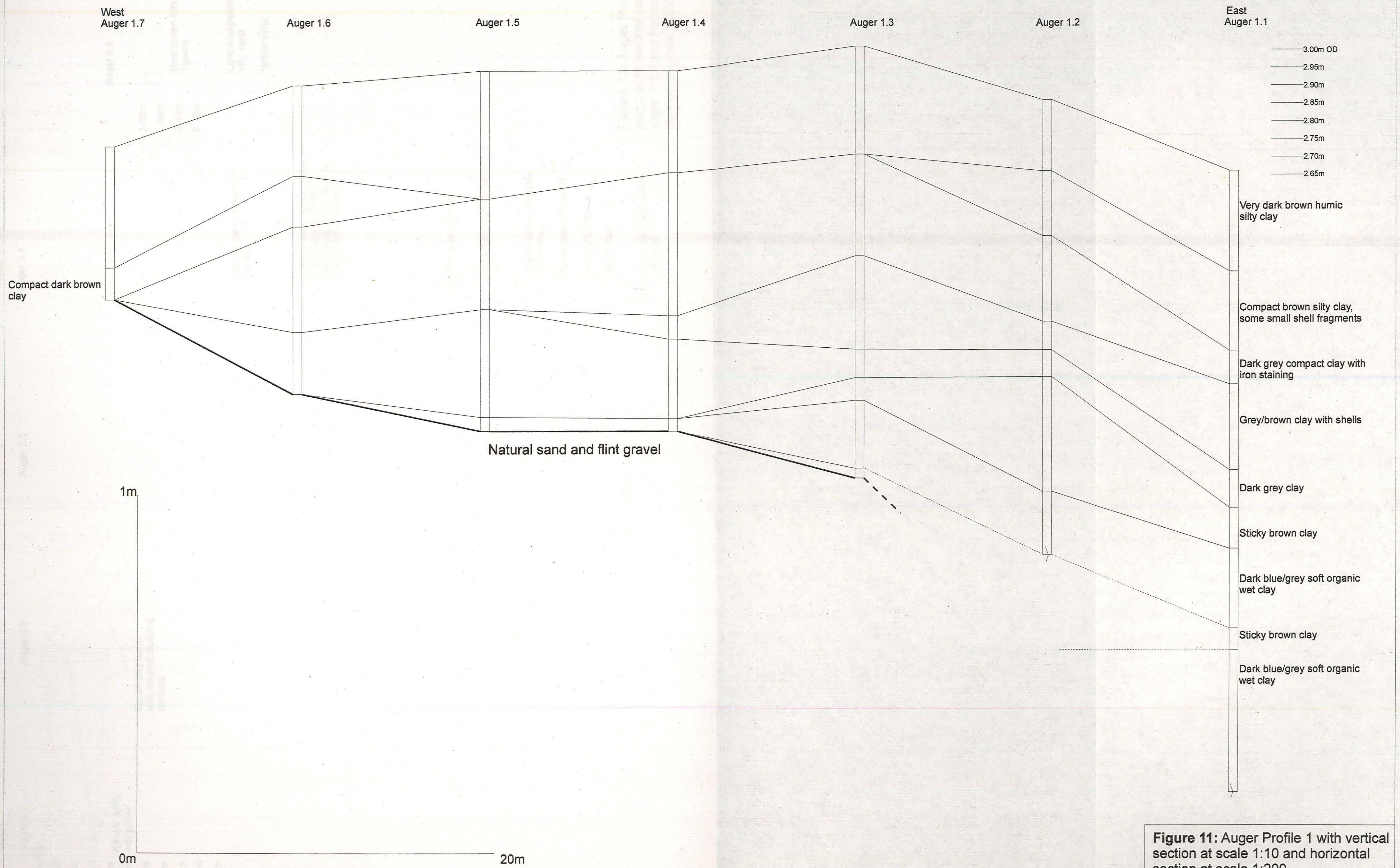

Figure 11: Auger Profile 1 with vertical section at scale 1:10 and horizontal section at scale 1:200

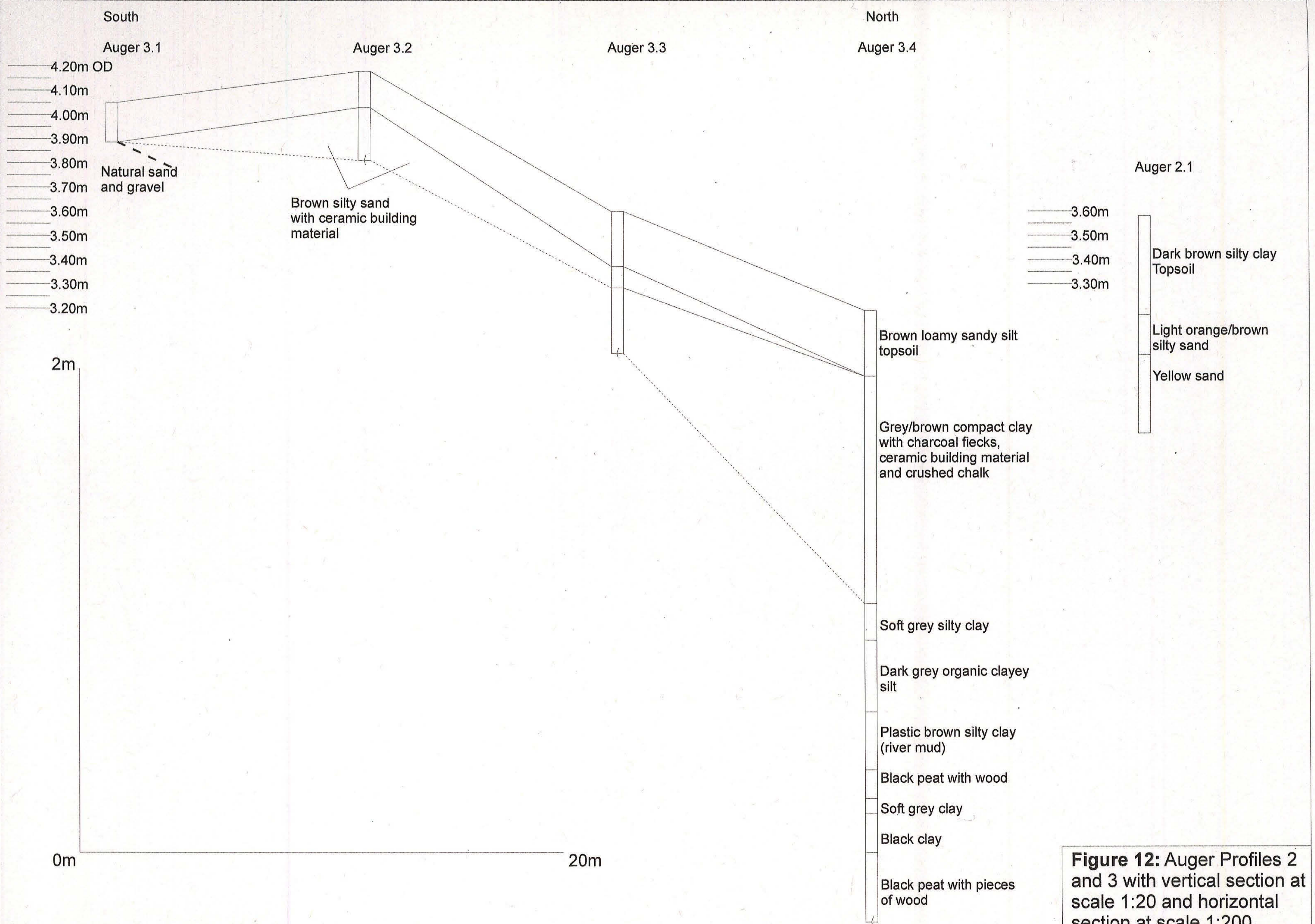

Figure 12: Auger Profiles 2 and 3 with vertical section at scale 1:20 and horizontal section at scale 1:200