St Michael's Priory, Breamore: Geophysical Survey Report November 2004

SREP 13/2004

Compiled by K. Strutt

Archaeological Prospection Services of Southampton

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St Michael's Priory, Breamore: Geophysical Survey Report August 2004

Summary

This report presents the results of geophysical surveys undertaken at St Michael's priory, Breamore in the Spring of 2004. It specifies the survey methodology together with an interpretation and discussion of the survey results. Survey was conducted over an area of nearly 4 hectares at the site, and the results were successful in locating a large number of features associated with the Augustinian priory, and the system of drainage features and water meadows that surround the monastic complex.

1. Introduction

In April of 2004, a geophysical and topographic survey was conducted at Breamore in Hampshire (Fig. 1), by the Department of Archaeology at the University of Southampton. The survey represented the latest phase of work for the Breamore Settlement and Landscape Project, an initiative directed by Prof. David Hinton and Dr Chris Loveluck, aimed at the full study of the settlement of Breamore and its environs.

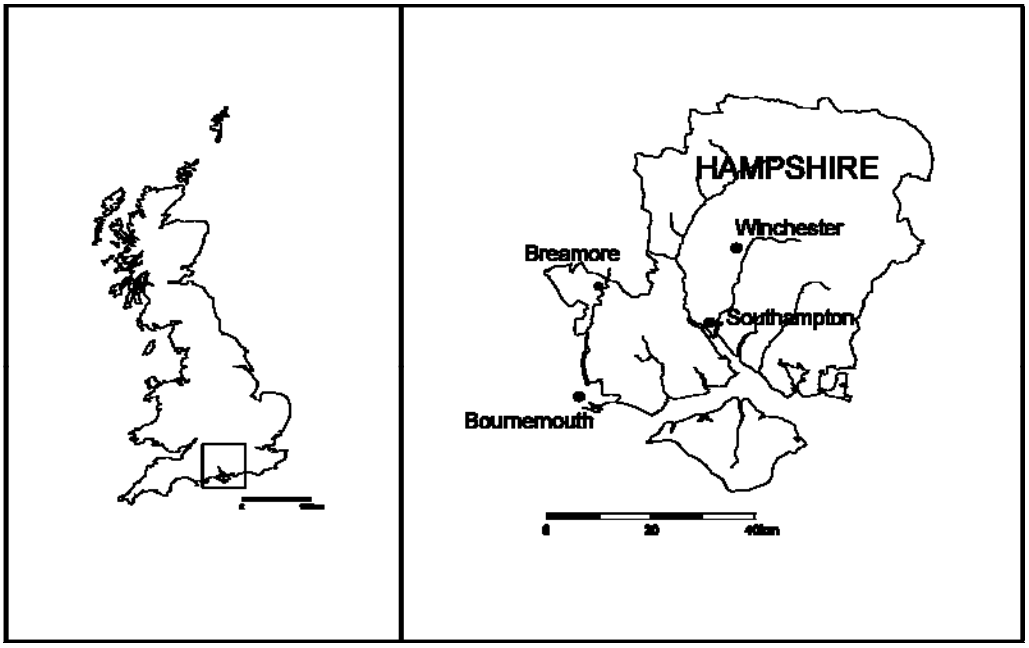

Fig. 1 Location map of Breamore, north of the New Forest, Hampshire

The aims of the project are to build on the results of the Middle Avon survey (Light et al. 1994), and more recently discovered evidence housed in the Hampshire SMR, to investigate the history of land use and settlement development in the Middle Avon valley within the environs of Breamore, over an area of 9 square km (Fig. 2); and to enhance the value of the more general information provided by the wider surface collection survey. The season of work at St Michael's priory was funded by the British Academy.

1.1 Location and Background (C. Loveluck and K. Strutt)

The modern village of Breamore is situated on the valley floor and gravel terraces of the River Avon (Fig. 2; Plate 1). The area was subject to archaeological survey by surface collection within the Middle Avon Valley survey, carried out under the co-ordination of Stephen Shennan, then of the Department of Archaeology, University of Southampton, and Tony Light of the Avon Valley Archaeological Society, between 1979 and 1986. The discoveries made during this survey (Light *et al*. 1994) provided extensive evidence of activity from the Mesolithic to the post-Medieval period. The scatters of surface material comprised lithics, pottery and metalwork. Alongside the results of this fieldwalking, surviving earthworks and monuments, protected as scheduled sites or within registered 'historic parkland', and further work by the Avon Valley Archaeological Society indicates the many diverse elements contributing to the settlement and landscape history of the Breamore area. These include a dense scatter of material from the Neolithic/Bronze Age; a series of Iron Age to Late Roman settlement foci of different sizes; at least four Anglo-Saxon pottery and artefact scatters, which probably reflect settlement sites, and two sites of early Anglo-Saxon cemeteries; and numerous later medieval pottery concentrations (Light *et al*. 1994; Gifford 1997).

The evidence from the ploughsoil and earthworks is augmented by some exceptional standing remains, in the form of a large Late Saxon church (Rodwell and Rouse 1984); the remains of an Augustinian priory from the medieval period; and Breamore House, built in the 1580s, amongst other post-medieval buildings in the vicinity. Documentary evidence concerning Breamore and its nearby hamlets begins with the Domesday survey. In 1066, Breamore was a royal estate of Edward the Confessor, linked with Rockbourne to the west. Other hamlets are also mentioned as the foci of smaller estates held from Edward. Consequently, the whole area appears to have been royal land in 1066. As a directly administered royal estate, Rockbourne-Breamore was not assessed for taxation like the surrounding smaller estates, providing an intriguing documentary lacuna upon which only archaeological investigation might shed light.

The place-name Breamore is Old English for 'broom – marsh' (Coates 1989, 40), and the Domesday Book also makes clear the different ecological resources available in the locality, namely well-drained chalk land in the north, arable land on the river gravel terrace, marshy heath land on the river alluvium and woodland to the south (Munby 1982, ref. 39b). Further extant documentation relates to the Augustinian priory, dedicated to St Michael and founded in the early 1130s, and medieval manorial accounts. Recent historical and morphological studies of medieval settlement in the Avon valley and Hampshire, have also emphasized the unusually dispersed nature of the settlement

pattern, with only very limited nucleation until the post-Medieval period (Lewis 1997, 81; Roberts and Wrathmell 2000).

1.2 Aims of Survey

The present geophysical survey was initiated with the aim of locating and mapping the remains of sub-surface archaeological features associated with the Augustinian priory of St Michael, on the banks of the river Avon (Fig. 2). Work concentrated predominantly on the pasture fields within the scheduled area of the site, with further survey taking place in the fields to the north.

2. Methodology

2.1 Survey Method

Although a number of different geophysical survey techniques could have been applied at the priory (Appendix 2), previous fieldwork in 2001 had shown that a combination of magnetometry and resistivity was successful in recording the remains of sub-surface archaeological structures. For the priory survey resistivity was chosen as the main technique, due to the nature of the archaeological deposits. It was hoped that this method would be most adept at locating the large masonry structures associated with the priory buildings in the alluvial deposits of the Avon floodplain. This was complimented by a small area of magnetometry, designed to test the application of the technique in relation to the resistivity results.

2.2 Survey Strategy

For the survey, grids of 30m by 30m were set out using a Leica TC(R) 307 total station. These were then geo-referenced to the Ordnance Survey maps for the area. The resistivity survey was carried out using a Geoscan Research RM15 Resistance Meter. Readings were recorded at 1m intervals along 1m traverses. In addition, a small magnetometer survey was conducted using a Geoscan Research FM36 Fluxgate Gradiometer, with readings taken on 1m traverses, at 0.5m intervals. Due to the open nature of the terrain, an automatic trigger was used with the gradiometer to record measurements.

During the season, areas of the site were also targeted for Ground Penetrating Radar survey. This work was conducted by Dr Justin Dix of the University of Southampton oceanographic department. The results of this survey will be presented in a separate report at a later date.

To optimise the integration of the different sets of results, the same survey grids were utilised for each method, and recording was initiated in the same direction for magnetometry and resistivity. The total station was also used to record a series of spot heights within each survey area at approximately 8m intervals, and on the breaks of slope. This provided a topographic survey of the area within the curtailage of the

scheduled monument where buried remains were indicated in the geophysical survey results.

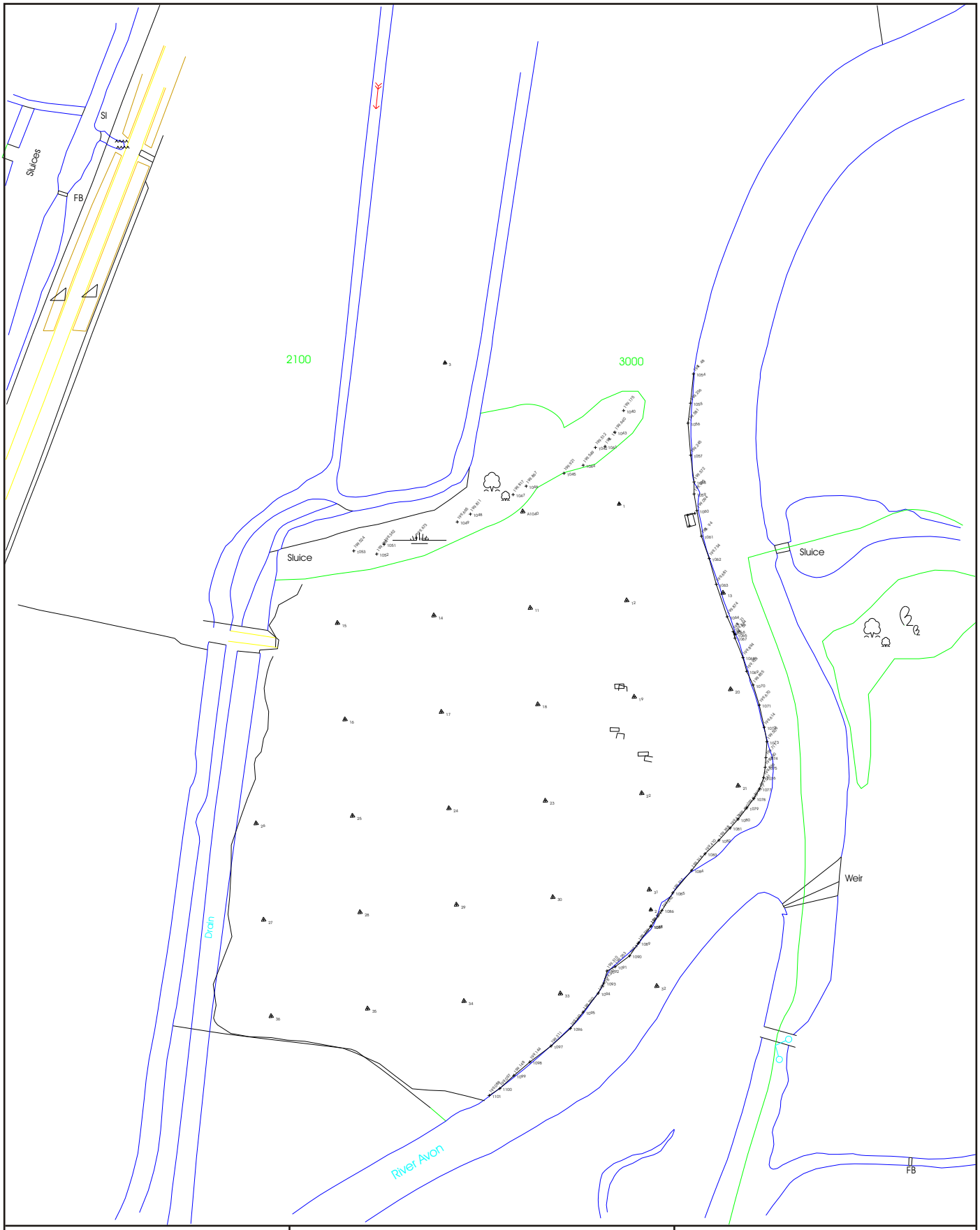

Fig. 2 Location of St Michael's priory, Breamore

N

0 60m

Breamore Parish, Hampshire

Survey data © Archaeological Prospection Services of Southampton

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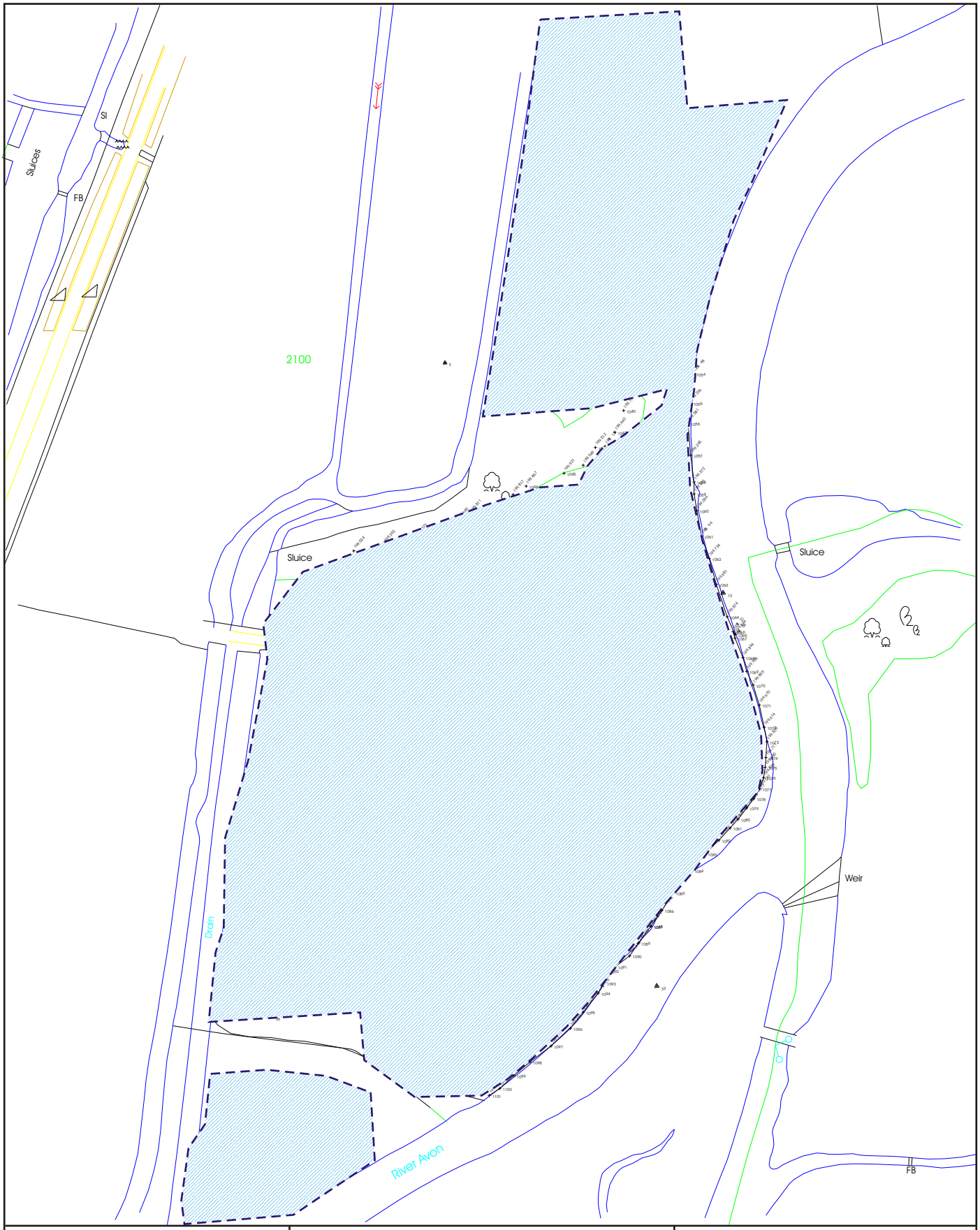

Fig. 3 The area covered by geophysics in the 2004 season

N

0 60m

Breamore Parish, Hampshire

Survey data © Archaeological Prospection Services of Southampton

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3. Survey Results

In total, an area of approximately 3.5 hectares was surveyed using resistivity at St Michael's priory. The main area of the scheduled curtailage of the site was covered, together with an area immediately to the north (Fig. 3). This area was also covered by topographic survey. A small area of magnetometry was also conducted across the cloister and main buildings of the priory.

3.1 Topographic Survey

The topography of the site is complex, and suggests a high state of preservation of the priory remains (Fig. 4). The priory field itself is approached by a dirt track from the west, and the topography at the field's edge is elevated by approximately 1m **(A)** from the surrounding area. In the centre of the field, a low rectilinear depression is visible **(B)**, showing the location of the cloister. This depression is surrounded on all sides by small ridges of ground **(C)**, **(D)** and **(E)**, made irregular by smaller hollows. These demonstrate the existence of the church and refectory buildings surrounding the cloister. The ground to the east also demonstrates a low ridge **(F)**, which then falls away towards the river Avon **(G)**. Two small depressions are represented in the topography **(H)** and **(I)**, coinciding with what appear to be chambers in the results of the resistivity (see below). To the south west, the land is marked by a slope in the topography **(J)**, that falls for over 1m leaving a rectangular hollow **(K)** that measures some 60m by 40m. The ground to the east of this shows evidence of further structures **(L)** associated with the priory. To the north of the main site, the topography highlights the drainage channels **(M)**, **(N)** and **(O)** represented in the geophysical survey. The edge of the site is also marked by a linear hollow **(P)** that runs along the north west edge of the field. This probably indicates the course of a further drainage channel.

3.2 Resistivity Survey

The results show that an incredibly rich and complicated range of deposits are located at the site (Figs 5 and 6), centred on the cloister and buildings of the priory. A high resistance rectangular feature **[r1]**, approximately 25m across, shows the location of the priory cloister. This is surrounded by buildings. To the west, a structure **[r2]** some 40m in length from north to south, and 10m wide demarcates the side of the cloister. It opens out at its southern end **[r5]** into a separate chamber. A larger structure is located along the south side of the cloister **[r6]**, measuring some 50m in length and 35m wide. This consists of a rectilinear feature in the centre of the structure **[r7]**, measuring nearly 10m across, and a large open area to the east ending in an east wall.

A smaller structure is visible to the north of the cloister, consisting of a small chamber **[r3]** and a longer building stretching for some 60m. This has at least two separate chambers **[r9]**. The structures comprising the monastic complex end abruptly to the east, close to the channel of the river Avon.

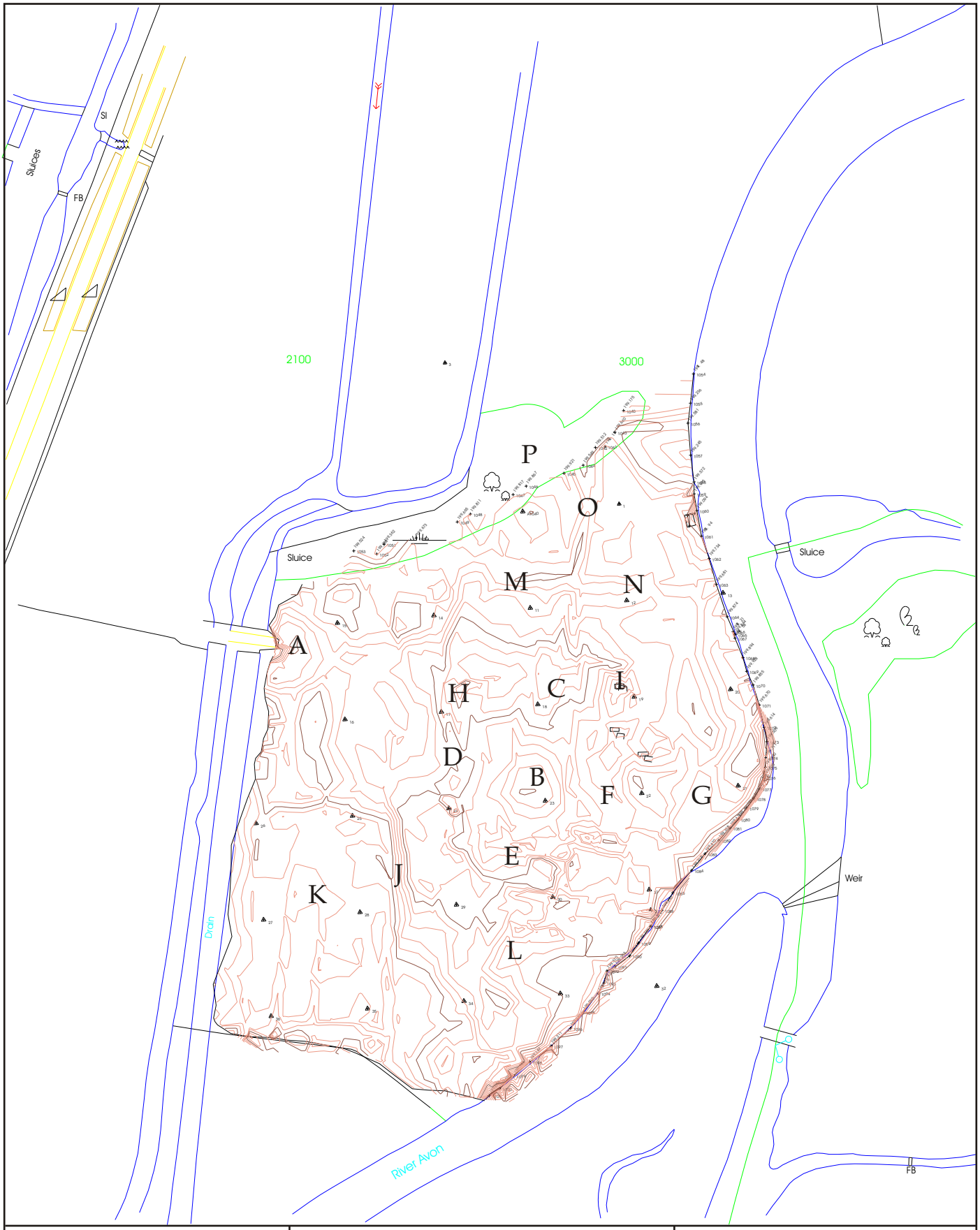

Fig. 4 Topographic survey results for St Michael's priory

N

0 60m

Breamore Parish, Hampshire

Survey data © Archaeological Prospection Services of Southampton

Map data © Crown Copyright Ordnance Survey. An EDINA Digimap/JISC supplied service.

Fig. 5 Greyscale image of the resistivity survey results from St Michael's priory

N

16 Ohms/m -16

0 60m

Breamore Parish, Hampshire

Survey data © Archaeological Prospection Services of Southampton

Map data © Crown Copyright Ordnance Survey. An EDINA Digimap/JISC supplied service.

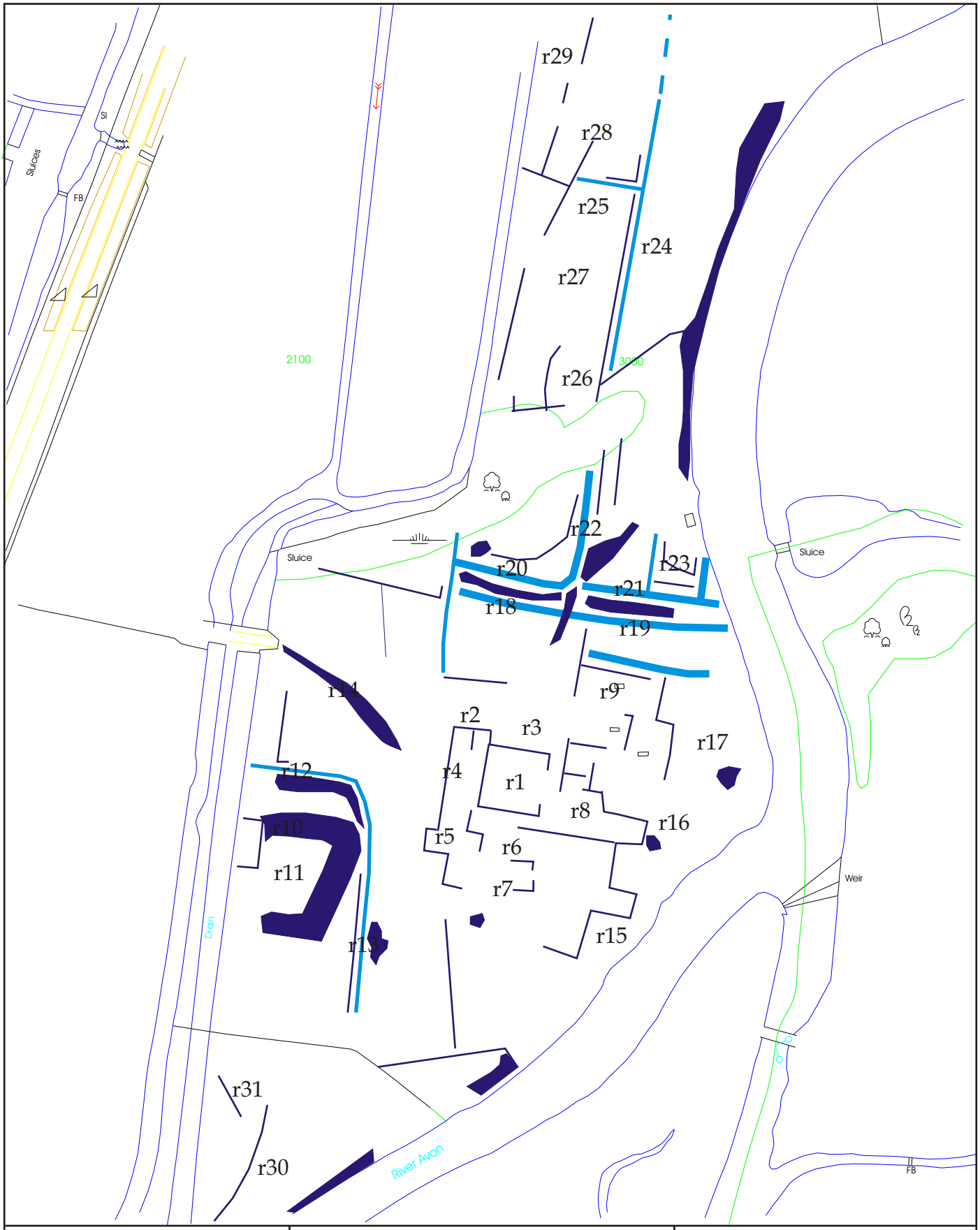

Fig. 6 Interpretation plan derived from the resistivity survey results from St Michael's priory

N

0 60m

Breamore Parish, Hampshire

Survey data © Archaeological Prospection Services of Southampton

Map data © Crown Copyright Ordnance Survey. An EDINA Digimap/JISC supplied service.

To the west, a number of large features associated with the priory are visible. These consist of a high resistance linear bank of readings **[r12]**, to the north of a broad rectilinear feature of high resistance readings **[r10]**. These are in turn cut by a narrow, low resistance feature **[r13]** that runs from the western edge of the field, and then turns to the south. These appear to be associated with the water meadows in the area surrounding the priory.

The zone to the east of the priory is of interest. Features here demarcate an edge to the structures, commencing in the south **[r15]**, and running to the north **[r16]** and **[r17]** for a distance of 80m. To the east of this line, no structures are evident, and the deposits appear to be entirely alluvial. To the north, a series of features indicate drainage channels linked to the monastic complex. They consist of low resistance linear features **[r18]** and **[r19]** tracing the line of drainage channels, with a further two channels situated immediately to the north **[r20]** and **[r21]**, the former of which runs west-east, then turns to the north **[r22]**. A possible structure is located on the bank of the river Avon **[r23]** measuring some 8m across.

These drainage features and field systems continue to the north. The drainage channel **[r22]** runs for a distance of 110m **[r24]** before leaving the northern edge of the survey area. Its course is joined by a perpendicular channel running in from the west **[r25]**, and these features are surrounded by a series of field boundaries **[r26]**, **[r27]**, **[r28]** and **[r29]**.

A number of linear high resistance features are also visible along the southern tip of the scheduled area, [r30] and [r31], and are most probably associated with field systems.

3.3 Magnetometer Survey

A small area of magnetometry was surveyed across the monastic complex, comprising of one 30m by 30m grid (Fig. 7). Results of this survey were disappointing, but not entirely surprising bearing in mind the nature of the archaeological deposits (Fig. 8). A number of positive maculae are visible **[m1]** and **[m2]** in the east portion of the grid, with a further positive maculae and possible linear feature **[m3]** to the west. The orientation of these features bears no relation to the features present in the resistivity survey, and in all probability demonstrate the location of discrete magnetic materials or evidence of burnt deposits within the priory buildings to the north of the cloister.

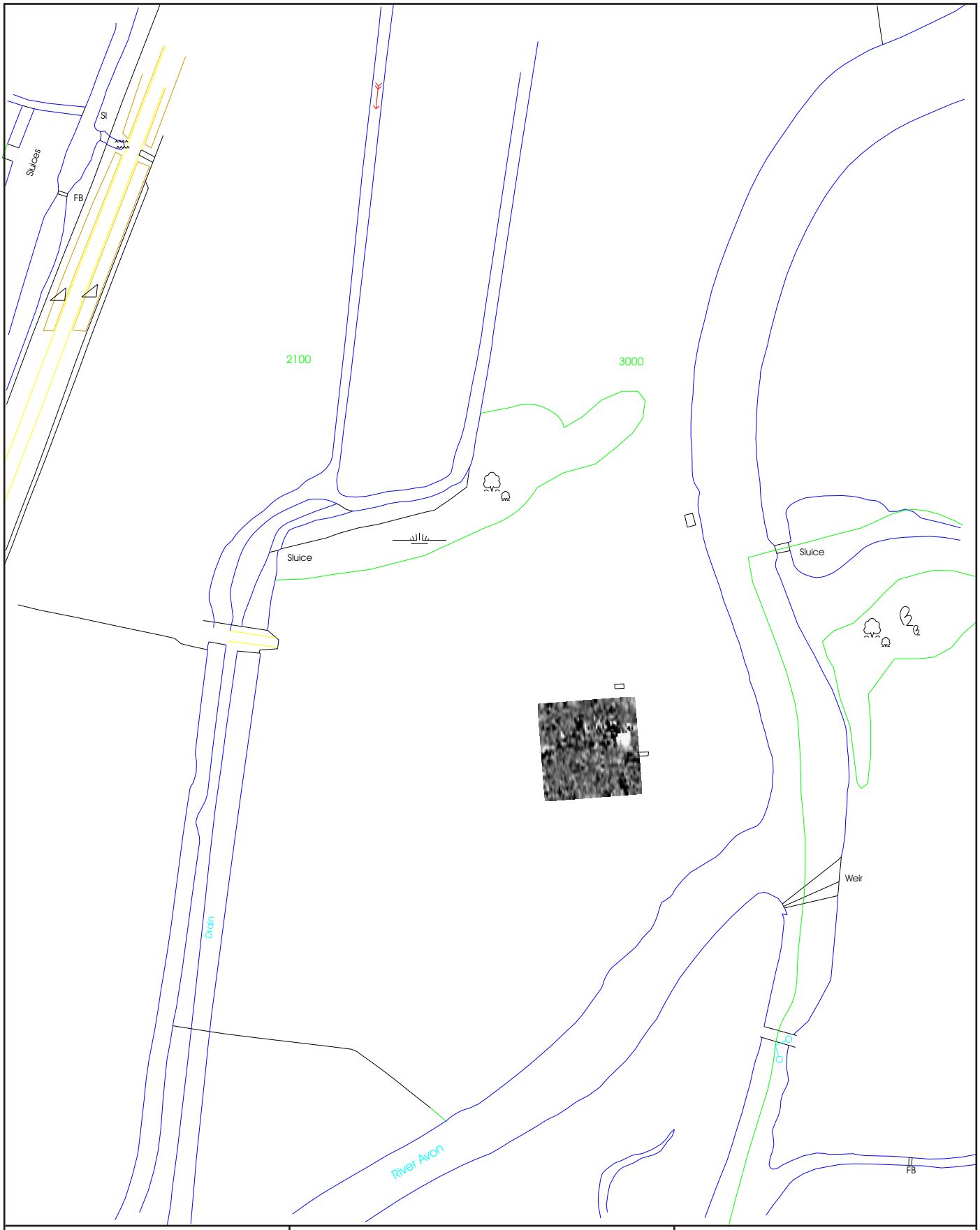

Fig. 7 Greyscale image of the magnetometer survey results from St Michael's priory

N

1 ηT -2

0 60m

Breamore Parish, Hampshire

Survey data © Archaeological Prospection Services of Southampton

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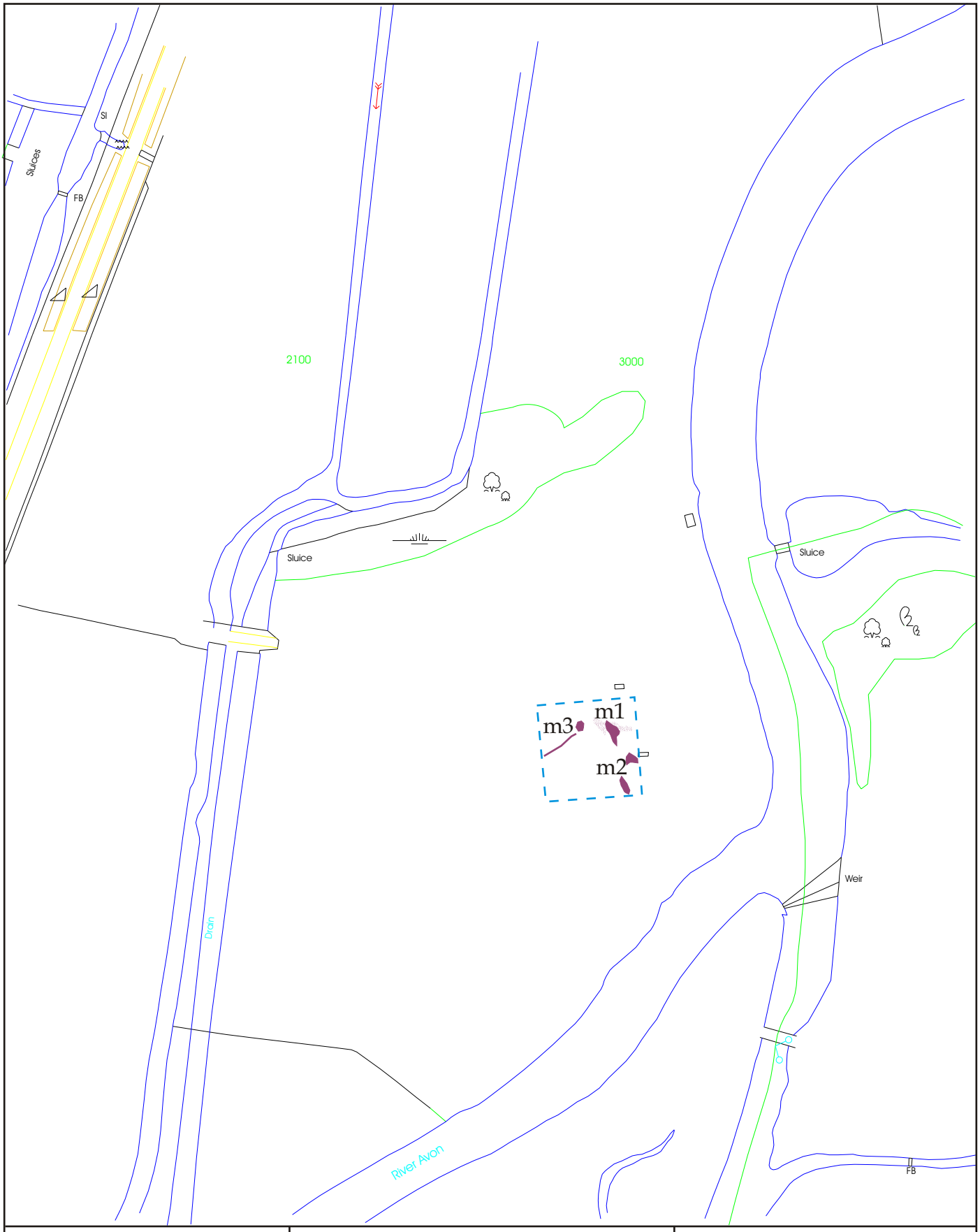

Fig. 8 Interpretation plan derived from the magnetometer survey results from St Michael's priory

N

0 60m

Breamore Parish, Hampshire

Survey data © Archaeological Prospection Services of Southampton

Map data © Crown Copyright Ordnance Survey. An EDINA Digimap/JISC supplied service.

4. Discussion

Results of the survey indicate the excellent survival rate and complexity of the remains of St Michael's priory. The cloister and surrounding structures are all clearly represented in the results, and show the location of the probable church, refectory and associated chambers. Results of the resistivity survey are less clear than might have been anticipated, and this is due predominantly to the quantity of surviving remains.

The quantity of material presented in the results from the curtailage of the priory contrast sharply with the surrounding area. Beyond the priory there is scant evidence of settlement associated with the monastic complex. A number of drainage channels are however visible, indicating part of the water meadow system that surrounded the priory and continued in use after its dissolution. Evidence of one such field exists to the south west of the priory remains, and appears to be associated with a small rectilinear structure. It is unclear as to whether these features are broadly contemporary with, or post-date the priory. The field immediately to the north is sub-divided by drainage channels and field boundaries. The large low resistance anomalies situated along the northern edge of the monastic complex suggest the extensive and large scale of channels associated with the priory.

5. Conclusions

The survey at St Michael's priory was successful in locating and mapping the remains of the Augustinian monastery and the surrounding field systems. The cloister, refectory, chapel and related buildings are visible. The edge of the complex along the river Avon is clearly visible, as is the overall extent of the priory and the extensive channels and field boundaries that surround the main site. It is interesting to note the mediocre response in the survey to magnetometry, and this serves to illustrate the advantage in applying complementary survey techniques.

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. Primarily, thanks go to Sir Edward Hulse and Michael Hulse, the land-owners and residents at Breamore House, for their kind permission and support throughout the current survey work and excavation. Thanks are also due to the tenant farmer on the priory site, Mr George Whidden of South Charford Farm, for permission to survey on the land. At the University of Southampton the guidance and enthusiasm of the project directors, Prof. David Hinton and Dr Chris Loveluck, is gratefully acknowledged. The successful completion of the surveys would have been impossible without the assistance of the following personnel in executing the survey: Dom Barker, Sophie Hay and Edward Oakley. Finally, sincere and grateful thanks go to the British Academy for funding this research.

Plate 1 The River Avon to the south of the priory

Appendix 1 - Details of Survey Strategy

Dates of Survey: 11th April – 5th May 2004
Site: Breamore
District Parish: Fordingbridge
County: Hampshire
Grid Reference: SU 152 179
Surveyor: University of Southampton
Personnel: Dom Barker, Sophie Hay, Edward Oakley, Kris Strutt
Geology: Gravels and alluvial deposits

Survey Type 1: Resistivity
Approximate area: 3.5 hectares
Grid size: 30m
Traverse Interval: 1m
Reading Interval: 1m
Instrument: Geoscan Research RM15
Resolution: 0.1 Ω
Probe Configuration: Twin electrode
Probe Separation: 0.5m

Survey Type 2: Magnetometer
Approximate area: 0.1 hectares
Grid size: 30m
Traverse Interval: 1m
Reading Interval: 0.5m
Instrument: Geoscan Research FM36
Resolution: 0.1 nT
Trigger: Encoder

Survey Type 3: Topography

Approximate area: 3.5 hectares

Sample interval: 10m

Instrument: Leica TC 605 total station

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 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 (Ω/m).

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 0.1Ω, 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 is 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.

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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