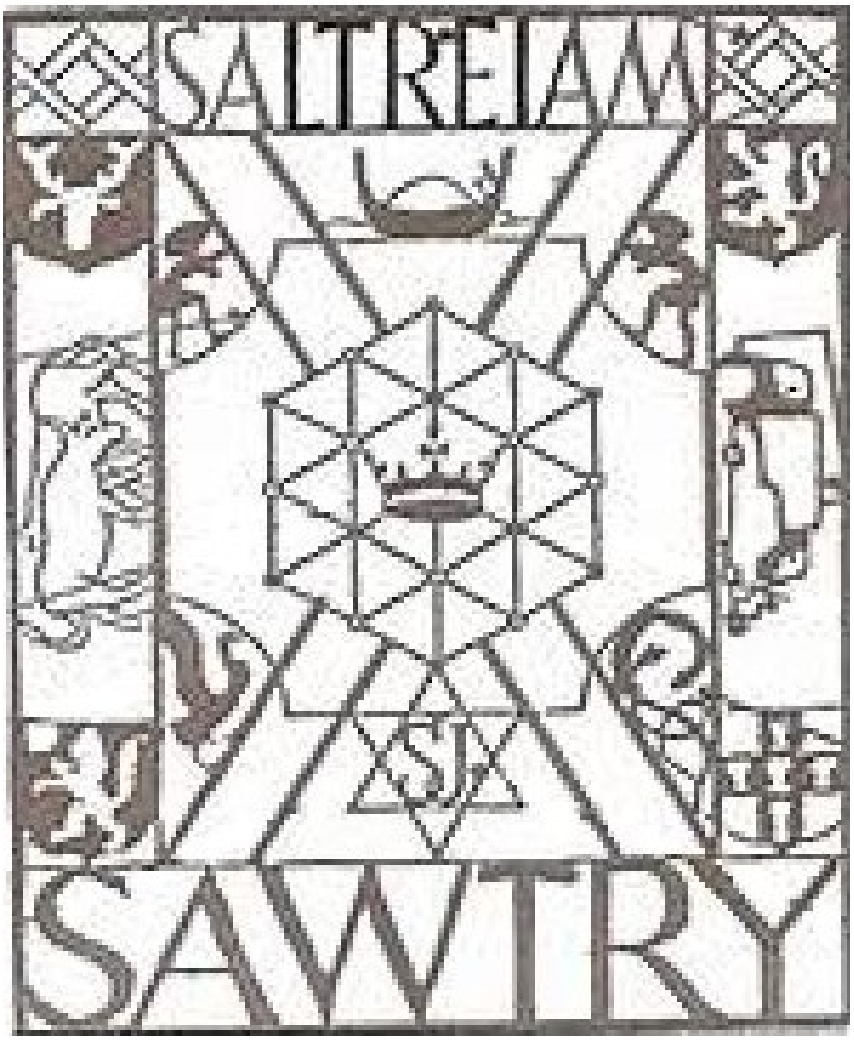
SAWTRY HISTORY SOCIETY



ARCHAEOLOGICAL GEOPHYSICAL SURVEY REPORT SHS 16-1/R-1

REPORT ON THE GEOPHYSICAL EARTH RESISTANCE AND MAGNETOMETRY SURVEY CONDUCTED 25-26 JUN 16 AND GEOPHYSICAL EARTH RESISTANCE SURVEY CONDUCTED 8 DEC 16 - SAWTRY ABBEY SURVEY (SHS 16-1)

25 March 2018

by

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LIST OF ILLUSTRATIONS

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Louise Quinsay	Topographical Surveyor
Archaeology Department	University Centre Peterborough

OASIS REPORT FORM

PROJECT DETAILS	**OASIS No:**	
Project name	Archaeological geophysical survey of Sawtry Abbey, Sawtry, Cambridgeshire	
Short description	Sawtry History Society archaeologists undertook an earth resistance and magnetometry survey of Sawtry Abbey in order to determine the accuracy of drawings made by Inskip Ladds during the period 1907-1912.	
Project type	Geophysical survey	
Site status	Scheduled Ancient Monument (SAM 27031) - HLE 1013280	
Previous work	None	
Current land use	Pasture	
Future work	Further geophysical survey	
Monument type/ period	Cistercian Abbey / c.1147-1536	
Significant finds	None	
PROJECT LOCATION		
County	Cambridgeshire	
Site address	Sawtry Abbey, Sawtry	
Study area	8,400m^2	
OS grid reference	TL19746 82565	
Height OD	8m aOD	
PROJECT CREATORS		
Organisation	Sawtry History Society (SHS)	
Project brief originator	Sawtry History Society (SHS)	
Project design originator	N/A	
Director/Supervisor	Philip Hill	
Project Manager	Kevin Redgate	
Sponsor or funding body	Sawtry History Society	
PROJECT DATE		
Start date	25 Jun 16	
End date	8 Dec 16	
ARCHIVES	Location	Content
Physical		
Paper		
Digital	SHS Archaeological Digital Archive	SHS Archaeological Digital Records and Media
BIBLIOGRAPHY		
Title	Report on the Geophysical Earth Resistance and Magnetometry Survey Conducted 25-26 Jun 16 and Geophysical Earth Resistance Survey Conducted 8 Dec 16 - Sawtry Abbey Survey (SHS 16-1)	
Serial title & volume	N/A	
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Date	25 March 2018 (Revised 26 June 2020)	

ABSTRACT

The survey was undertaken over the periods 25-26 Jun 16 (earth resistance and magnetometry) and 8 Dec 16 (earth resistance) with the principal purpose of determining the accuracy of drawings made by Inskip Ladds and whether they were influenced by his visit to Roche Abbey, and locating buildings/ functional spaces commonly expected to be present in the Cistercian abbey model but not included on the Inskip Ladds drawings. The survey was also purposed to enable Sawtry History Society (SHS) archaeologists to gain proficiency in the use of geophysical survey equipment and associated processing software, and to develop geophysical survey procedures. Both surveys successfully met these purposes.

In addition, the survey conducted on 8 Dec 16 was utilized as an opportunity to introduce first-year undergraduate archaeology students from University Centre Peterborough to the basic principles of geophysical earth resistance survey. Again, this purpose was also successfully met.

This report is based on the individual survey Results and Analysis documents (SHS16-1_RA-1 and SHS16-1_RA-2).

1. **Introduction**.

1.1. **Site Details**.

1.1.1. **Accession Number**. ECB6689.

1.1.2. **Location**. Sawtry Abbey site rests on the eastern parish boundary (Figure 1.1) in the eastern half of National Grid Reference (NGR) square TL1982.

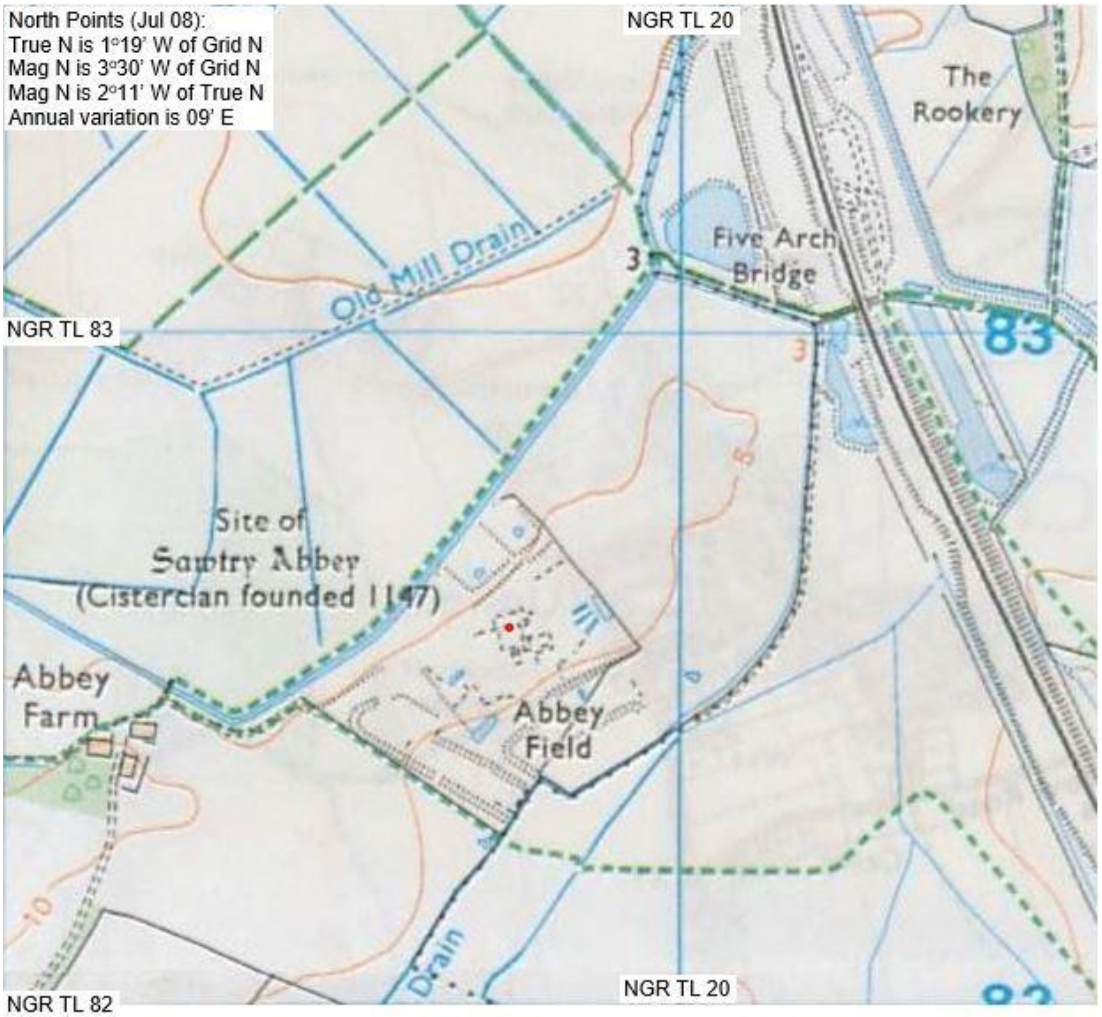

Figure 1.1: Sawtry Abbey Site with SBM in red (Ordnance Survey, 2006)

1.1.3. **Site Benchmark (SBM)**. This has been set at the center point of the southern nave wall of the Abbey church at NGR TL19746 82565 (Figure 1.1).

1.1.4. **Geology**. The site sits astride a narrow 5m contour on bedrock that is comprised of Oxford Clay Formation-Mudstone, with no superficial deposits, and lies directly below the top and sub-soils (Figure 1.2).

Figure 1.2: Site Geology (British Geological Survey, 2017)

1.1.5. **Protection**. Sawtry Abbey site is a Scheduled Monument under the Ancient Monuments and Archaeological Areas Act 1979 as amended, and is listed on the Historic England (HE) Heritage List (HLE 1013280). Licence to survey was given by HE on the condition that a survey report was submitted.

1.1.6. **Land Use**. The site is private land owned by St John's College, with Savills acting as the land agent. The land is managed by Abbey Farm and is held in pasture for livestock grazing.

1.1.7. **Utilities**. There are no known utilities within the site boundaries.

1.2. **Historical Background**. The remaining stone features of the dissolved Abbey precinct were extensively robbed-out in the mid-19th Century when a local land owner employed out-of-work railway labourers to remove all re-usable stone. The surviving earthworks suggest that, in addition to the removal of standing stone features, foundations were also excavated. During the period 1907-1912 an extensive survey of the Abbey Site was undertaken by Inskip Ladds which resulted in the publishing of a paper and informed drawings (Figures 1.3 and 1.4).

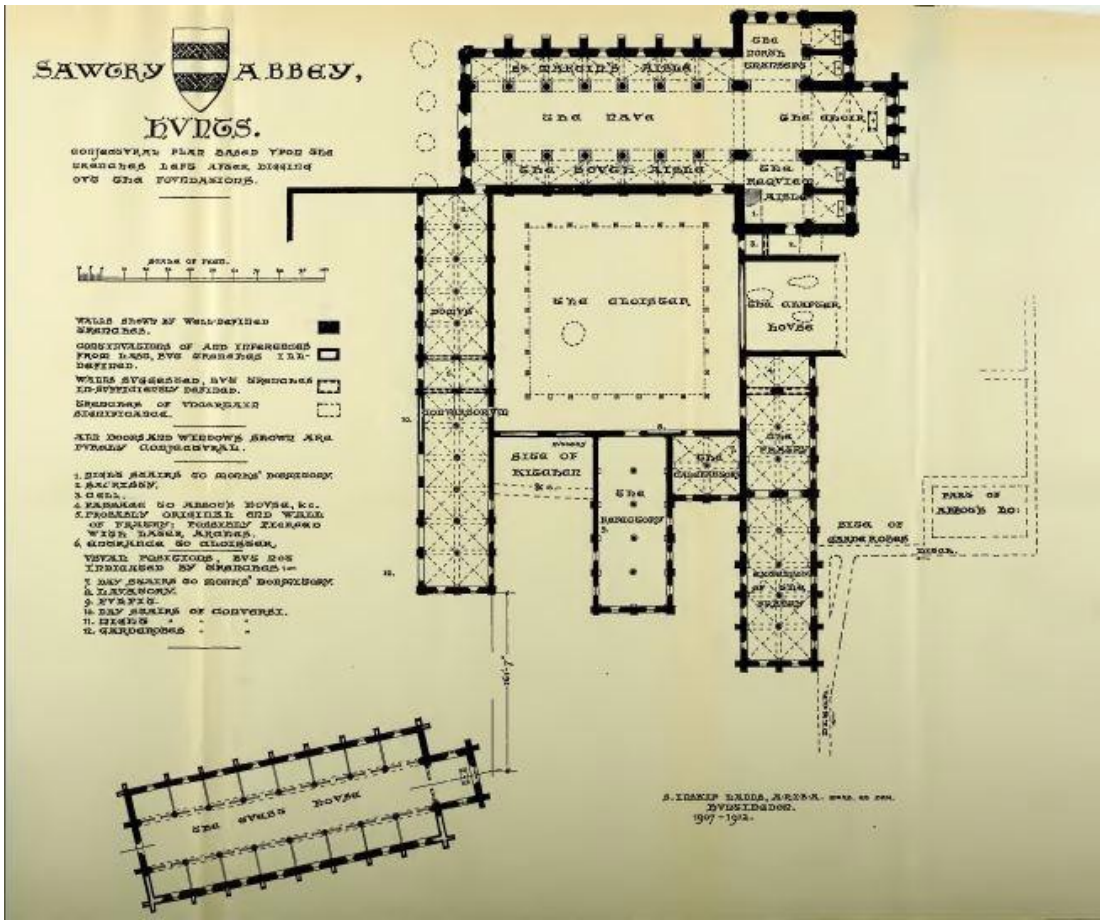

Figure 1.3: Abbey Plan (Inskip Ladds, 1913)

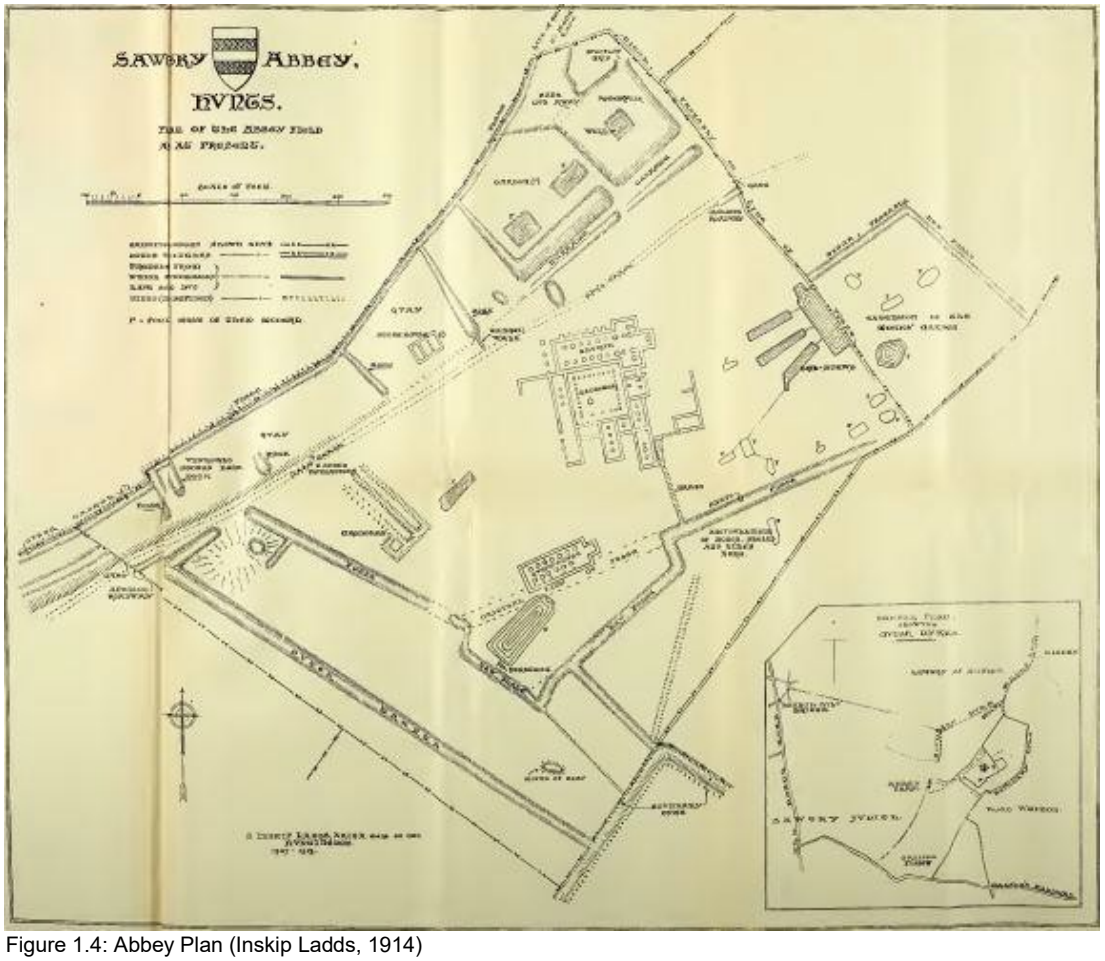

Figure 1.4: Abbey Plan (Inskip Ladds, 1914)

1.3. **Survey Objectives**. The survey consisted of a series of geophysical earth resistance and magnetometry surveys over the periods 25-26 Jun 16 and 8 Dec 16. Their purpose was to:

1.3.1. Determine the accuracy of drawings made by Inskip Ladds and ascertain to what extent, if any, they were influenced by his visit to Roche Abbey (Inskip Ladds, 1913: 300-301 & 341).

1.3.2. Locate buildings/functional spaces commonly expected to be present in the Cistercian abbey model, not included on the Inskip Ladds drawings.

1.3.3. Enable Sawtry History Society (SHS) archaeologists to gain proficiency in the use of both the Geoscan Research RM85 Resistance Meter System and PA20 probe array assembly, and Geoscan FM256 Fluxgate Gradiometer.

1.3.4. Enable SHS archaeologists to gain proficiency in the use of Snuffler software, specifically; importing, filtering, interpreting and analyzing data.

1.3.5. Enable SHS archaeologists to develop (25-26 Jun 16) and test (8 Dec 16) geophysical survey procedures for future surveys.

1.3.6. Introduce first-year undergraduate archaeology students from University Centre Peterborough to the basic principles of geophysical earth resistance survey.

2. Methods.

2.1. Survey Methods.

2.1.1. Survey Grids.

2.1.1.1. **25-26 Jun 16**. A bespoke survey grid was established which extended 60m east and west, and 60m south, from the SBM, aligned with the south nave wall earthwork. The survey grid encompassed the cloistral garth; the east, west and south ranges; earthworks east of the cloistral complex (possibly including the infirmary and Abbots lodging); missing elements of the south range; and potential service activity west of the cloistral complex. The survey grid was divided into 20m x 20m squares with each square being allocated a unique reference number, G1-G18 (Figure 2.1).

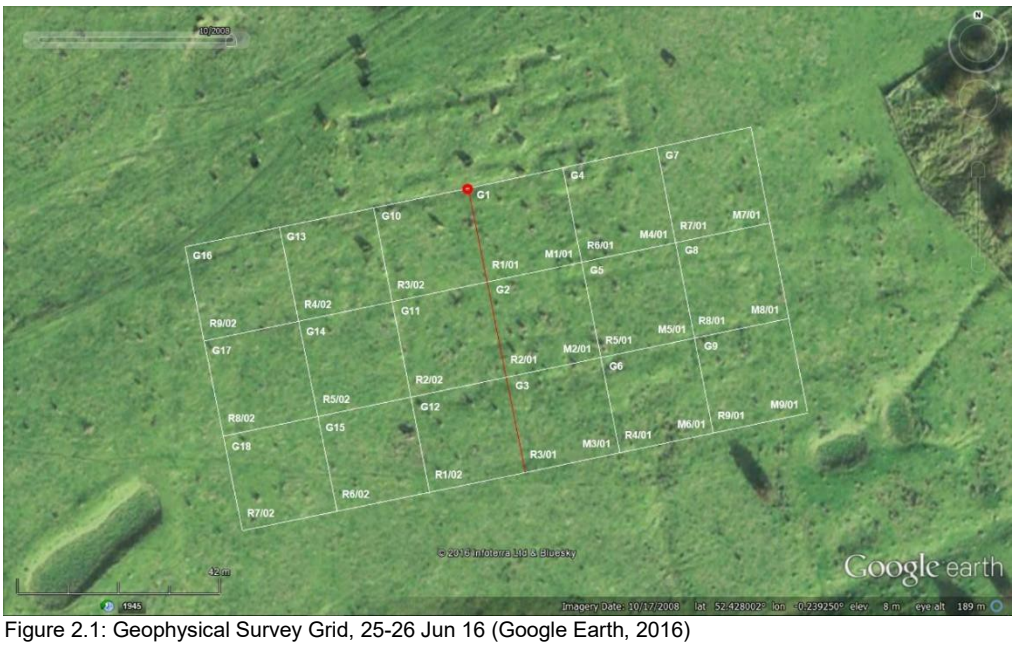

Figure 2.1: Geophysical Survey Grid, 25-26 Jun 16 (Google Earth, 2016)

2.1.1.2. **8 Dec 16**. The survey grid east of the base line was extended north by 20m encompassing the east half of the nave, the transepts and chapels, crossing, the presbytery and cemetery area. This resulted in a survey area consisting of three 20m x 20m squares; with each square being allocated a unique reference number, G19-G21 (Figure 2.2).

Figure 2.2: Geophysical Survey Grid, 8 Dec 16 (Google Earth, 2016)

2.1.2. **Topographical Survey**. The SBM and four Site Reference Points (SRP) were then surveyed (Figure 2.3). Whilst the SRP were not utilized during the surveys, they remain useful for future site triangulations. This survey was undertaken by external specialists using the Trimble R7 GPS Receiver.

Figure 2.3: SBM and SRP (Google Earth, 2016)

2.1.3. **Earth Resistance Survey #1**. This survey was carried out using the Geoscan Research RM85 Resistance Meter System and PA20 Probe Array assembly. The survey sequence was G1, G2, G3, G6, G5, G4, G7, G8 and G9 which can be identified on Figure 2.1 by the series R1/01-R9/01. Each grid consisted of twenty traverse lines with readings being taken at one metre intervals along each traverse. The traverses in G1-G3 and G7-G9 started in the NW corner and followed a zig-zag pattern to end in the SW corner, the traverses in G6-G4 started in the SW corner and followed a zig-zag pattern to end in the NW corner.

2.1.4. **Earth Resistance Survey #2**. This survey was carried out using the Geoscan Research RM85 Resistance Meter System and PA20 Probe Array assembly. The survey sequence was G12, G11, G10, G13, G14, G15, G18, G17 and G16 which can be identified on Figure 2.1 by the series R1/02-R9/02. Each grid consisted of twenty traverse lines with readings being taken at one metre intervals along each traverse. The traverses in G12-G10 and G18-G16 started in the SE corner and followed a zig-zag pattern to end in the NE corner, the traverses in G13-G15 started in the NE corner and followed a zig-zag pattern to end in the SE corner.

2.1.5. **Magnetometry Survey #1**. This survey was carried out using the Geoscan FM256 Fluxgate Gradiometer. The survey sequence was G1, G2, G3, G4, G5, G6, G7, G8 and G9 which can be identified on Figure 2.1 by the series M1/01-M9/01. Each grid consisted of twenty traverse lines with readings being taken at 0.25 metre intervals along each traverse. The traverses in each grid square started in the NW corner and followed a zig-zag pattern to end in the SW corner.

2.1.6. **Earth Resistance Survey #3**. This survey was carried out using the Geoscan Research RM85 Resistance Meter System and PA20 Probe Array assembly. The survey sequence was G19, G20 and G21 which can be identified on Figure 2.2 by the series R1/03-R3/03. Each grid consisted of twenty traverse lines with readings being taken at one metre intervals along each traverse. The traverses in each grid square started in the SW corner and followed a zig-zag pattern to end in the SE corner.

2.2. **Survey Record**.

2.2.1. Earth Resistance survey #1 was undertaken on 25 Jun 16.

2.2.2. Earth Resistance survey #2 was undertaken on 26 Jun 16.

2.2.3. Magnetometry survey #1 was undertaken on 26 Jun 16.

2.2.4. Earth Resistance survey #3 was undertaken on 8 Dec 16.

2.2.5. Survey Record sheets can be found at Annex A.

2.3. **Data Processing**. Survey data was imported into Snuffler (version 1.21) as four different data sets; earth resistance survey #1 (Res16-1), earth resistance survey #2 (Res16-2), earth resistance survey #3 (Res 16-3) and magnetometry survey #1 (Mag16-1). Results of the earth resistance surveys can be found as composites at para 2.4, whilst results of the magnetometry survey can be found at para 2.5. Results are presented in the default linear display option and greyscale display type; other display options and types are provided at Annex B:

Black	= low resistance; pits, ditches, clay dumps
	= high magnetic response; iron, steel, brick, burned soil, kilns, hearths, ditches, pits
White	= high resistance; walls, rubble, paving areas
	= low magnetic response; stone features

linear = display colour blocks are assigned to equal ranges of values
non-linear = display colour blocks are assigned to equal numbers of readings
relief plot = displays results as a 3D image
- high resistance readings are high points
- low resistance readings are low points

2.4. **Earth Resistance Data Presentation**.

2.4.1. **Raw Data Composite Plot**. Raw data composite plot is provided as a pair; the first without grid lines in order to present an uninterrupted picture, the second with grid lines in order to aide with orientation (Figure 2.4).

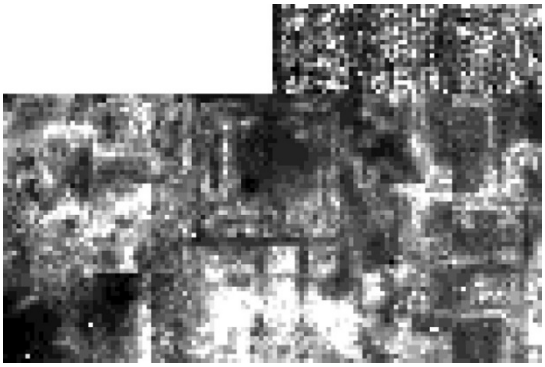
Figure 2.4a: Res Composite, Raw Data

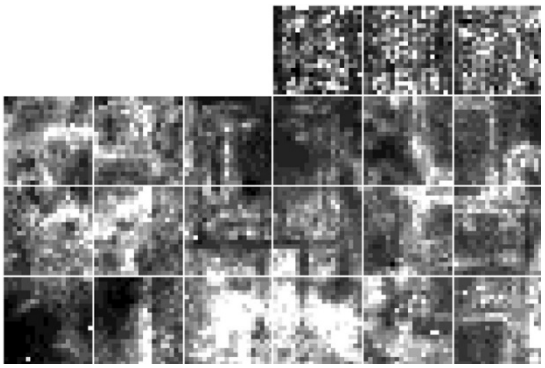
Figure 2.4b: Res Composite, Raw Data, Grid

2.4.2. **Corrected Data Composite Plots**. Corrected data composite plots are provided in pairs; the first without grid lines in order to present an uninterrupted picture, the second with grid lines in order to aide with orientation. Correction to the raw data was applied in two stages, firstly through the application of clip, de-spike and edge correction (Figure 2.5) and secondly through the further application of sharpen (Figure 2.6).

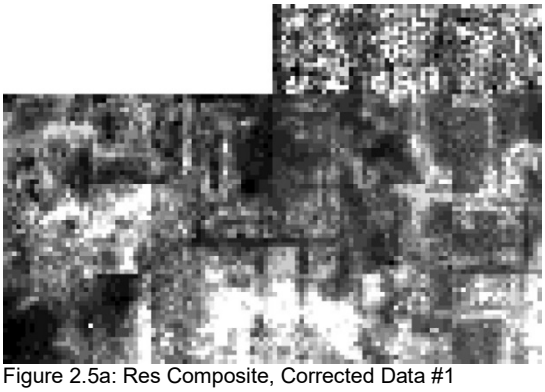
Figure 2.5a: Res Composite, Corrected Data #1

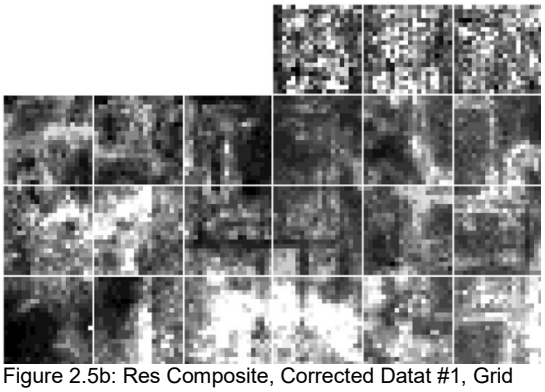
Figure 2.5b: Res Composite, Corrected Datat #1, Grid

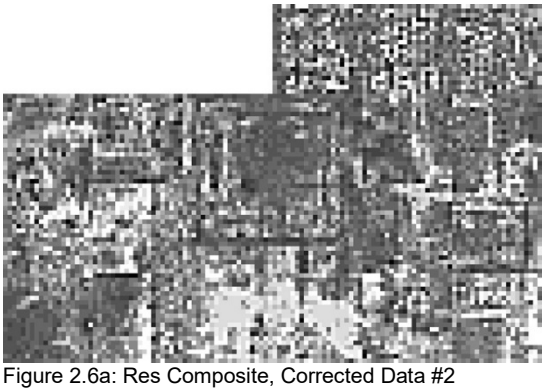
Figure 2.6a: Res Composite, Corrected Data #2

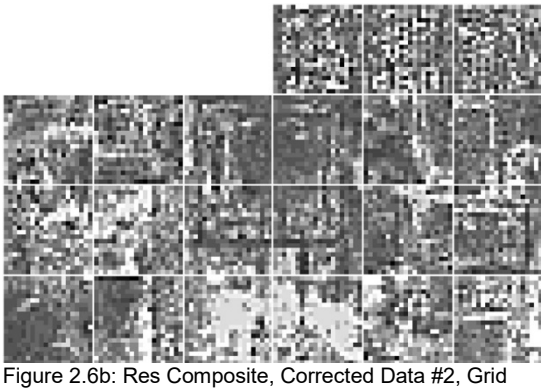
Figure 2.6b: Res Composite, Corrected Data #2, Grid

2.4.3. **Filtered Data Composite Plots**. Filtered data composite plots are provided in pairs; the first without grid lines in order to present an uninterrupted picture, the second with grid lines in order to aide with orientation. The corrected data in Figure 2.5 has been filtered by the application of interpolate (x2) (Figure 2.7), whilst the corrected data in Figures 2.6 has been filtered by the application of remove geology and interpolate (x2) (Figure 2.8).

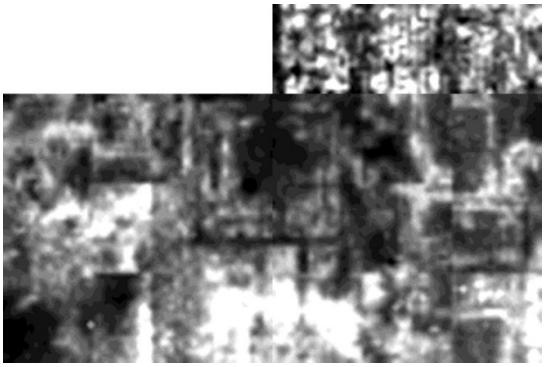

Figure 2.7a: Res Composite, Filtered Data #1

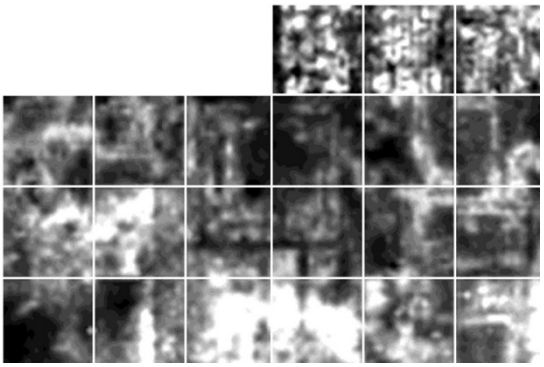

Figure 2.7b: Res Composite, Filtered Data #1, Grid

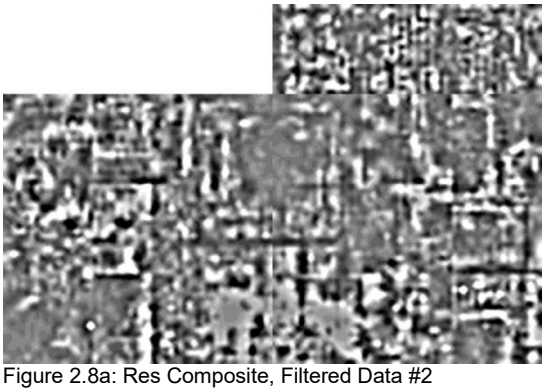

Figure 2.8a: Res Composite, Filtered Data #2

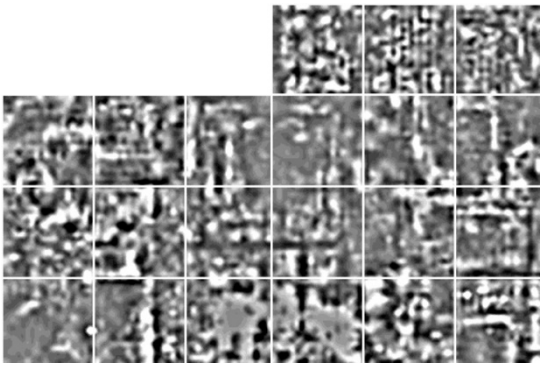

Figure 2.8b: Res Composite, Filtered Data #2, Grid

2.5. **Magnetometry Data Presentation**.

2.5.1. **Raw Data Plot**. Raw data plot is provided as a pair; the first without grid lines in order to present an uninterrupted picture, the second with grid lines in order to aide with orientation (Figure 2.9).

Figure 2.9a: Mag16-1, Raw Data

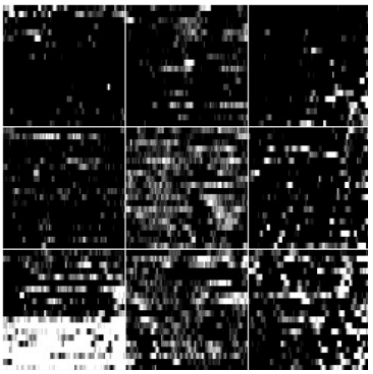

Figure 2.9b: Mag16-1, Raw Data, Grid

2.5.2. **Filtered Data Plot**. Filtered data plot is provided as a pair; the first without grid lines in order to present an uninterrupted picture, the second with grid lines in order to aide with orientation. The raw data plot in Figure 2.9 has been filtered by the application of de-stripe and interpolate (x2) (Figure 2.10).

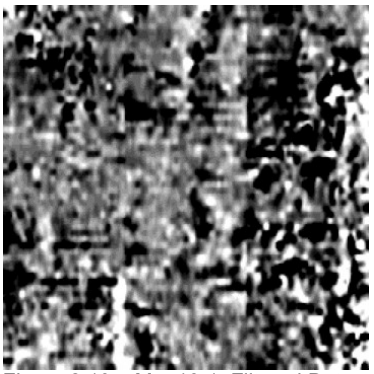

Figure 2.10a: Mag16-1, Filtered Data

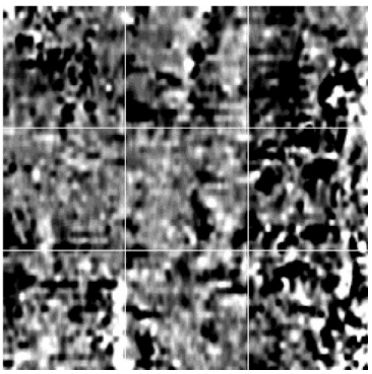

Figure 2.10b: Mag16-1, Filtered Data, Grid

3. **Results**.

3.1. **Description**. The filtered earth resistance results at Figures 2.7 and 2.8 show a number of distinct linear anomalies of both high and low resistance, often parallel and in association, that are clearly indicative of the cloistral complex and other significant precinct buildings. Of particular interest are the numerous anomalies in the northwest and eastern grid squares, both areas with no discernible earthworks and only the vaguest suggestion of buildings on the Inskip Ladds drawing (Figure 1.4), and the three grids on the southern edge indicating different 'surface texture'. Surveying errors, due to a lack in understanding of the processing software (Snuffler v1.21), are such that the results for grids G4, G5, G6 and G13, G14, G15 cannot be accurately analyzed. Analysis of spaces will be in the context of the ordinary (to use a Cistercian term) south facing cloistral layout and other precinct buildings, as detailed in France (2012, Ch 5), and Burton and Kerr (2011, Ch 3). The grid in Figures 2.7b and 2.8b is referenced as in Figure 2.2.

3.2. **Interpretation**.

3.2.1. The cloistral garth and arcades are clearly visible within G10, G1, G11 and G2. This suggests a short rectangle with approximate measurements of 40 metres east/west and 34 metres north/south. Linear anomalies that are indicative of the inner arcade walls are clearly identifiable suggesting arcades with approximate widths of 3-4 metres, which in turn suggests a garth approximately 32 metres east/west and 26 metres north/south. Also, of interest is the strong low resistance circular anomaly clearly visible in the southwest corner of the garth (on the east end of the G10/G11 boundary); which could be suggestive of a well, or cistern of the water management system, due its proximity to the kitchen.

3.2.2. The anticipated east range is discernible along the east edges of G1, G2 and G3, and in the west half of G4, G5 and G6; it is highly probable that the east range extends further south. Despite the surveying error mentioned earlier there are sufficient linear anomalies that indicate a chapterhouse in the centre of the east range measuring approximately 15 metres square. Of potential interest are two strong low resistance 'voids' measuring approximately 2 metres by 1 metre aligned east/west that appear to be within the chapterhouse. The numerous high and low resistance anomalies of varying strengths, intermixed with the unusual 'surface texture' anomaly, may indicate remains of building material from the fratry or possibly the monks' dormitory from above.

3.2.3 The south range is more evident within the southern halves of G11 and G2, and within G12 and G3. It is clearly defined by strong linear anomalies of both high and low resistance that encompass two significant areas of the unusual 'surface texture' anomaly in both the refectory and kitchen. The refectory is delineated by strong linear anomalies in the west of G2 and G3, and straddling into G11 and G1, with an approximate width of 10 metres; it is unclear whether the southern wall is within the survey area, or whether the length of the refectory extends beyond.

3.2.4. The calefactory is suggested by the strong low resistance linear anomaly east of and parallel to the refectory (G2). Its southern edge cannot be determined and is either the weak high resistance linear anomaly (coincidental with the gridline) or is masked by the unusual 'surface texture' anomaly.

3.2.5. The kitchen is discernible west of the refectory (G11 and G12) with an approximate width of 15 metres. Inskip Ladds was not able to determine the southern wall (Figure 1.3), however, there is a weak high resistance linear anomaly at the south edge of the survey area, hinting at a kitchen that is approximately 25 metres long.

3.2.6. The west range can be determined (straddling G13, G14, G15 and G10, G11, G12) by very strong high and low resistance anomalies; the west wall being particularly clear. It is unclear whether the east wall of the west range faces directly onto the cloistral garth or whether there exists, or existed, a *ruelle des convers* (lay brother's lane) separating the west range from the west wall of the cloister.

3.2.7. East of the east range are three distinct groups of linear anomalies.

3.2.7.1. The first group, in G7, consists of a horizontal high resistance anomaly just south, and extending east of, the south-east corner of the presbytery; extending south from the east end of this anomaly is a vertical high resistance anomaly.

3.2.7.2. The second group, predominantly in G8 but extending into G5, is suggestive of a cloister with north and east ranges. Faint high resistance anomalies indicate the possibility of a south range or ambulatory and possible west wall. There is also short horizontal high resistance anomaly that appears to connect this cloister with the east range of the main cloister. There is a possibility that this is the infirmary for the choir monks.

3.2.7.3. The third group, predominantly in G9 but extending into G6, is suggestive of another cloister with north and east ranges that extends beyond the south edge of the survey area. Faint high resistance anomalies indicate the possibility of a west wall. Here too is a short horizontal high resistance anomaly that appears to connect this cloister with the east range of the main cloister; if so, this raises the possibility of a separate Abbot's Lodgings, otherwise it could suggest a guest house for important visitors.

There are three other potential iterations of these groups of anomalies (Burton and Kerr, 2011, Ch 3):

3.2.7.4. The top and middle groups could be interrelated to form a larger infirmary with the Abbot's Lodge or guest house to the south.

3.2.7.5. All the groups are interrelated in a similar manner as suggested in para 3.2.7.4, but with the Abbot's Lodge or guest house adjacent to the south range or ambulatory of the infirmary cloister.

3.2.7.6. All the groups form a single large infirmary complex that incorporates the Abbot's Lodgings.

3.2.8. West of the west range, in the west halves of G13, G14 and G15, and within G16, G17 and G18, is a concentration of strong high and low resistance anomalies; including several linear anomalies, that are suggestive of buildings such as the infirmary for the lay brothers, service and industry. Unfortunately, it is not possible to determine anything specific.

3.2.9. The transepts and crossing are discernible straddling squares G19 and G20, extending beyond the survey area to both the north and south, with high resistance linear anomalies in square G20 suggestive of the northern of the two chapels in the south transept, whilst the form of the presbytery is discernible in the centre of square G20. There are no identifiable linear anomalies that are indicative of the north and south walls of the nave; however, it is probable that any potential wall anomalies have been masked by the scatter of irregular high and low resistance anomalies that are suggestive of demolition and/or collapse rubble. Two strong low resistance circular(ish) anomalies at the western end of square G19, along with a similar anomaly in square G20 are suggestive of robbed out column bases.

3.2.10. The group of anomalies to the east of the presbytery in square G21 are where the cemetery is typically located. As no buildings or elements of the water management system would be expected in this area it is unsure what these could be; however, evidence of graves cannot be completely ruled out.

3.2.11. The majority of low resistance linear anomalies are sharply defined and are suggestive of robbed out walls or sections of a water management system. Similarly, the majority of high resistance linear anomalies in the possible infirmary and associated complex(es) are also sharply defined and may indicate surviving stone wall. The majority of other high resistance anomalies are irregularly defined and suggest surviving collapsed wall or other stone building debris; particularly those that are linear in nature and associated with sharply defined linear low resistance anomalies.

3.2.12. The results in Figure 2.10 for G1, G2, G3, G4, G5, G6, G7, G8 and G9 have not been analyzed in any depth as the limited exposure the SHS archaeologists have had to magnetometry has been insufficient to do so. There is a strong low magnetic linear response on the east edge of G3 that may associate with resistance linear anomalies, whilst the apparent magnetic responses in G7, G8 and G9 may support the resistance analysis for these squares.

4. **Conclusion**.

4.1. **Assessment of Survey Objectives (25-26 Jun 16)**.

4.1.1. In the area surveyed, Inskip Ladds drawings have been broadly verified. There is correlation between the survey results and drawings with linear anomalies suggesting buildings and spaces in approximately the same location and of approximate dimensions. It is not possible to determine from the survey results themselves whether Inskip Ladds' drawings were influenced by his visit to Roche Abbey.

4.1.2. The results clearly indicate buildings/functional spaces commonly expected to be present in the Cistercian abbey model, not included on the Inskip Ladds drawings; primarily the complexes both east and west of the cloister. They also include linear anomalies suggestive of both the east wall of the chapter house and south wall of the kitchen that Inskip Ladds was unable to determine.

4.1.3. SHS archaeologists gained sufficient proficiency in the use of both the Geoscan Research RM85 Resistance Meter System and PA20 probe array assembly, and Geoscan FM256 Fluxgate Gradiometer, and are ready to develop that proficiency further through the undertaking of further surveys.

4.1.4. SHS archaeologists gained sufficient proficiency in the use of Snuffler software (Snuffler v1.21) and are able to safely import and generate raw data files, effectively process raw data into accurate results, and provide objective interpretation

and analysis of the results; although more experience with magnetometry surveys is required to develop proficiency in this aspect of geophysical surveying. The surveying errors that resulted due to the lack in understanding of the processing software that prevented the results from grids G4, G5, G6 and G13, G14, G15 from being accurately analyzed can now be prevented from recurring in future surveys.

4.1.5. The lessons learned from this survey have enabled SHS archaeologists to develop embryonic geophysical survey procedures. A significant lesson identified stemmed from aligning the survey grid with the earthworks; a number of geophysical anomalies were coincidental with the survey grid boundaries which made it difficult to determine whether they were indeed anomalies or surveying errors. The lesson learned from this is the creation of a site grid oriented on magnetic north on which survey grids can be placed thereby minimizing the coincidence of geophysical anomalies with survey grid boundaries.

4.2. **Assessment of Survey Objectives (8 Dec 16)**. Although the data produced little of discernible value, the survey achieved several successes:

4.2.1. The participating first-year undergraduate archaeology students from University Centre Peterborough gained a valuable introduction to the basic principles of geophysical resistivity survey.

4.2.2. SHS archaeologists gained further proficiency in the use of the Geoscan Research RM85 Resistance Meter System and PA20 probe array assembly when operated using default settings.

4.2.3. SHS archaeologists gained further proficiency in the use of Snuffler software, the safe import and generation of raw data files, effective processing of raw data into accurate results, and provision of objective interpretation and analysis of the results.

4.2.4. Geophysical survey procedures developed from lessons learnt from the previous survey undertaken on 25-26 Jun 16 were successfully proven by SHS archaeologists.

4.3. **Summary of Results**. The survey, on the whole, was a success and met most, if not all, its aims. SHS archaeologists have a better understanding of the survey equipment, techniques and effects of differing ground conditions. The experience gained, development of procedures and the results themselves (even where flawed) are sufficient justification to not only undertake a resurvey, but to expand the survey area.

4.4. **Recommendations**.

4.4.1. SHS archaeologists resurvey the area to correct survey errors in order to better re-examine the accuracy of drawings made by Inskip Ladds.

4.4.2. SHS archaeologists conduct expanded surveys to locate:

4.4.2.1. The gatehouse.

4.4.2.2. The abbott's lodgings and/or infirmary.

4.4.2.3. Buildings/functional spaces commonly expected to be present in the Cistercian abbey model, not included on the Inskip Ladds drawings.

4.4.2.4. The precinct boundary.

4.4.3. SHS archaeologists refine geophysical survey procedures in preparation for future surveys on Sawtry Abbey site.

APPENDIXES

A. Survey Record Sheets.
B. Additional Data and Composite Plot Display Options.

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