magnitude surveys

# Geophysical Survey Report MSSJ53

# of

# Land north of Woodchurch C.E. Primary School

# Birkenhead, Merseyside

**For**

**Big Heritage**

**On Behalf Of**

**Woodchurch C.E. Primary School**

**Magnitude Surveys Ref: MSSJ53**

**November 2016**

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# Abstract

Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a *c.* 1.94 ha area of land north of Woodchurch C.E. Primary School, Birkenhead, Merseyside. A hand-pulled, cart-based magnetic survey was successfully completed and no anomalies of probable or possible archaeological origin were identified. The geophysical results primarily reflect modern ferrous material, as well as general metallic debris on or near the ground surface.

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# 1. Introduction

1.1. Magnitude Surveys Ltd (MS) was commissioned by Big Heritage (BH) on behalf of Woodchurch C.E. Primary School (WPS) to undertake a geophysical survey on a *c.* 1.94 ha area of land north of Woodchurch C.E. Primary School, Birkenhead, Merseyside (SJ 2754 8694).

1.2. The geophysical survey comprised hand pulled, cart-mounted fluxgate gradiometer survey.

1.3. The survey was conducted in line with the current best practice guidelines produced by Historic England (David et al., 2008), the Charted Institute of Field Archaeologists (CIfA, 2014) and the European Archaeological Council (Schmidt et al., 2015).

1.4. The survey commenced on Friday 14th of October 2016 and took one day to complete.

# 2. Quality Assurance

2.1. Project management, survey work, data processing and report production have been carried out by qualified and professional geophysicists to standards exceeding the current best practice (CIfA, 2014; David et al., 2008, Schmidt et al., 2015).

2.2. Magnitude Surveys is a corporate member of ISAP (International Society of Archaeological Prospection).

2.3. Director Graeme Attwood is a Member of the Chartered Institute for Archaeologists (CIfA), the chartered UK body for archaeologists, as well as a member of GeoSIG, the CIfA Geophysics Special Interest Group. Director Finnegan Pope-Carter is a Fellow of the London Geological Society, the chartered UK body for geophysicists and geologists, as well as a member of GeoSIG, the CIfA Geophysics Special Interest Group. Director Chrys Harris is a doctoral candidate in archaeological geophysics at the University of Bradford.

2.4. All MS managers have postgraduate qualifications in archaeological geophysics. All MS field staff have relevant archaeology or geophysics degrees and supervisors have at least three years field experience.

# 3. Objectives

3.1. The geophysical survey aimed to assess the subsurface archaeological potential of the survey area.

3.2. The survey forms part of the community archaeological project managed by Big Heritage, on behalf of Woodchurch C of E Primary School, and funded by the Heritage Lottery Fund. It aims to explore previously undiscovered archaeology hidden under Woodchurch Estate as well as engage pupils, parents and volunteers with the basic geophysical techniques behind archaeological surveys using hands-on experiments.

# 4. Geographic Background

4.1. The underlying geology comprises sedimentary bedrock of mudstone from Sidmouth Formation; no superficial deposits have been recorded. (BGS, 2016).

4.2. The soils consist of slowly permeable seasonally wet, slightly acid but base-rich loamy and clayey soils (Soilscapes, 2016).

4.3. Survey was undertaken on an open green field, 212m to the north of Woodchurch C.E. Primary School, 4.9 km west of Birkenhead. It is bounded by Meadow Crescent to the north, Pool Lane to the south and Meadowside Special School to the east. The terrain was flat, well maintained grassland.

# 5. Archaeological Background

5.1. A Heritage Gateway (2016) search revealed no heritage assets within the survey area. A search within a 1 km radius of the site was conducted and revealed various designated and non-designated heritage assets.

5.2. Four Listed Buildings of Grade II (1201625, 1210041, 1282588, 1282599) and one of Grade II* (1217887) are located within the wider study area.

5.3. A total of 38 non-designated heritage assets have been recorded within the study area. A brief summary is chronologically presented below:

5.4. No prehistoric activity has been recorded within the area or its immediate surroundings.

5.5. A single Roman findspot has been recorded (HER 66187) 500m to the east of the survey area.

5.6. The village of Woodchurch is recorded in the Domesday survey dating to 1087AD. Evidence for medieval activity in the village relates to the Church of the Holy Cross (1217887). Whilst the original building was possibly pre-Norman in date alterations to the nave date from the 12$^{th}$ century. The rectory (MME10761) is recorded to have been constructed in 1631. Associated with the church a standing cross (Monument No. 66202) dates from the early 16$^{th}$ century, this is located south of the church.

5.7. Various monuments and buildings are located within the wider study area from the WWII period: Pillbox (Monument No. 1420657), Anti Aircraft Battery Camp (MME10764), and lodges (MME856, MME865).

5.8. The survey area is noted as recreation ground on mapping since 1925 until 1938. The area neighbouring the survey site has drastically changed since the development of housings during mid 1950's until mid-1960's as recorded on OS historic mapping.

# 6. Methodology

## 6.1. Data Collection

6.1.1. Geophysical prospection comprised the magnetic method as described in the following table.

6.1.2. Table of survey strategies:

| Method | Instrument | Traverse Interval | Sample Interval |
|---|---|---|---|
| Magnetic | Bartington Instruments Grad-13 Digital Three-Axis Gradiometer | 1 m | 200 Hz reprojected to 0.125 m |

6.1.3. The magnetic data were collected using MS' bespoke hand-pulled cart system.

6.1.3.1. MS' cart system was comprised of Bartington Instruments Grad 13 Digital Three-Axis Gradiometers. Positional referencing was through a Hemisphere S321 GNSS Smart Antenna RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The Hemisphere S321 GNSS Smart Antenna is accurate to 0.008 m + 1 ppm in the horizontal and 0.015 m + 1 ppm in the vertical.

6.1.3.2. Magnetic and GPS data were logged on a USB flash drive housed in MS' bespoke data-logger and transferred to a laptop computer for processing.

6.1.3.3. A series of temporary sight markers were established in each survey area to guide the surveyor and ensure full coverage with the cart. Data were collected by traversing the survey area along the longest possible lines, to ensure that the data was efficiently collected and processed.

## 6.2. Data Processing

6.2.1. Magnetic data were processed in bespoke in-house software produced by MS. Processing steps conform to Historic England's standards for "raw or minimally processed data" (see sect 4.2 in David et al., 2008: 11).

Sensor Calibration – The sensors were calibrated using a bespoke in-house algorithm, which conforms to Olsen et al. (2003).

Zero Median Traverse – The median of each sensor traverse is calculated within a specified range and subtracted from the collected data. This removes striping effects caused by small variations in sensor electronics.

Projection to a Regular Grid – Data collected using RTK GPS positioning requires a uniform grid projection to visualise data. Data are rotated to best fit an orthogonal grid projection and are resampled onto the grid using an inverse distance-weighting algorithm.

Interpolation to Square Pixels – Data are interpolated using a bicubic algorithm to increase the pixel density between sensor traverses. This produces images with square pixels for ease of visualisation.

## 6.3. Data Visualisation and Interpretation

6.3.1. This report presents geophysical results as greyscale images. Multiple greyscales images have been used for data interpretation; these were at different plotting ranges and show different components of the vector magnetic field. This report presents the gradient of the sensors' total field data. Greyscale images should be viewed alongside the XY trace plots, found on the archive disk. XY trace plots visualise the magnitude and form of the geophysical response, aiding in anomaly interpretation.

6.3.2. Geophysical results have been interpreted using greyscale images and XY traces in a layered environment, overlaid against open street mapping, satellite imagery, historic mapping and LiDAR data.

# 7. Results

## 7.1. Qualification

7.1.1. *Geophysical techniques are not a map of the ground and are instead a direct measurement of subsurface properties. Detecting and mapping features requires that said features have properties that can be measured by the chosen technique(s) and that these properties have sufficient contrast with the background to be identifiable. The interpretation of any identified anomalies is inherently subjective. While the scrutiny of the results is undertaken by qualified, experienced individuals and rigorously checked for quality and consistency, it is often not possible to classify all anomaly sources. Where possible an anomaly source will be identified along with the certainty of the interpretation. The only way to improve the interpretation of results is through a process of comparing excavated results with the geophysical reports. MS actively seek feedback on their reports as well as reports of further work in order to constantly improve our knowledge and service.*

## 7.2. Survey Considerations

| Survey Area | No. Survey Blocks | Surveyed Y/N | Ground Conditions | Further notes: |
|---|---|---|---|---|
| 1 | 1 | Y | Flat, short grass open field. | |

Refer to Figure 2 for survey area locations.

## 7.3. Discussion

7.3.1. The geophysical results, both greyscale images and XY traces, were interpreted in consideration with satellite imagery (Bing, 2016; Figure 5) and historic mapping (Ordnance Survey, 6" 2nd edition *c.*1882-1913; Figure 6).

7.3.2. The magnetic survey has responded well to the survey area's environment. No anomalies of possible or probable archaeological origin were identified. The development of Woodchurch Estate during the 1950s and the site being closely surrounded by housing and schools may have obscured any features of possible archaeological origin should they be present. The results primarily reflect modern metallic debris.

7.3.3. The second objective of this project was to engage members of Woodchurch community, and this was successfully accomplished. Groups of children from Years 5 and 6 of Woodchurch C.E. Primary School, science ambassador students from a nearby high school, teachers and volunteers could get hands-on with experiments and techniques used in geophysical archaeological surveys.

## 7.4. Interpretation

### 7.4.1. General Statements

7.4.1.1. Geophysical anomalies will be discussed broadly as classification types across the survey area. Only anomalies that are distinctive or unusual will be discussed individually. Specific anomalies discussed within the text have been assigned numbers, which are emboldened within square parenthesis e.g. [**1**].

7.4.1.2. **Undetermined** – Anomalies are classified as Undetermined when the anomaly origin is ambiguous through the geophysical results and there is no supporting or correlative evidence to warrant a more certain classification. These anomalies are likely to be the result of geological, pedological or agricultural processes--although an archaeological origin cannot be entirely ruled out. Undetermined anomalies are generally not ferrous in nature.

7.4.1.1. **Ferrous (Discrete/Spread)** – Discrete ferrous-like, dipolar anomalies are likely to be the result of modern metallic disturbance on or near the ground surface. A ferrous spread refers to a concentrated scattering of these discrete, dipolar anomalies. Broad dipolar ferrous responses from modern metallic features, such as fences, gates, neighbouring buildings and services, may mask any weaker underlying archaeological anomalies should they be present.

### 7.4.2. Magnetic Results - Specific Anomalies

7.4.2.1. **Ferrous (dipolar)** – Ferrous anomalies around the south-eastern edge of the survey perimeter are due to the proximity of a large metal fence around the Meadowside Special School. The northern extent is bounded by Meadow Crescent a relatively busy road, the passing of cars may have caused these ferrous anomalies.

7.4.2.2. **Ferrous (spread)** – Areas of metallic spread across the western half of the survey area are of modern origin. These are likely associated with the construction of housing on Meadow Crescent and left over building material. The use of the site as a recreation ground between 1928 and 1935 would also produce a disturbance across the site.

# 8. Conclusions

8.1. The magnetic survey has responded well to the survey area's environment. No anomalies of possible or probable archaeological origin have been detected. The geophysical results primarily reflect modern activity.

8.2. Modern activity is reflected in the magnetic results primarily as ferrous materials. These features include small scale dipolar ferrous anomalies across the site, but with a higher concentration on the western half of the field, possibly caused by modern debris scattered on or near the ground surface. Broad dipolar anomalies around the perimeter of the site is due to the proximity of a large metal fence and a road. Weak archaeological features may have been masked by these ferrous responses, if any were present.

8.3. The community project was successfully completed. All members that participated on the project could learn about and experience two different geophysical techniques (magnetometry and earth resistance) as well as engaging on different hands-on experiments relating to the basic geophysical theory behind archaeological surveys.

# 9. Archiving

9.1. MS maintains an in-house digital archive, which is based on Schmidt and Ernenwein (2013). This stores the collected measurements, minimally processed data, georeferenced and un-georeferenced images, XY traces and a copy of the final report. A copy of this archive will be included in a disk with the final printed report.

9.2. MS contributes all reports to the ADS Grey Literature Library subject to any time embargo dictated by the client.

9.3. Whenever possible, MS has a policy of making data available to view in easy to use forms on its website. This can benefit the client by making all of their reports available in a single repository, while also being a useful resource for research. Should a client wish to impose a time embargo on the availability of data, this can be achieved in discussion with MS.

# 10. Copyright

10.1. Copyright and the intellectual property pertaining to all reports, figures, and datasets produced by Magnitude Services Ltd. is retained by MS. The client is given full licence to use such material for their own purposes. Permission must be sought by any third party wishing to use or reproduce any IP owned by MS.

# 11. References

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MSSJ53 - Woodchurch School, Big Dig
Figure 1 - Site Location
1 : 25,000 @ A4


Survey Area

N

0 0.5 1 km

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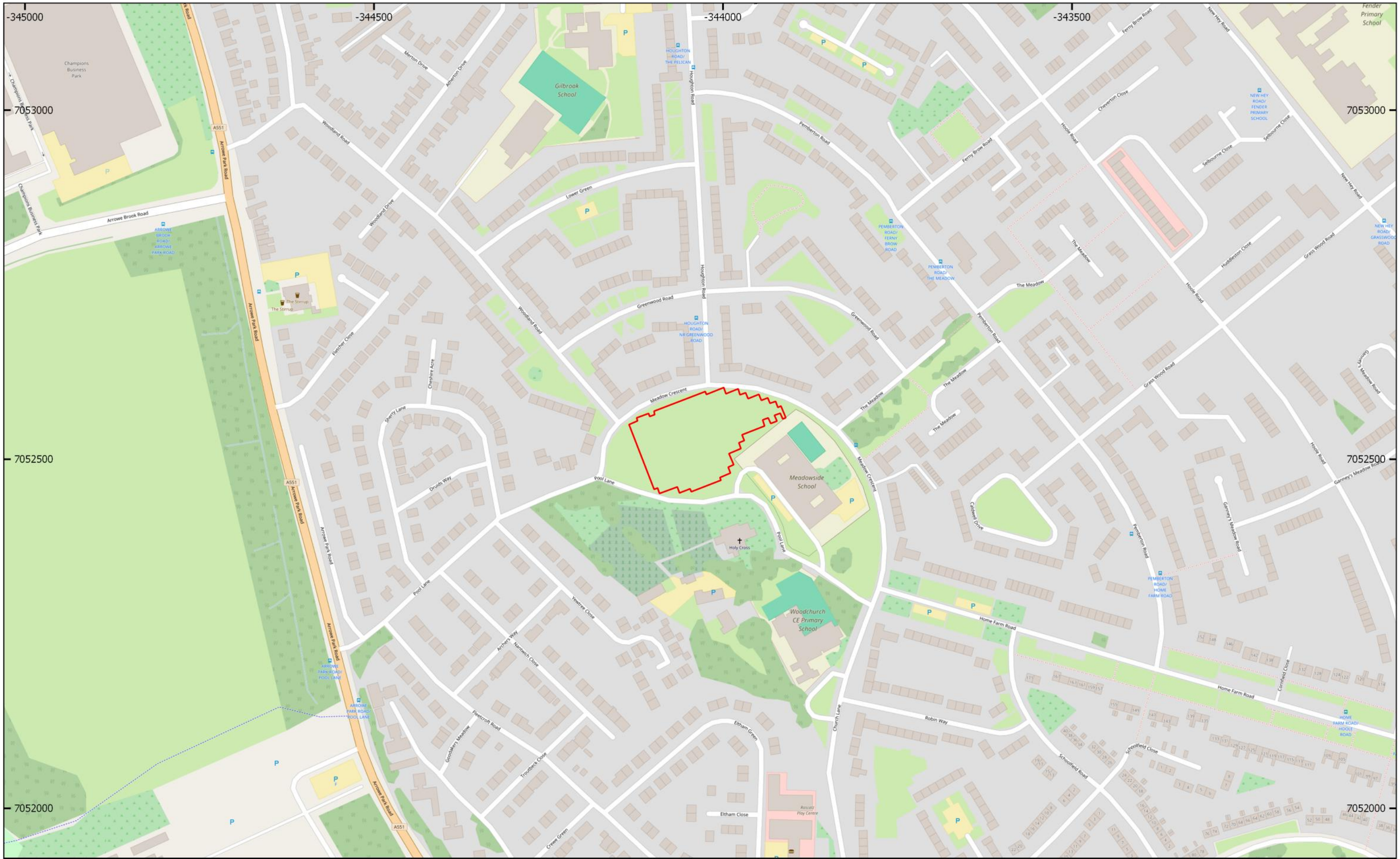


MSSJ53 - Woodchurch School, Big Dig
Figure 2 - Location of survey area
1 : 5000 @ A3


Survey Area

N

0 100 200 300 m

magnitude surveys

-344200
-344100
-344000
-343900
7052600
7052500
Woodland Road
Meadow Crescent
Meadow Crescent
Meadow Crescent
Pool Lane
Pool Lane
Meadowside School
P

MSSJ53 - Woodchurch School, Big Dig
Figure 3 - Magnetic Greyscale
1 : 1000 @ A3


-1 nT 2

N

0 20 40 60 m

magnitude surveys

-344200
-344100
-344000
-343900
7052600
7052500
Woodland Road
Meadow Crescent
Meadow Crescent
Meadow Crescent
Pool Lane
Pool Lane
Meadowside School
P

MSSJ53 - Woodchurch School, Big Dig
Figure 4 - Magnetic Interpretation
1 : 1000 @ A3


Ferrous (Dipolar)
Ferrous (Spread)

N
0 20 40 60 m

magnitude surveys


MSSJ53 - Woodchurch School, Big Dig
Figure 5 - Magnetic Interpretation - Satellite
1 : 1000 @ A3


Ferrous (Dipolar)
Ferrous (Spread)

N

0 20 40 60 m

magnitude surveys

-344000

-343500

7052500

7052500

Acres

Holy Cross Church

Woodchurch

Rectory

School

1.142·9

MSSJ53 - Woodchurch School, Big Dig
Figure 6 - Magnetic Interpretation - Historic mapping
1 : 3000 @ A3

Historic mapping Ordnance Survey, 62 2nd edition c. 1882-1913 © National Library of Scotland

Ferrous (Dipolar)
Ferrous (Spread)

N

0 70 140 210 m

magnitude surveys