Geophysical Survey Report No. 39

NIEA License Number AE/17/08G

Lumen Christi, Derry City, Co. L'Derry

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Summary of results

An evaluation resolution electrical resistance survey was carried out over a total area of 0.5 hectares in the grounds of Lumen Christi School, Derry City. The survey area is situated *c.* 400m southwest of the famous city walls, 50m due south of a 17th-century windmill (LDY 014:500) in the vicinity of the unlocated remains of Franciscan Friary (LDY 014:062). The area between the location of the windmill and the river *c.* 400m to the south is associated with a 17th-century skirmish site where Jacobite forces were routed at Windmill Hill during the Williamite Wars. The urban environment prohibited the application of magnetic gradiometery.

The area surveyed is to the immediate southeast of the modern school in the location of a lawn rimmed with trees. The multiple, parallel probe array (1m + 0.5m x 2) facilitated two depths of resistivity readings to be gathered simultaneously effectively producing depth slices through any anomalies recorded.

Evidence for archaeologically significant geophysical responses were limited. However a high resistance circular feature (R1) to the centre of the northern third of the survey area does warrant further investigation. A pair of straight linear features (R5 & R6) truncating the survey area may be drainage features possible associated with the earlier landscaping of the site.

Site Specific Information

Site Name: Lumen Christi School, Derry City

Townland: Londonderry

SMR No: LDY 014:500/ LDY 014:062

Grid Ref: C 42868 16086

County: L'Derry

Date of Survey: 16th January – 3rd February 2017

Surveyors Present: Grace Macalister & Ruth Logue Centre for Archaeological Fieldwork, School of Natural and Built Environment, Queens University, Belfast.

Size of area surveyed: 0.5 hectares

Weather conditions: Mild

Solid Geology: Sandstone

Drift Geology: Sand & silt

Current Land Use: Ornamental lawn

Intended Land Use: N/a

Survey methodology overview

Survey type:
Electrical resistance
Instrumentation:
Geoscan RM85
Probe spacing:
One meter beam with multiple three probe array taking three readings (1m + 0.5m x 2)
Grid size:
20m x 20m
Traverse interval:
1m/0.5m
Sample Interval:
1m
Traverse Pattern:
Zig-zag

Lecia CS15 differential GNSS
Survey grid setup:
Established with differential GNSS
Survey Internal Accuracy:
Survey grade accuracy (<3cm)
Georeferencing:
The GNSS data will be used to georeference the geophysical survey datasets exported from Geolplot v.4 in ArcMap 10.3.

Data processing:
The geophysical data was processed in Geoplot v.4 software. Raw data was prepared for comparison by clipping to +/- 3 Std Dev, despike and conversion from resistance to resistivity. The primary processes applied were high pass filtering (HPF) to remove geological 'background' noise and low pass filtering (LPF) which helps to eradicate minor spikes in the data. The datasets were also interpolated which creates a smoothing effect.

Visualisations:
The datasets were visualised within Geoplot v.4 using shade, trace, dot density and relief plots. Processed datasets and bitmap graph plots were exported from Geoplot v.4 and imported into ArcGIS 10.3. Once georeferenced statistical analysis were carried out on the rasters within ArcGIS 10.3 and they were interpreted in relation to the historical mapping of the area and orthorectified aerial photographs.

Digital archive:
The geophysical datasets were collected, processed and archived in accordance with Archaeological Data Services best practice.[1]

[1] Schmidt, A. & E. Ernenwein, 2011, Guide to good practice: Geophysical data in Archaeology [Online] http://guides.archaeologydataservice.ac.uk/g2gp/Geophysics_Toc

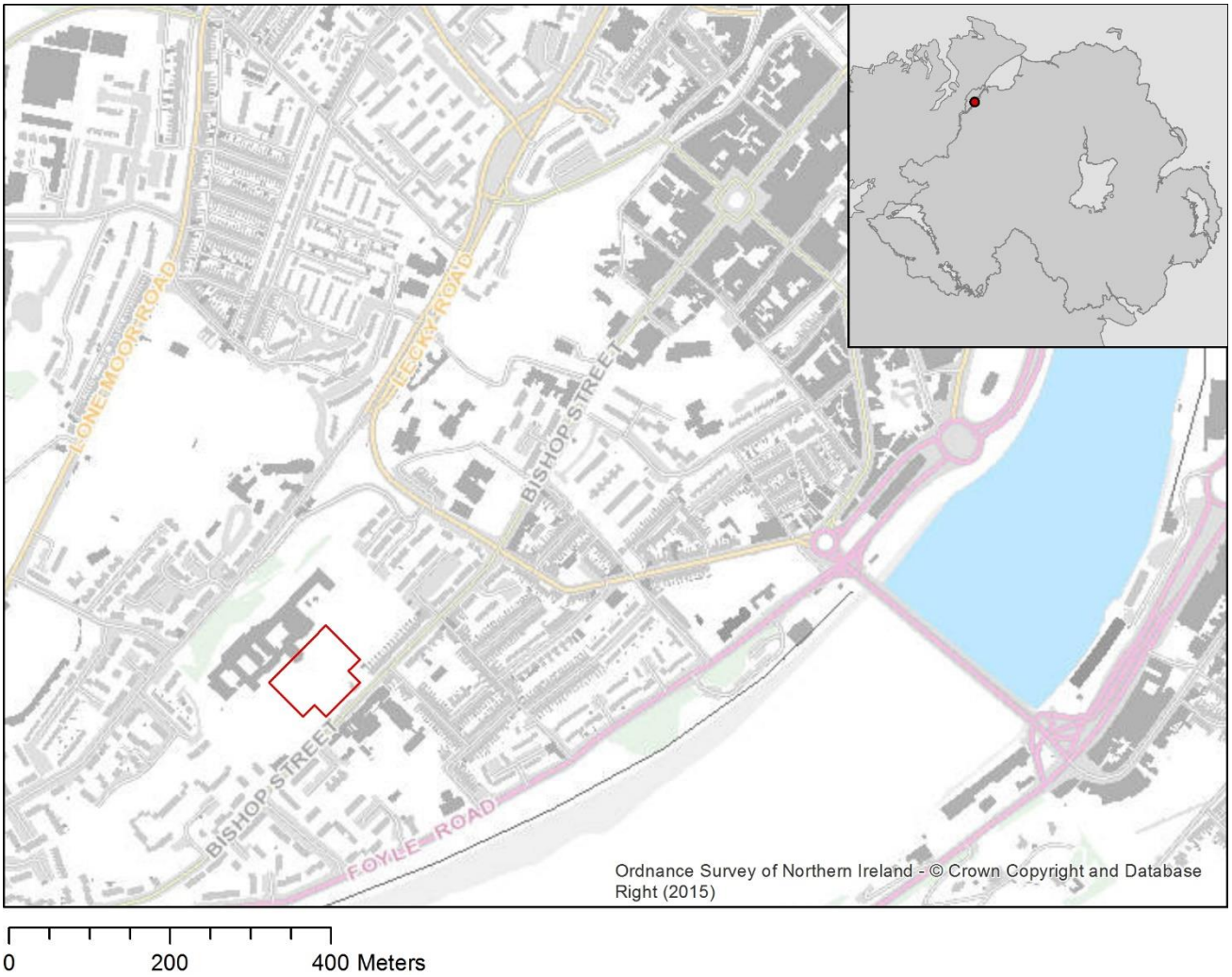


Figure 1 Location and landscape setting of the geophysical survey. Survey area marked in red.*

Introduction

An evaluation resolution electrical resistance survey, total area 0.5 hectares, was carried out over an ornamental lawn in front of Lumen Christi School. The survey location is situated *c.* 400m southwest of the Bishop's Gate in Derry City walls, outside and to the southwest of the city walls. The kidney-shaped lawn is the last remnants of garden area. The topography of the site slopes from the northwest, at the front of the main school entrance, towards the south-eastern gates which give access to the complex. The current ornamental lawn has an overall diameter of *c.* 100m SW - NE. It is bounded on all sides by tarmacked routeways with trees planted along southern and eastern curves.

It is believed that this area between the 17th-century windmill, 50m to the north, and Lough Foyle *c.* 300m to the south, was the scene of a bloody skirmish during the mid-17th-century Siege of Derry (Figure 2). Jacobite forces had advanced onto Williamite defensive earthworks erected in front of the Bishop's Gate with an initial clash occurring between the windmill and the river. The Williamite defences proved decisive and settled the conflict in their favour.[2] The Jacobite forces were routed with heavy losses. The location is

[2] Doherty, R. *The Siege of Derry 1689: The Military History* (Stroud 2008).

identified in primary source by reference to a windmill[3] this is commonly associated with the stump of a 17th-century windmill (LDY 014:500) found in the grounds of Lumen Christi.[4] Which would situate the ornamental lawn, in front of the school, in the same location as the 17th-century skirmish site.

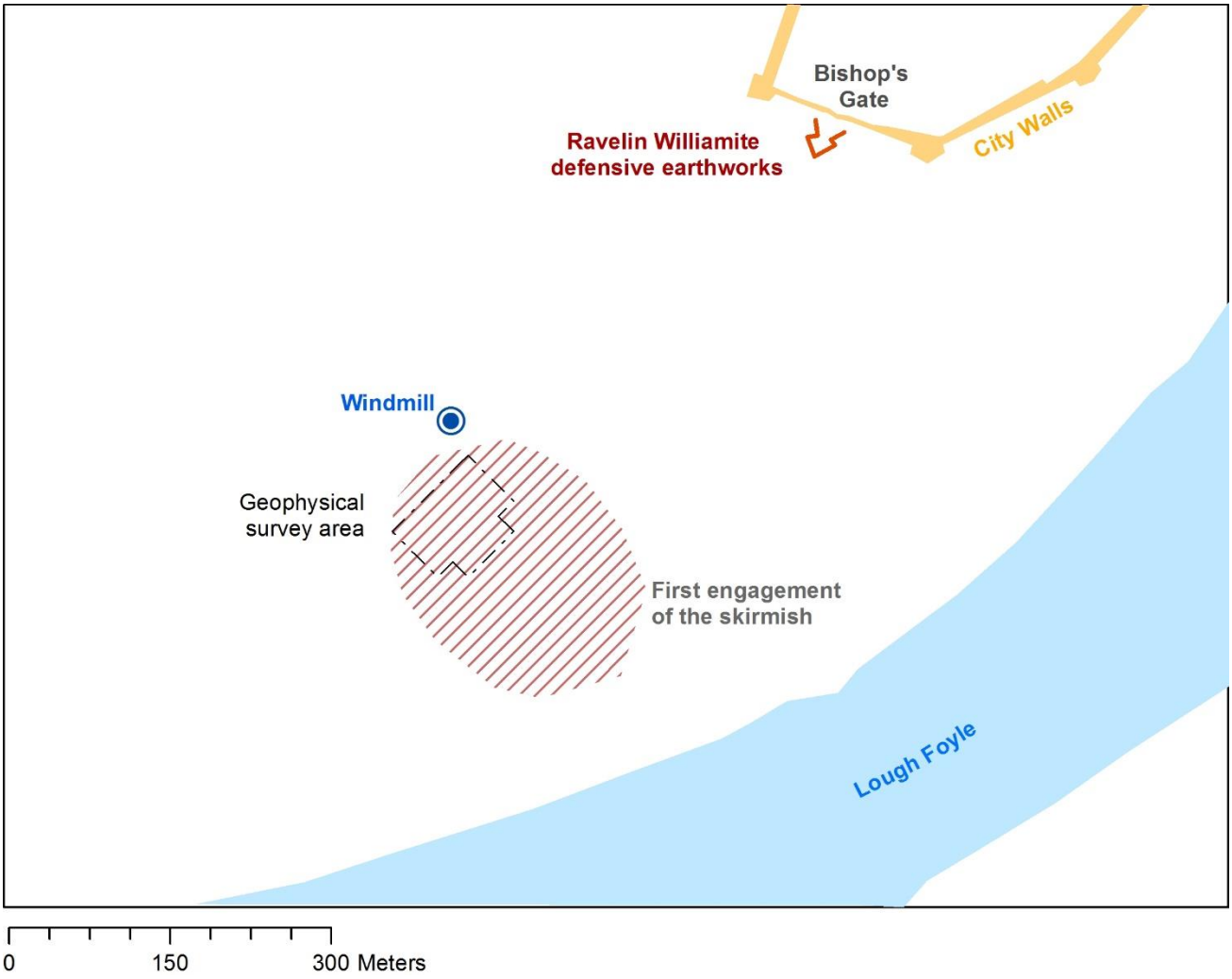


Figure 2 Reconstruction of the skirmish of Windmill Hill and its relationship to the area surveyed in this study.

The surrounding modern landscape is heavily urbanised with the school development to the west clockwise through to the north and housing from the east clockwise to the south. An open area to the northeast of the survey area has been laid with all-weather pitches, from the 1980s onwards, while grass playing fields are situated to the southwest. The latter appears to have been heavily scarped, with much of the originally ground level removed. This would mean that the ornamental lawn is one of the last areas of relatively untouched ground in the vicinity of skirmish site.

[3] Gilbert, J T (Ed), *A Jacobite Narrative of the War in Ireland* (Dublin 1892).
[4] SM7 file for LDY 014:500 [online] available at http://appsc.doeni.gov.uk/ambit/docs/LDY/LDY_014/LDY_014_500/Public/SM7-LDY-014-500.pdf (accessed 24-03-2017).

In a late 19th-century map of the gardens curvilinear pathways can be traced snaking over the survey area. To the northeast are the Bishop's Gardens, now the all-weather playing fields. The then Christian Brother's School is a more modest affair than the current school situated further back. Houses are evident facing onto Bishop Street with gardens behind which are now more heavily built upon. The playing fields to the southwest would have been heavily landscaped during their construction but once formed part of the 19th-century gardens.

Electrical resistance data was gathered at two probe-spacing's (1m + 0.5m) to facilitate the interpretation of the depth and nature of the geophysical anomalies recorded.

Description and interpretation of anomalies (Figure 4)

Table 1 Description and interpretation of archaeological anomalies.

Code	Description	Interpretation
R1	Circular area of high resistance towards the centre of the northern third of the survey area. Measuring *c.* 6m N-S by 5.5m E-W. The feature has a mean resistivity reading twice that of the dataset average, with some of the highest readings for the entire group. Its plan is better mapped at the shallower depth, 0.5m probe spacing, although it is still identifiable on the deeper readings. .	One of only three immediately obvious features from the raw data at both probe spacing depths R1 may be a pit with a fill of material of higher resistance than the surrounding soil matrix. If this pit-like feature were associated with the skirmish an obvious conclusion is that it could be a burial pit. One would imagine that a pit associated with such a mass burial would give lower resistance readings as the biological matter would have higher moisture levels then the surrounding soils. Unless the pit was then infilled with rubble. The feature R1 is an obvious target for further archaeological evaluation.
R2	Irregular area of high resistance to the north of the survey area. Measuring 22m N-S by 16m E-W. The area plan increases at the deeper penetrating 1m probe spacing.	The increased plan area at the greater depth suggests this irregular anomaly could be geological in nature.
R3	Curvilinear band of low resistance hugging the limits of a modern tarmacked drive to the north of the survey area. The low resistance anomaly occupies the north-western limits of dataset with a maximum width of *c.* 8m.	Areas of low resistance are usually associated with moisture-rich or water-logged soils which provide less resistance to the passage of an electrical current. The limits of the survey area are defined by low resistance readings which suggests that drainage is being impeded by the tarmacked surfaces that bound the lawn. Seemingly the topography of the site, where anomaly R3 is upslope compared with the rest of the survey area, does not appear to improve drainage. However given that type of archaeological remains we may anticipate in the area could include linear ditches it may be worthwhile targeting a section of R3 to confirm it is non-archaeological in nature.
R4	Subtle band of lower resistance readings appearing to branch off R3 towards the southwest. Traceable for a length of 13m SW - NE with a width of 3m.	Appears to follow the route of a curvilinear path marked on the 1873 plan of the area. The feature may be water-logging due to obstructed water drainage caused by the earlier landscaping feature.
R5	Straight low resistance band running NW - SE from southern edge of R3 towards eastern limit of the	Straight, linear low resistance features are usually associated with drainage works. That R5 runs roughly parallel to R6 and downslope it does appear to support this interpretation. Neither feature has a relationship with each other that mimics any form of complex 17th-

	survey area for a distance of c. 36m with a max width of 3m. Runs parallel to R6.	century military earthwork, although they could be simple, rapidly erected ditches. However it does warrant investigation to clarify its purpose.
R6	Straight low resistance band running parallel to R5. The readings falter to the north of the feature. It can be mapped for a distance of c. 38m before merging with an area of low resistance at the SE limit of the survey. Maximum width of c. 3.5m	Probably related to R5 and possible drainage features.

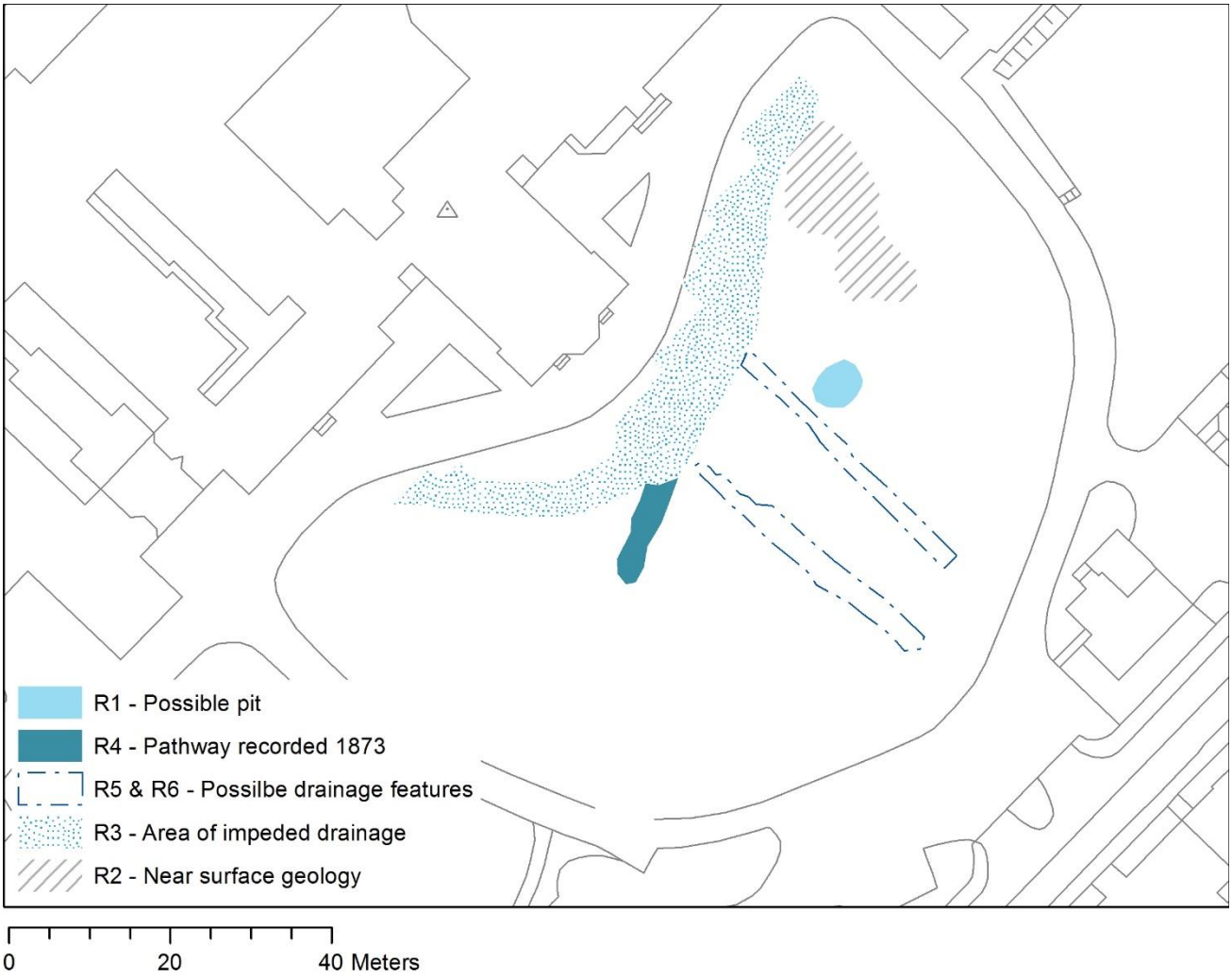


Figure 3 Interpretation diagram with geophysical anomalies identified

Discussion

The geophysical returns with archaeological potential are limited in the Lumen Christi dataset. Given the nature of a skirmish site we may expect to find evidence for linear earthworks and perhaps mass burials, which could be identified by electrical resistance survey if the features were large enough. The urban location of the site meant that electromagnetic survey could not be applied due to high levels of magnetic interference. The anomaly R1, a high resistance pit-like feature, could be related to the skirmish or perhaps a refuse pit perhaps associated with remodelling of some of the surrounding urban fabric. The probably paired anomalies R5 & R6 are aligned on a downhill slope and are probably related to drainage activity. Their plan does not appear to mimic any form of complex 17th-century earthwork. The irregular band of low resistance R3 is probably the result of impeded drainage but given that we are expecting to find possible linear earthworks in the vicinity, this does increase the archaeological potential of any such low resistance linear bands identified in the area.

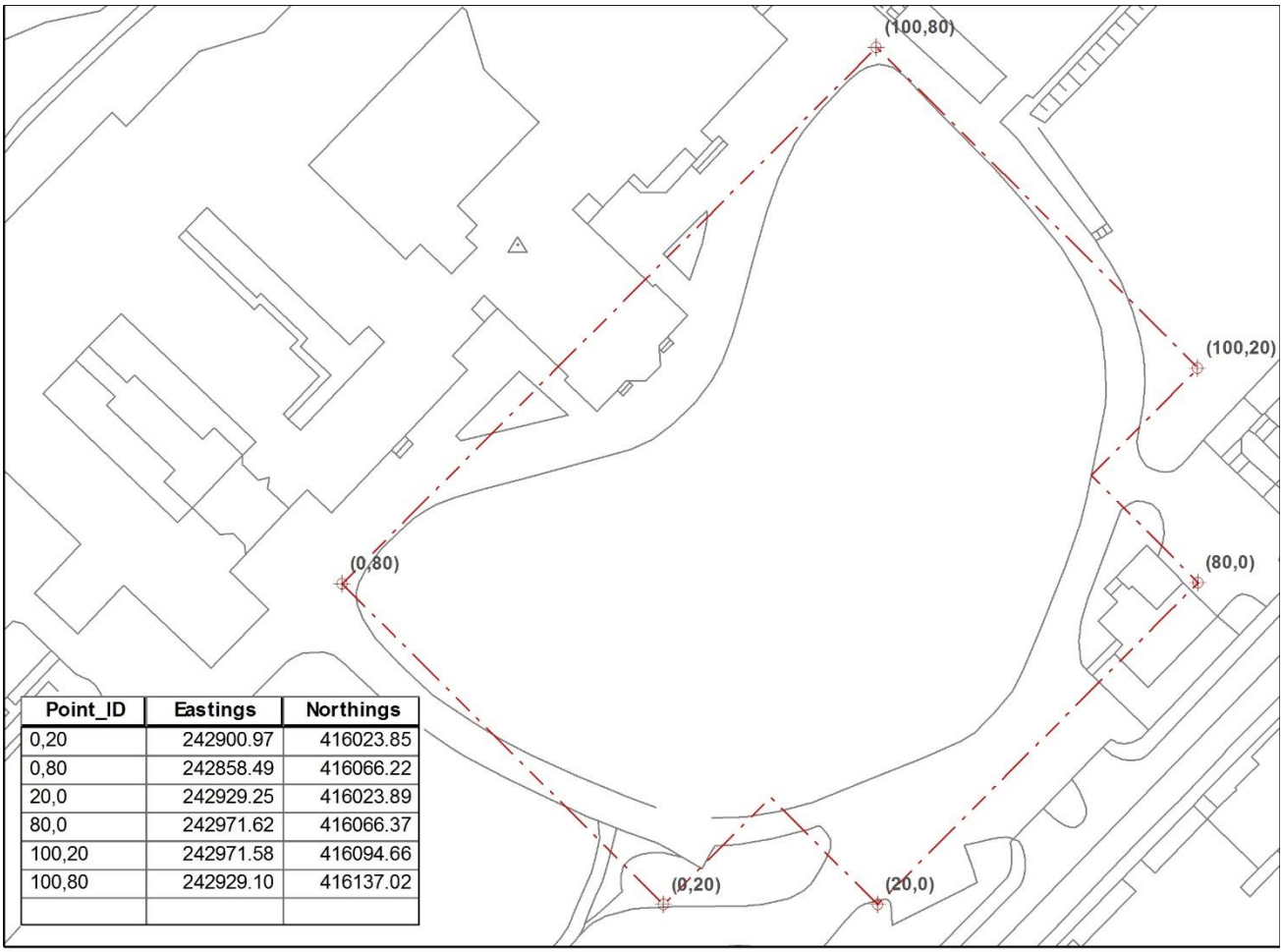
Recommendations

Targeted excavation of the features R1 & R5 should establish if they are archaeological in nature. Further examination of a portion of R3 would be useful to confirm that it is related to impeded drainage.

Acknowledgements

This survey was commissioned by the Siege Museum, Londonderry. Thank-you to Grace McAlister and Ruth Logue, Centre for Archaeological Fieldwork, Queen's University Belfast, for leading on the fieldwork.

Appendix one: Georeferenced geophysical survey grid



Point_ID	Eastings	Northings
0,20	242900.97	416023.85
0,80	242858.49	416066.22
20,0	242929.25	416023.89
80,0	242971.62	416066.37
100,20	242971.58	416094.66
100,80	242929.10	416137.02

Figure 4 Irish National Grid coordinates for geophysical survey grid extent.*

Appendix two: Raw geophysical survey plots

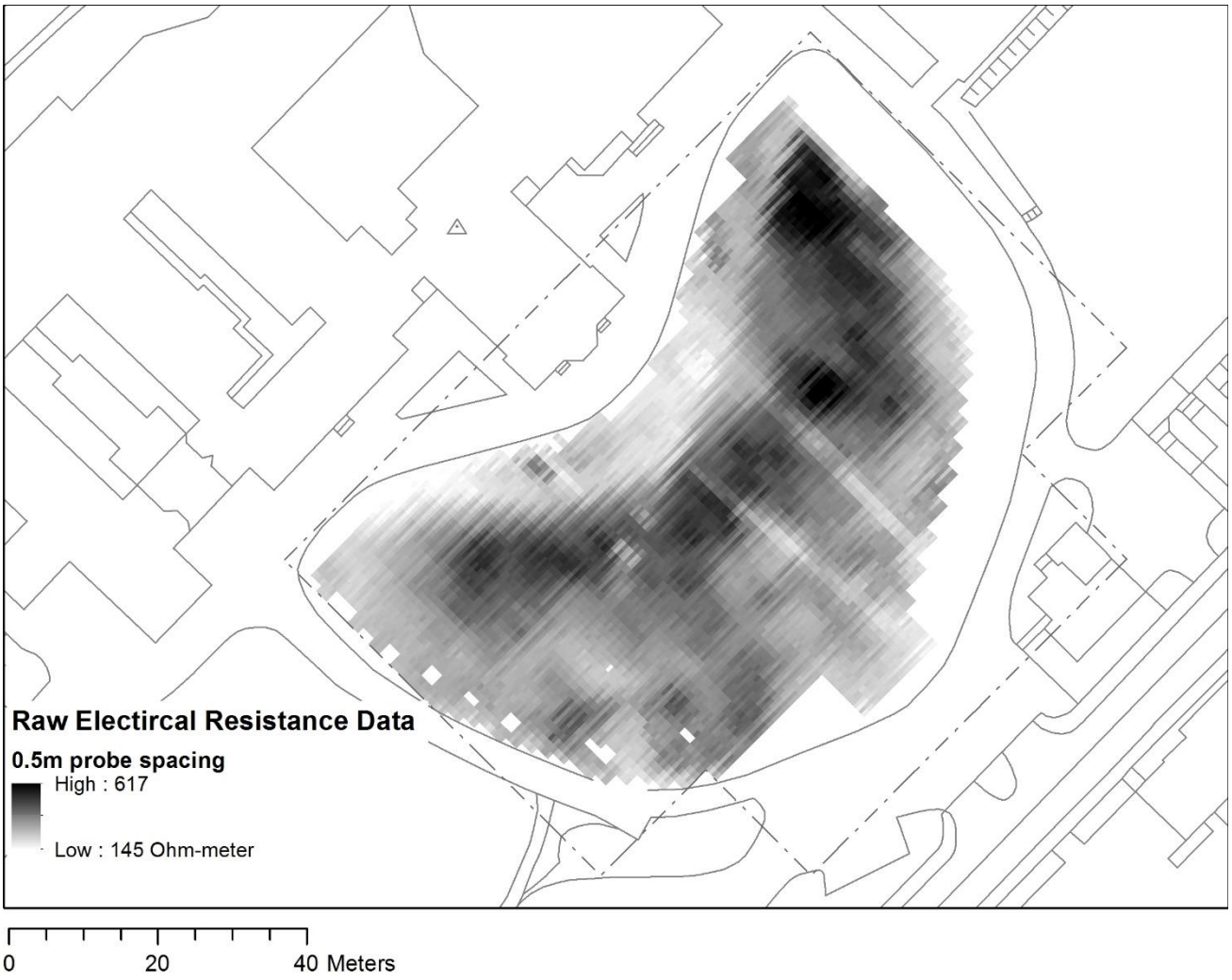


Figure 5 Greyscale plot of raw data for gathered with 0.5m probe spacing. Data clipped +/- 3 Std Dev., despiked and converted from Ω to Ωm Statistics: Mean: 337 Ωm, Std Dev. 84.8.[5]*

[5] Note the Ωm readings appear high because during data capture the range was set incorrectly. This does not affect the usefulness of the data captured however all readings can be better understood by moving the decimal point one place to the left. The survey itself remains correct and the datasets can be interpreted in relation to each other correctly.

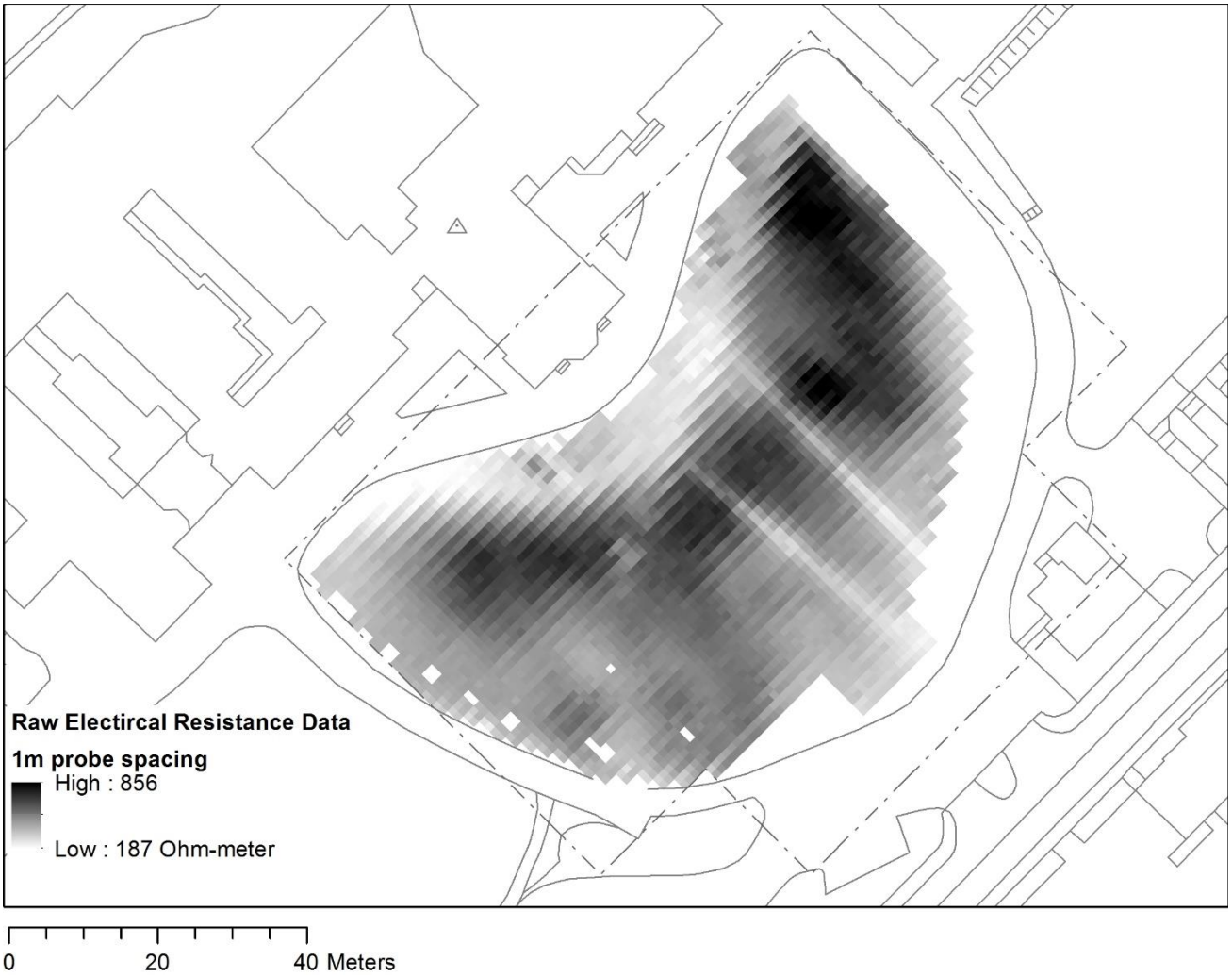


Figure 6 Greyscale plot of raw data for gathered with 1m probe spacing. Data clipped +/- 3 Std Dev., despiked and converted from Ω to Ωm Statistics: Mean: 474 Ωm, Std Dev. 126 (see footnote 5) *

Appendix three: Processed geophysical survey plots

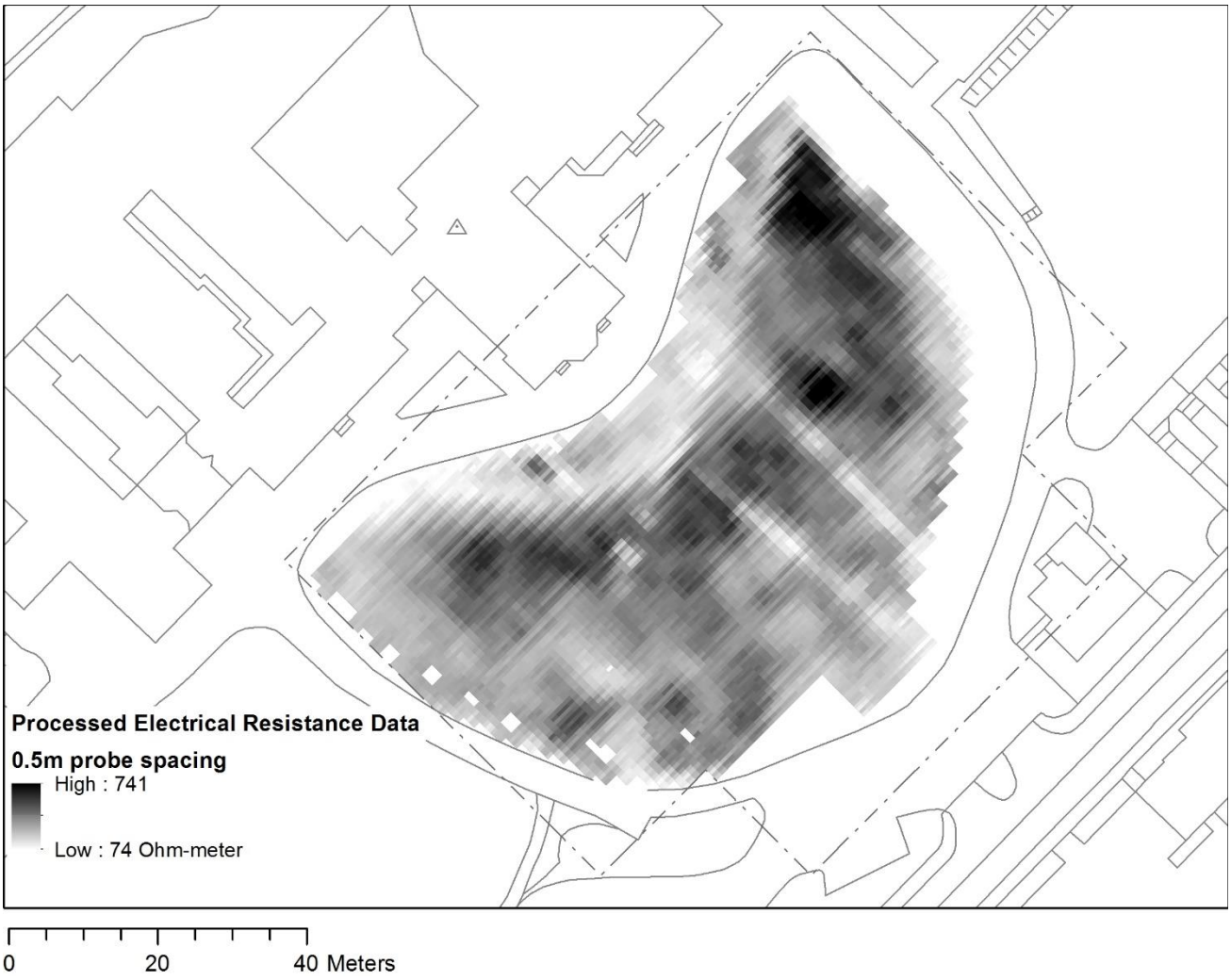


Figure 7 Greyscale plot of processed data gathered with 0.5m probe spacing. Raw data plot has been processed with HPF (Gaussian weighting applied X = 10, Y = 10), LPF (Gaussian weighting applied x2 on x- & y-axis). Statistics: Mean: -213 Ωm, Std Dev: 65.7. (see footnote 5)*

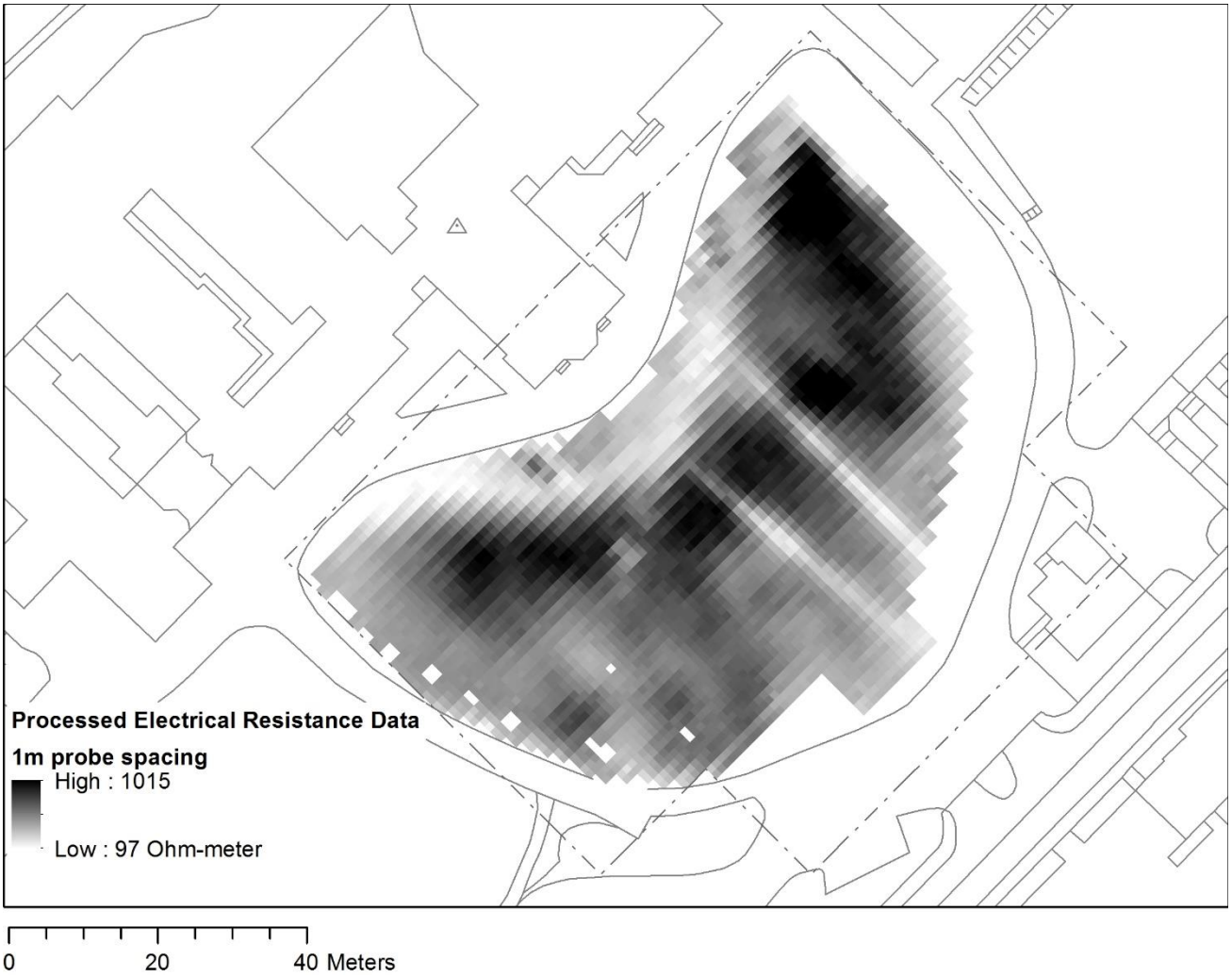


Figure 8 Greyscale plot of processed data gathered with 1m probe spacing. Raw data plot has been processed with HPF (Gaussian weighting applied X = 10, Y = 10), LPF (Gaussian weighting applied x2 on x- & y-axis). Statistics: Mean: 150 Ωm, Std Dev: 45.4. (see footnote 5)*

Appendix four: Historical mapping

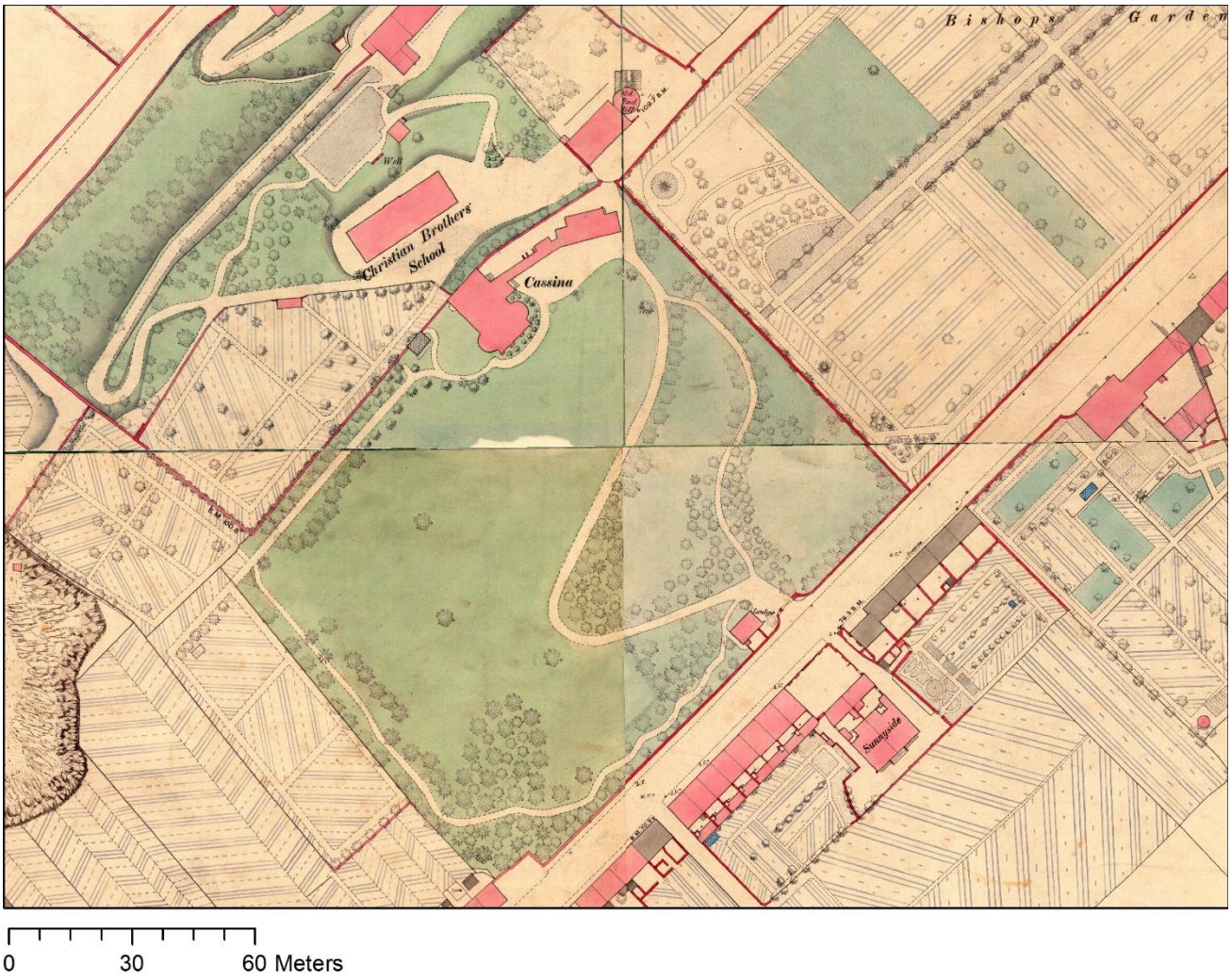


Figure 9 The lawn in front of Lumen Christi as depicted on a 1:500 map of the area from 1873.*

Figure 10 Lumen Christi survey area, and immediate hinterland as captured in the 2006 ortho-rectified aerial photograph series.*