Geophysical Survey Report No. 28

Dunboe Church,

Co. L'Derry

Dr Siobhán McDermott & Grace McAlister

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Summary of results

An evaluation resolution resistivity survey was carried out over a total area of 0.3 hectares due east of the remains of Dunboe church and graveyard (LDY 002:001) in the townland of Downhill, Co. L'Derry. The land is currently owned by the National Trust who wish to verify the archaeological potential of the area. The underlying Basalt geology mitigated against the application of magnetic gradiometery although the potential for its application was explored on site. The survey instead focussed on electrical resistance.

The results of the electrical resistance survey indicate a curvilinear ditch (r2), possibly a double ditch (r3), enclosing the old church site. It encloses an area of erratic, non-discernible high resistance readings that may be geological in nature but the consequence of quarrying activity. A clearly defined high resistance feature (r1) appears to cut into this possible double-ditched feature and may be related to a medieval secular settlement phase.

Site Specific Information

Site Name: Dunboe Church, Co. L'Derry

Townland: Downhill

Parish: Dunboe

SMR No: LDY002:001

Grid Ref: C 7579 3538

County: Antrim

Dates of Survey: 1st – 2nd May 2014

Surveyors Present: Siobhán McDermott, Grace McAlister

Size of area surveyed: 0.3 Hectares

Weather conditions: Changeable – overcast, wet and windy through to clear and sunny

Solid Geology: Upper Basalt Formation: Antrim Lava Group

Drift Geology: Diamicton till

Current Landowners: The National Trust

Current Land Use: Sheep grazing

Intended Land Use: Burial

Survey methodology overview

Survey type:
Electrical resistance
Instrumentation:
Geoscan RM85 resistance meter
Probe spacing:
0.5m parallel twin array
Grid size:
30m x 30m
Traverse interval:
1m
Sample Interval:
1m
Traverse Pattern:
Zig-zag

Lecia TS06-plus total station
Station setup:
Floating grid orientation towards magnetic north using a spotting compass (+/- 3 degrees)
Spatial Accuracy:
Survey grade internal accuracy (<3cm)
Georeferencing:
The dataset was downloaded from the TS06 and imported into ArcGIS 10.2. It was georeferenced to the Ordnance Survey 10km vector data. The grid points were extracted as a separate feature class and used to georeference the geophysical survey datasets exported from Geolplot v.3.

Data processing:
The geophysical data was processed in Geoplot v. 3 software.
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.3 using shade, trace, dot density and relief plots. Processed datasets and bitmap graph plots was exported from Geoplot v.3 and imported into ArcGIS 10.2. Once georeferenced statistical analysis were carried out on the rasters and they were interpreted in relation to the First, Third and Fifth Edition Ordnance Survey maps of the area, the 2006 orthorectified aerial photographs and relevant georeference bitmap imports.

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

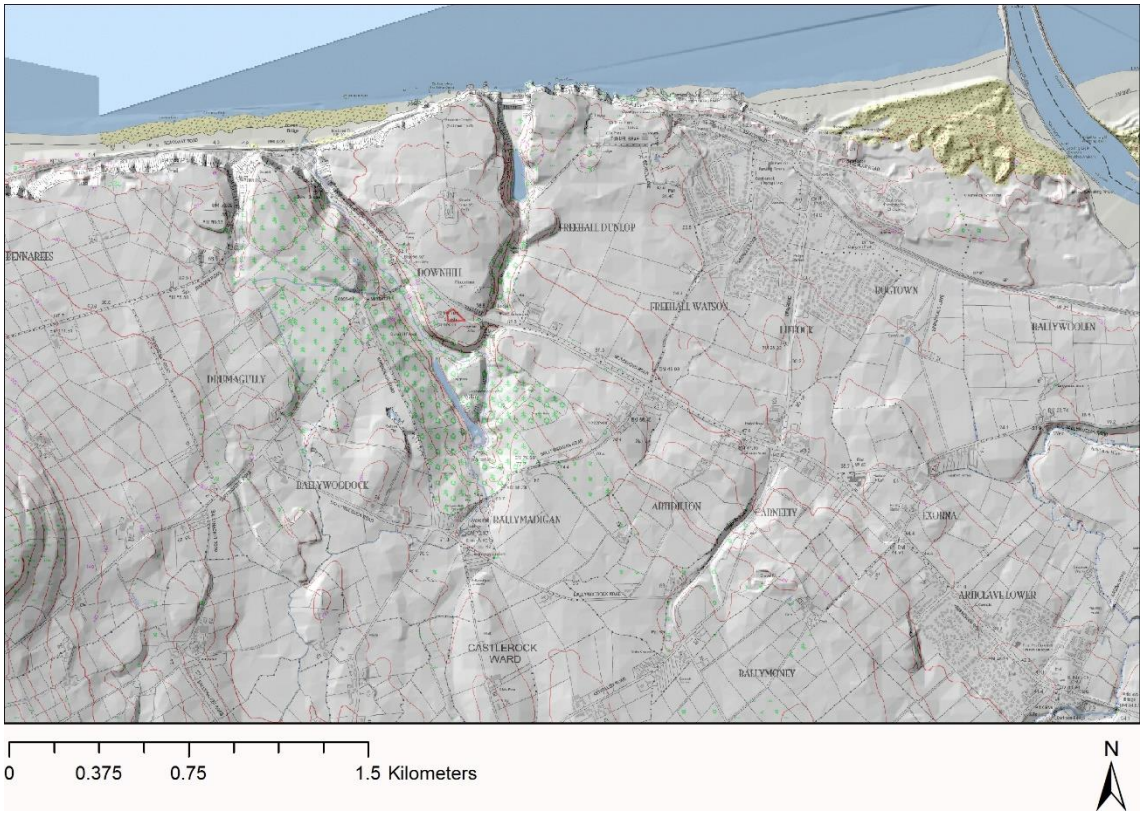

Figure 1 Location and landscape setting of the Dunboe Church. The area of the electrical resistance survey marked in red (OSNI 10km vector data layered over 5km DEM Hillshade)*

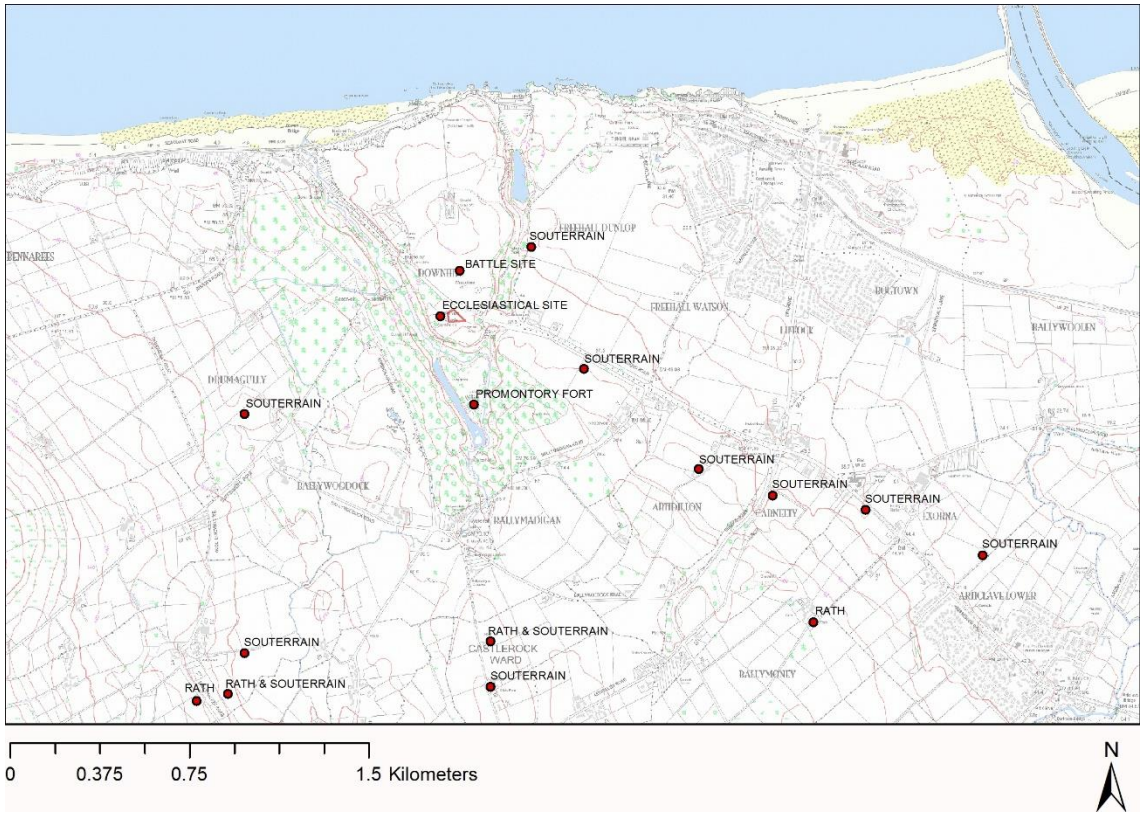

Figure 2 Wider recorded medieval archaeological landscape setting. Geophysical survey area in red with Key NISMR locations noted**

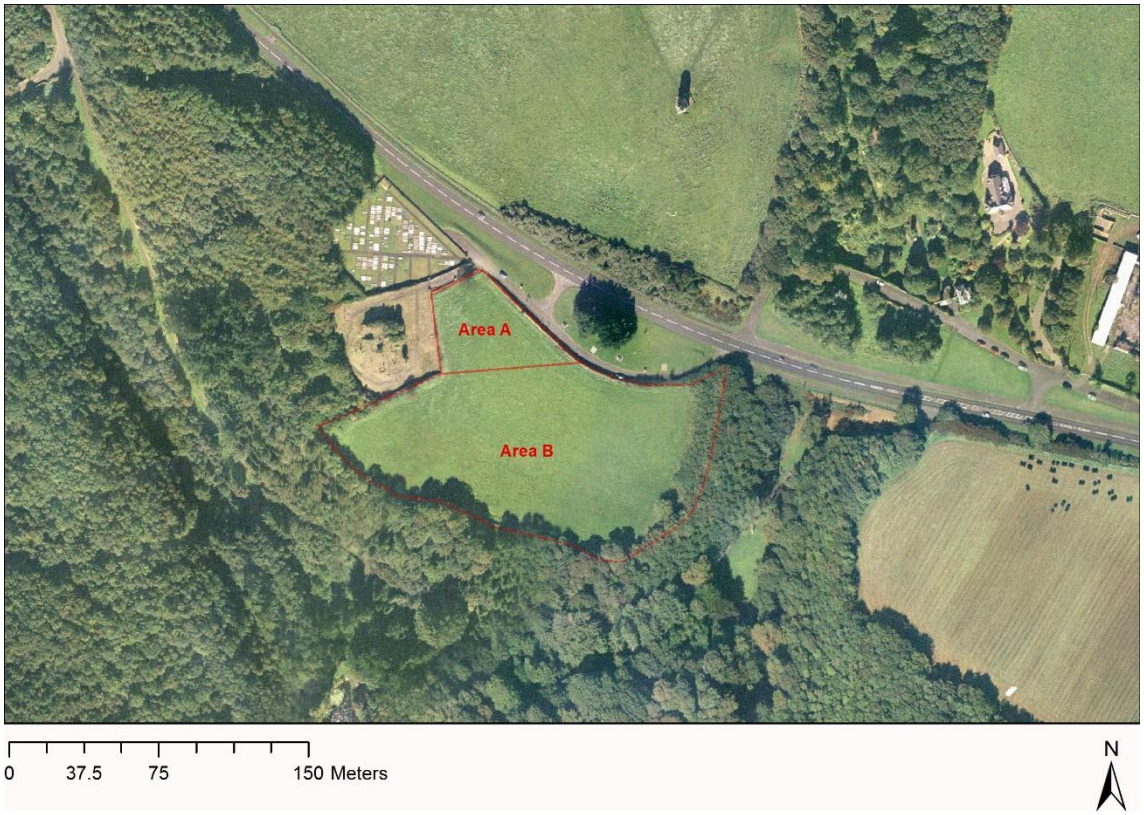

Figure 3 Location of the proposed geophysical survey areas overlaid on 2006 ortho-rectified aerial photographs*

Introduction

The project brief was to evaluate the archaeological potential of an area immediately to the east and south-east of Dunboe Church and graveyard (LDY002:001). The site was a parochial centre by the late 13th century and continued into use until the 17th-century. The upstanding remains have no diagnostic features and the funerary markers in the graveyard date from the early 19th-century. The land is earmarked for the potential expansion of the modern Castlerock Presbyterian graveyard to the north of the survey area.

Dunboe church and graveyard is situated in north Co. L'Derry to the west of the River Bann along the A2 which links Coleraine with Castlerock and Downhill. The church site shares its name with the civil parish of Dunboe (Lewis 1837, 567). The church, graveyard and survey area are include within the designated area of Downhill as listed in the Register of Historic Parks, Gardens and Demesnes.[2] It is designated as part of the Eastern Binevenagh Slopes Landscape Character Area.[3] This is an area characterised as having relatively poor quality farmland; mostly rough pastures with acidic soils and patches of gleyed and marshy soils. Although the land immediately surrounding the survey site is of a typically better agricultural nature being primarily improved grassland and arable horticulture. To the immediate south and west of the church site is Downhill

[2] Downloadable polygon dataset available online [http://www.doeni.gov.uk/niea/gardens.zip].
[3] Northern Ireland Landscape Character Areas available online [http://www.doeni.gov.uk/niea/land-home/landscape_home/country_landscape.htm] and as a downloadable polygon dataset [http://www.doeni.gov.uk/niea/landscape_character_areas.zip].

forest, a small mixed woodland of 83 hectares. The forest contains Downhill Lake an area of eutophic standing water noted for its biodiversity potential.

Geologically the survey is situated between the Downhill cliffs of multiple basalt lava flows which slope down towards the River Bann. It is an area of weaker palaeosol horizons of weathered basalt that encourage localised collapse as they wear back and undermine the overlying basalt – there is historical evidence for the retreat of the coast towards the cliff top Mussenden Temple.[4] This complex geology may explain the erratic nature of the magnetic returns noted during the gradiometery trail scan.[5]

The demesne lands themselves contain the remains of Downhill House (HB 3/12/15) and the Mussenden Temple folly (HB 3/12/16) both situated with striking vistas as well as two spectacular gateways with associated lodges (HB 3/12/18 & HB 3/12/12), a mausoleum (HB 3/12/14) and various other demesne offices (3/12/11-13 & 17-20). The wider archaeological landscape is dominated by a strong Early Medieval settlement horizon of raths and souterrains. Many of the souterrains are unlocated being referred to in oral tradition or destroyed prior to recording. It appears that right-angles are an important characteristic of souterrain plans in the locality with the curvilinear plan of the Big Glebe example (LDY 006:042) being noted as an exception to the rule.[6] Just under 400m south of Dunboe church is an Early Medieval promontory fort, commonly known as Dungannon Hill (LDY 002:006). The monument is supposed to have been heavily vandalised, in the name of landscaping, at the end of the 18th century (Eccles 1996, 55). The placename is also associated with a 12th-century battle although the precise location is unknown (O'Donovan 1856, 61).

The current plan of the church and graveyard appears very different then that mapped by the Ordnance Survey in the early 1830s. In the Frist Edition Ordnance Survey map (Figure 9) the church is aligned south-west to north-east within a rectangular graveyard in the centre of open land. Both the east and west gables are standing as well as westerly section of the north and south walls. Subsequent revisions map a different landscape, the graveyard has expanded and is trapezoid in form with the church ruins aligned east to west and field boundaries are evident in the surrounding landscape. The disparity may be explained by a difference of approach between the first and subsequent surveys. The county of L'Derry was the first to be mapped by the Ordnance Survey who initially didn't map field boundaries. There was also a tendency to take a generic approach to certain elements of the cultural landscape e.g. all raths are mapped as circular 'forts', which may be the same for a ruined church site. It is highly unlikely that the orientation of the ruin changed between the First and Third surveys, and the headstones in the graveyard start to date from before the mid-19th-century survey.

It was initially hoped that the underlying Basalt bedrock would be locally uniform enough to facilitate a magnetic gradiometery survey over the entire site, areas A and B (Figure 3). Magnetometry surveys measure the magnetic variation in the soil which can be caused extreme temperatures, i.e. kilns or furnaces, or by cutting and re-filling features, i.e. ditches or pits. It is therefore a useful method to identify the types of

[4] http://www.doeni.gov.uk/niea/land-home/landscape_home/country_landscape/38/38-geo.htm

[5] The magnetic levels of the site were tested using a Bartington Grad601-2 in scan mode. This is a fundamental stage of a gradiometery survey during which a zeroing station is identified (a change of less than +/-2nT in any direction for a distance of 1m). This condition could not be meet in the field and therefore the magnetic survey was not taken any further.

[6] http://apps.ehsni.gov.uk/ambit/Details.aspx?Monid=11546

anomalies commonly associated with an Early Medieval ecclesiastical foundation and later funerary activity, such as enclosing ditches and grave cuts. However testing indicated that the underlying Basalt geology was too complex and the magnetic readings too erratic to allow the successful use of magnetometry. The consequence being that electrical resistance survey was the only method applied over a reduced area, Area A. An electrical resistance survey measures the varying levels of electrical resistance in the soil. It is very useful for identifying stone footings and structures or cut features where the level of moisture in the fill is lesser or greater than the surrounding soil. It cannot identify cut features which do not have varying moisture levels and therefore its application can be limited.

The tenants who farm the land described the field has having a shallow covering of topsoil with near surface bedrock. They described the soil as clayey and prone to water-logging but noted that when graves used to be dug in the old graveyard the soil was very easy to work. They had not deep-ploughed the field instead tilling to a depth of *c.* 20cm. When prompted they said they had not seen bone fragments or pottery shards in the plough soil.

Cautions aside the Dunboe electrical resistance survey did reveal a number of features that suggest there is increased archaeological potential to the area immediately east of the church and graveyard. These features (r1, r2 & r3) could be interpreted as Early Medieval in nature (see Discussion below).

Description and interpretation of anomalies (Figure 4)

General comments:

A grade of archaeological potential has been identified for each anomaly listed below. Features which have a plan that clearly suggests they are the consequence of human activity have a high level of archaeological potential. Features which appear natural in form but by their association with other anomalies suggest human activity are identified as having a medium level of archaeological potential. Features which appear natural in form, are not associated with other anomalies of high or medium potential but cannot be explained due to the processes outline below are given a low level of archaeological potential. Finally features which can be explained due to geology, taphonomic, geomorphology, historical mapped sources, modern interference and/or agricultural practices (e.g. wire fencing), the survey methodology and data treatment are identified as having no archaeological potential.

It is important to note that these grades of archaeological potential are partly subjective and only applicable to the specific survey data covered in this report. Archaeological anomalies may be present, but undetected by geophysical survey, in all areas of the site and this cannot be mitigated against without further 'ground-truthing' i.e. test trenching or excavation. This is especially relevant in regards to the singular use of electrical resistance without an accompanying magnetic gradiometery survey.

Table 1 Description and interpretation of archaeological anomalies in Area A

Code	Description	Interpretation	Archaeological Potential
r1	Clearly defined U-shaped high resistance anomaly with a short spur on the southern arm. Measuring *c.* 6.4m SW – NE, *c.*5.9m NW – SE, *c.* 2m width, *c.* 10m in overall length with a mean raw data resistance reading of 59.37 ohm. Lying *c.* 44.5m ESE of the church ruins.	The strong, clearly defined resistance readings suggest that this is a stone structure however the irregular plan is difficult to interpret. It appears too small and too curiously laid out to be the footings of a stone-walled house. It would enclose an area of 2.6m² in walls that average *c.* 2m in width. A logical explanation for the strength of readings, the feature's dimensions and plan could be that this is a souterrain with lintels in-situ. A souterrain would fit into the wider archaeological landscape distribution model (Figure 2). The dimensions of r1 fall within the expectable bounds of such a monument type if we consider that the lining stones would have been mapped by the resistance survey. Further, part of the souterrain may have been removed through prior	High

		agricultural activity or could lie outside the effective survey depth (≤ 1m) of the probe array used during data collection.	
r2	Curvilinear higher resistance feature curving from the SW through to the N. Measuring *c.* 58m in length and *c.* 2.3m in width. Mean raw data resistance reading of 38.93 ohm. Lying *c.* 38m ESE of the church ruins.	The form and spatial relationship of r2 and r3 suggest that these could be the remnants of a pair of parallel curvilinear features. Electrical resistance surveys do not easily record cut features, unless the fill material has a different level of moisture then the surrounding soil. The higher, and notably equivalent, resistance readings of r2 and r3 suggest that a similar material fills each feature and that these retain less moisture then the surrounding soil. This may be expected of a fill which drains more easily than the surrounding soil or of more compact deposits associated with silting episodes. The farmers who work the land reported that the soil tended towards clay. In which case than r2, and possibly also r3, could be the remnants of a double-ditched enclosing feature focusing on the ruined church site. It is important to note the r3 has a very subtle expression. But, if it does form part of a double-banked enclosing feature then the anomaly r1 would appear to cut into and must post-date it.	High
r3	Curvilinear high resistance feature curving from the SW through to the N. Measuring *c.* 12m in length and *c.* 2.2m in width, with a mean raw data resistance reading of 38.94 ohm. It appears to run parallel with r2 the distance between the two features being *c.* 2.8m.		Medium
r4	Irregular high resistance feature on the SW limit of the survey. Measuring *c.* 4.3m E – W, *c.* 4.5m N – S, with a mean raw data resistance reading of 42.59 ohm. Lying *c.* 41.5m SSE of the church ruins.	This feature is only partially mapped by the resistance survey. It is currently mapped as a non-descript area of high resistance which could related to a stone-filled pit, a buried stone or stone feature.	Medium
r5	Regular area of high resistance. Measuring *c.* 2.8m E – W, *c.* 3m N – S, with a mean raw data resistance reading of 44.73 ohm. It lies to the NE limit of the survey area *c.* 47.5m E of the church ruins.	A number of high resistance returns which appear circular in form in the processed data. The feature r5 not appear to be associated with other anomalies of a more definable anthropogenic nature which makes it difficult to interpret beyond it may be a stone-filled pit, a buried stone or stone feature.	Medium - Low
r6	An irregular area of higher resistance on the N limit of the survey. Measuring *c.* 5.9m SW –	Compactly packed stones were noted just below the ground surface here during data collection. The higher resistance readings may be gravel laid down to	Low - None

	NE, *c.* 3.7m NW – SE max. It is situated at the gated entrance to the field.	facilitate access to the field by wheeled vehicles. During the fieldwork this was used as an access route to bring in vehicles to move livestock.	
r7	A large area of higher, irregular resistance readings. Clearly defined against the quieter, even resistance readings to the E of the survey area (Figure 8). The anomaly measures *c.* 21.7m E –W, *c.* 44m N – S, with a mean raw data resistance reading of 48.57 ohm. The area appears to respect r2 and does not extend to the east of this boundary.	No clear patterns could be distinguished within this area of higher readings. It may be significant that r7 respects the anomaly r2 and does not extend beyond it. It was noted during data collection that the soil here was stonier, especially nearer the graveyard wall, then elsewhere in the survey. The ground level within the graveyard itself undulates from a low-lying hollow in the SE corner of the graveyard to the central height upon which the church ruins and the bulk of the modern grave markers stand. It is possible that r7 is the remnants of a rock outcrop which has been quarried out. This may also explain the hollow to the SE of the graveyard, which has remained at its quarried level as the area outside the graveyard bounding wall was built up by subsequent agricultural activity. During the magnetic gradiometer testing phase higher, erratic magnetic readings where noted in this area which would suggest the bedrock was nearer the surface. However, this interpretation does not clearly explain why r7 appears to respect r2, and consequently r3.	Medium - Low

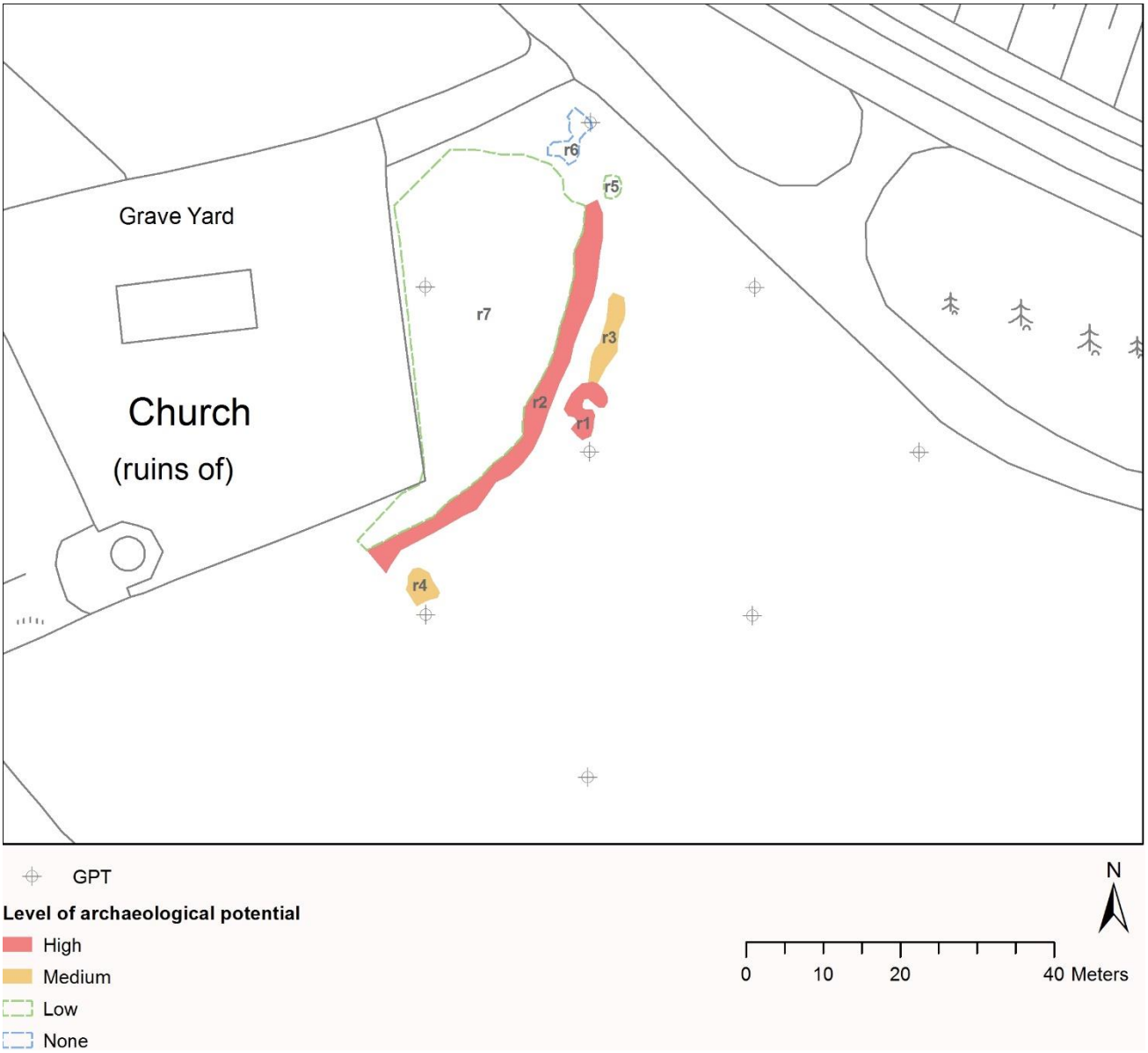

Figure 4 Interpretation diagram with electrical resistance anomalies and levels of archaeological potential*

Discussion

The data collected during the Dunboe electrical resistance survey indicates that there is potential for archaeology to be encountered within the survey area. The nature of this archaeology may be Early Medieval. The initial brief of this survey was to identify if funerary activity extended beyond the graveyard walls. It is not possible to meet this specification with electrical resistance survey. Magnetometry was attempted but the underlying geology mitigated against its application.

Dunboe church and graveyard are located *c.* 3km west of the River Bann. This would have been a major territorial boundary during the 9th century – the river divided the territory of the Cenél Conaill in the west and the Ulaid in the east (Byrne 1973, 121-2). The situating of churches along kingdom borders is a feature of Early Christian foundations (Edwards 1990, 105). The church shares it name with the parish a good

indicator of its function as a parochial centre. Although the earliest reference to the placename *dún bó* 'the fort of the cows' is 12th century.[7]

From the 7th century onwards there was a growing interest in the internal spatial organisation of ecclesiastical sites. This is evidenced in the archaeological record by the construction of *valla* or enclosing elements to protect the sanctity of the site. The form of these *valla* may vary from stone walls e.g. Nendrum, Co. Down, earthworks e.g. Rahan Co. Offaly (Edwards 1990, 105 – 7) or cut ditches (Gormley & Murray 2007, 4). The anomaly r2 is a subtle higher resistance curvilinear feature mapped for a total length of *c.* 58m with an average width of *c.* 2m. Present in the raw data (Figure 6) it is emphasised by the application of high and low pass filters (Figure 7). The feature r2 appears to enclose the current church ruins and graveyard. The strength of the returns (mean 38.93 ohm) is not typical of wall or stone footing but does have a higher resistance then the surrounding soil. This may mean the ditch fill is better drained, as water-logging lowers resistance, and possible more compact perhaps due to silt build-up. Excavations at Armoy, Co. Antrim excavated a section of ditch which was interpreted as a 5th- to 8th-century *valla* (Gormely & Murray 2007, 4). The excavated portion of ditch was 14m long and 2 – 2.5m in width (ibid, 34) with episodes of silting, re-cutting and maintenance.

Without testing it is difficult to tell from the survey data alone if the erratic, higher resistance readings of r7 are archaeological or geological. The anomaly does appear to respect r2, not extending beyond its eastern limits. It has been suggested above (Table 1) that r7 is essentially geological but the product of human activity namely quarrying.

While an argument can be made for the anomaly r2 being part of an Early Christian *valla* the presence of r3 is more difficult to explain. The anomaly is subtle and appears to run parallel to r2 for a short part of its length, *c.* 12m. Its width, *c.* 2.2m, and mean resistance reading, 38.94 ohm, is strikingly similar to those returned for r2. The distance between the two features is *c.* 2.8m. The dimensions and resistance readings suggest that r2 and r3 may relate to a similar phase of activity and have undergone similar taphonomic or geological processes. However the enclosing elements of Early Christian *valla* are not usually so closely spaced. They were conceptual in nature with the importance on the areas they enclose and maintaining their sanctity rather than on the scale of the boundaries. The concentric ditches suggested by r2 and r3 at Dunboe do not fit into this model but would be more appropriate for the ditched and banked enclosures of a secular settlement type such as the rath. Without testing it is impossible to say whether r2 and r3 are archaeological and coterminous. The subtle nature of their returns does not exclude the possibility that they are non-archaeological in nature.

Another explanation for r3 could relate to the anomaly r1. The strong, clearly defined high resistance feature is probably a stone structure. It would appear too small, enclosing an area of 2.6m², to function as a house. The feature's dimensions and plan suggest that this is a souterrain with lintels in-situ. Further, part of the souterrain may have been removed through prior agricultural activity and this may explain r3 which is not silting from a ditch but rather the better draining fill of a backfilled segment of a souterrain shaft. A souterrain would fit into the wider archaeological landscape distribution model (Figure 2). The nearby

[7] Placenamesni.org [http://www.placenamesni.org/resultdetails.php?entry=99].

souterrain of Artidillon (LDY 002:008)[8] and a destroyed example from Ballyhacket Glenahorry (LDY 006:023)[9] have similar proportions and a proliferation of right-angles which appears to be a feature of the souterrains of the locality. A souterrain phase was identified at Armoy that post-dated the use and maintenance of the *valla* (Gromely & Murray 2007, 5). Sometime after the ecclesiastical enclosure fell out of maintenance the souterrain was cut *c.* 16m to its east. The partly excavated section of souterrain had a total length of *c.* 10m, and a width ranging from 0.7 – 2m. It was roughly orientated north – south with a central passage that forked midway with a branch leading off towards the south-east. The main passage continued for *c.* 4m to end in a terminal chamber which was accessed through a low, narrow gap. The depth of the structure ranged from 0.4 – 1.5m (ibid, 52-7). If r1 is a souterrain, and it follows a similar plan, then it may only be partially mapped by the resistance survey as the 0.5m spacing of the parallel twin probe array will not penetrate deeper then *c.* 1m.

Recommendations

It has not been possible to say whether burials extend beyond the graveyard wall into the survey area. It must be concluded that there is still a likelihood they do. A programme of testing should be able to identify the nature of anomalies r2 and r3, and evidence for funerary activity. Of the features returned by the resistance survey r1 is the most likely to be archaeological in nature.

If r1 were a souterrain, with the lintels in-situ, then the interior of the structure should be a void. It may be possible to detect this void through the use of pseudo-sections generated from data collected by a sequence of expanding electrical resistance twin survey arrays.

It must be remembered that the grades of archaeological potential identified by this report are subjective and only applicable to the specific survey data covered in this report. Archaeological anomalies may be present, but remain undetected, in all areas of the site.

[8] [http://apps.ehsni.gov.uk/ambit/docs/LDY/LDY_002/LDY_002_008/Public/SM7-LDY-002-008.pdf]
[9] [http://apps.ehsni.gov.uk/ambit/docs/LDY/LDY_006/LDY_006_023/Public/SM7-LDY-006-023.pdf]

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I would like to thank Malachy Conway from the National Trust and Grace McAlister for her assistance.

Appendix one: Georeferenced geophysical survey grid

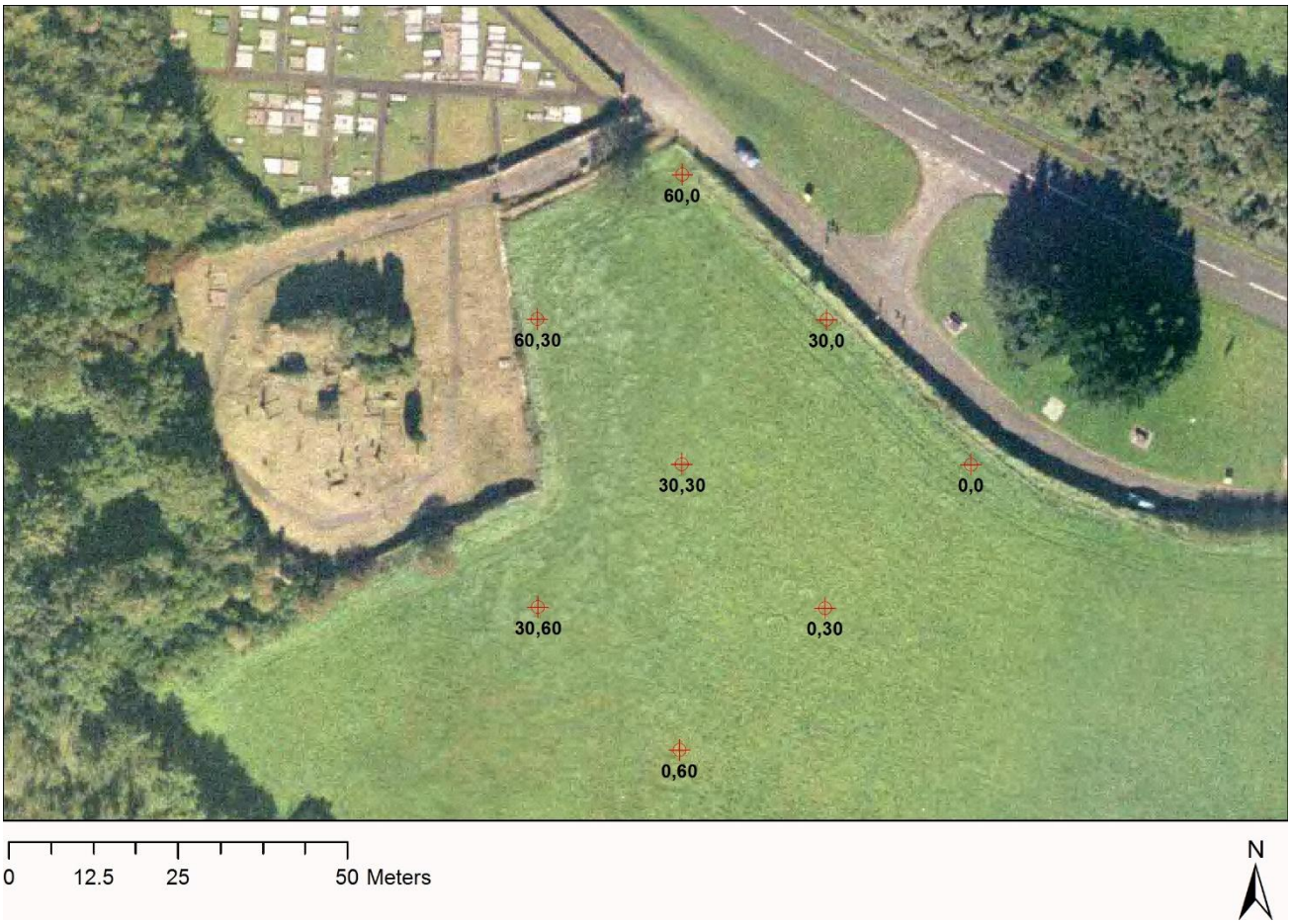

Figure 5 Location and coordinates of local geophysical survey grid. The local point of origin (0,0) is in the eastern corner*

Local Grid coordinate		Irish National Grid coordinate	
X	**Y**	**Eastings**	**Northings**
0	0	275919.1998	435388.7657
0	30	275897.5441	435367.5762
0	60	275876.1013	435346.5951
30	0	275897.8216	435410.1532
30	30	275876.3724	435388.8308
30	60	275855.0964	435367.6806
60	0	275876.4765	435431.5837
60	30	275855.0338	435410.2529

Table 2 Geophysical survey grid coordinates georeference to Irish National Grid

Appendix two: Raw data plot.

Figure 6 Greyscale plot of raw data clipped at 0/+100 Ohm and despiked.*

Statistics:
Mean: 36.017
Std Dev.:5.584

Appendix three: Processed data plot

Figure 7 Greyscale plot of processed data, clipped 0/+100 ohm, despiked, HPF (Gaussian weighting applied on the x- and y-axis), LPF (Gaussian weighting applied on the x- and y-axis) and interpolated on the x- and y-axis.*

Statistics:
Mean: -0.028
Std Dev.: 2.723

Appendix four: Supporting visualisations

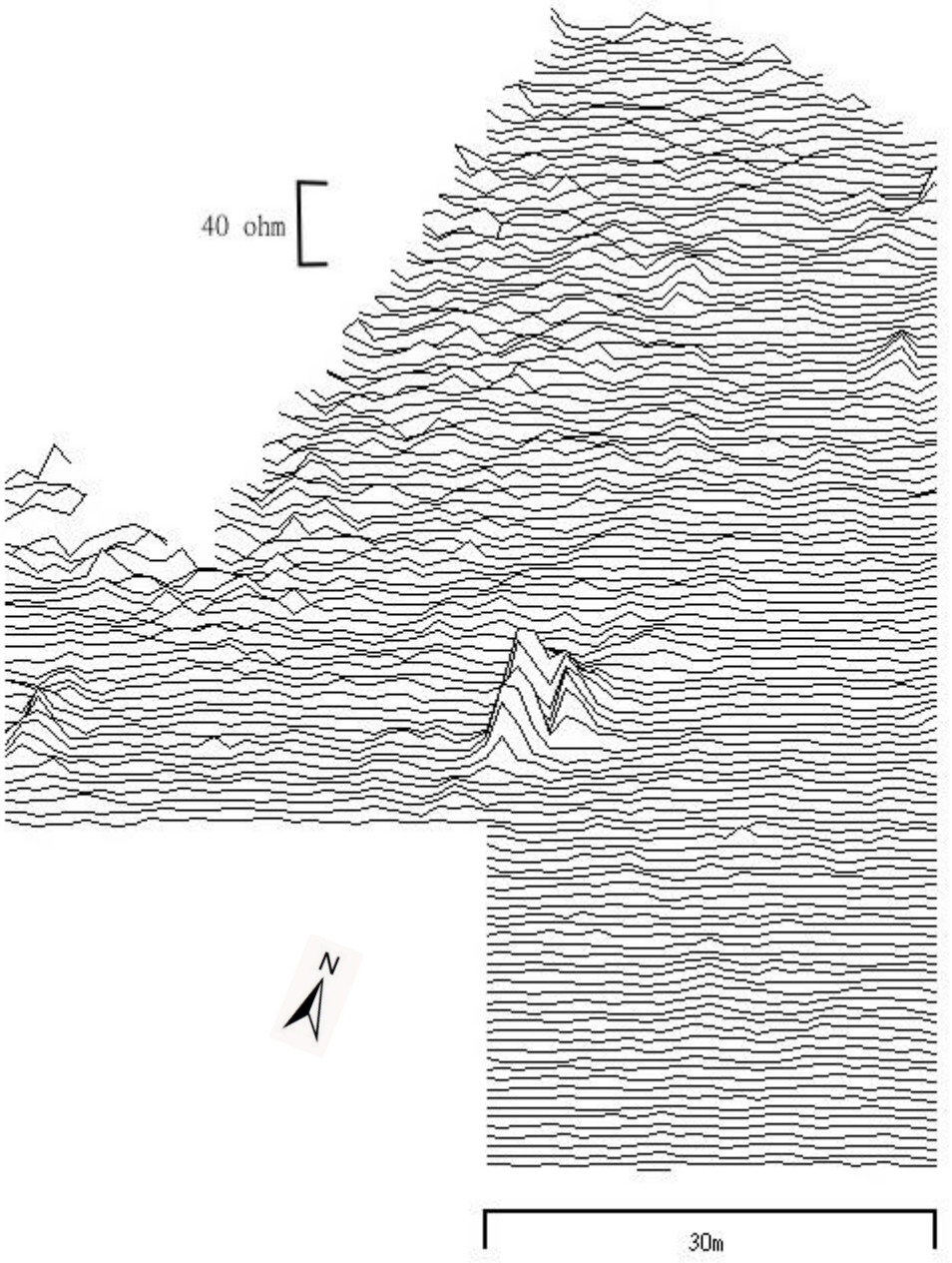

Figure 8 Trace plot, expanded on the y-axis expansion by 20%, of electrical resistance data. Data is clipped 0/+100 ohm, despiked and processed with HPF (Gaussian weighting applied on the x- and y-axis).

Appendix five: Historical mapping

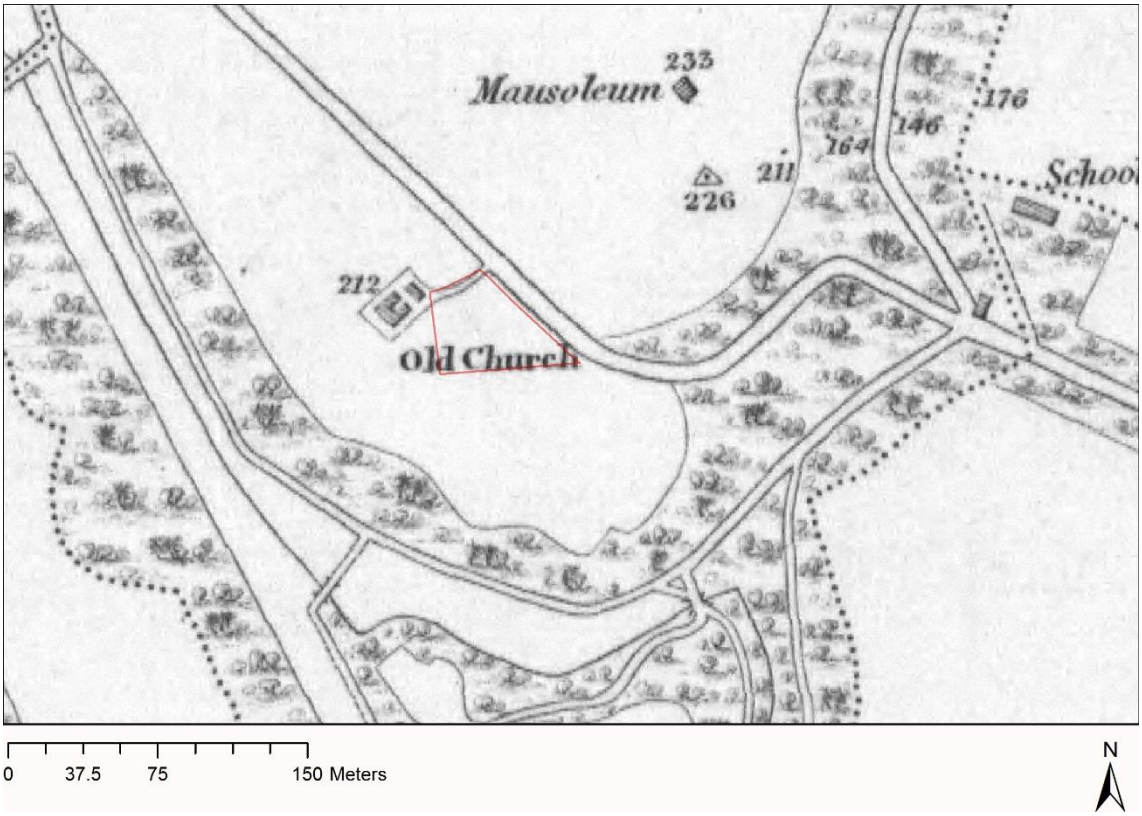

Figure 9 Geophysical survey areas in relation to the First Edition Ordnance Survey map series, *c.* 1830-2.*

Figure 10 Geophysical survey areas in relation to the Third Edition Ordnance Survey map series, *c.* 1904-6.*

Figure 11 Geophysical survey areas in relation to the Fifth Edition Ordnance Survey map series, *c.* 1924.*

Appendix six: Photographs of site

Figure 12 Photograph looking west onto Dunboe church ruins and graveyard taken from the east.

Figure 13 Photograph looking north-west onto Dunboe church & ruins taken from the south-east.