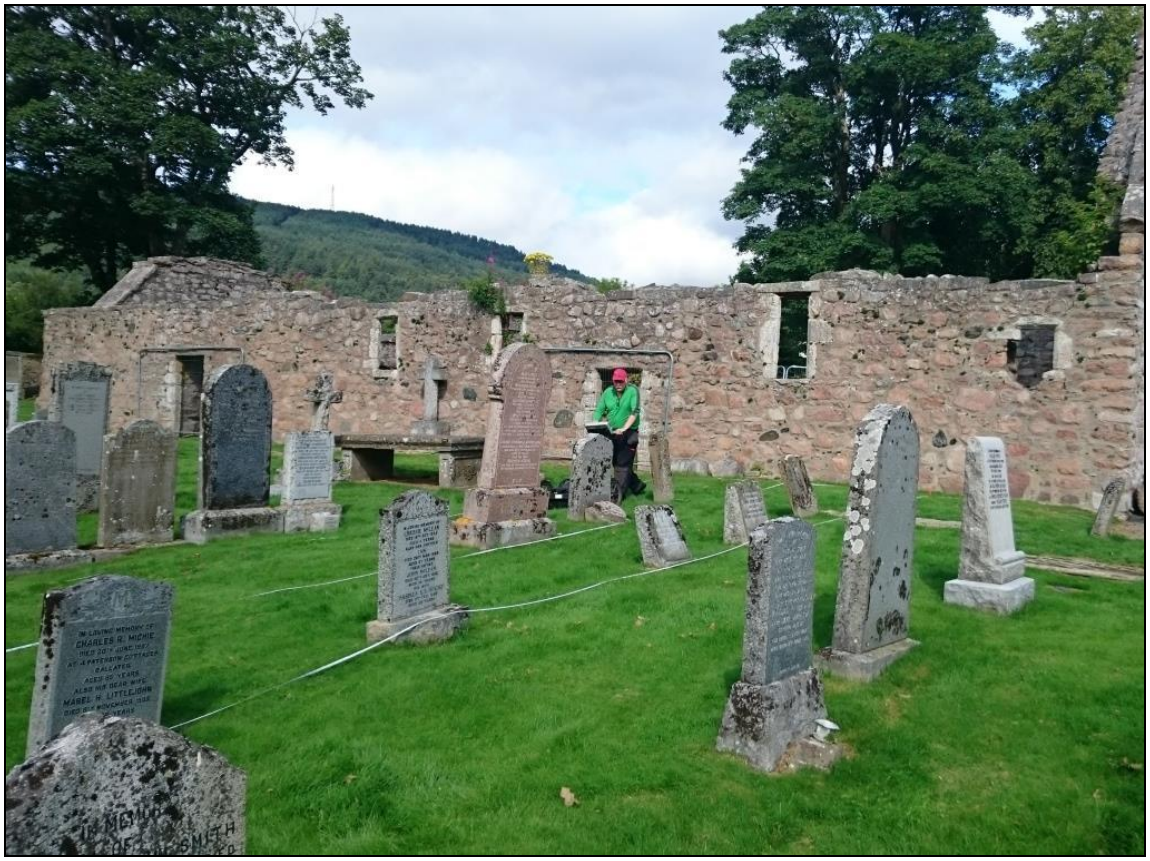
Geophysical Survey Report
Tullich Kirkyard, Ballater

RGC15160TKY



On Behalf of:

Aberdeenshire COUNCIL

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Executive Summary

Following a Ground Penetrating Radar (GPR) survey at Tullich Burial Ground in 2013 (RGC1273TBG) as part of a wider archaeological evaluation prior to the extension of the burial ground, a further GPR survey was carried out within the graveyards. The primary aim of the survey was to map any anomalies close to the Church walls prior to consolidation work. A secondary aim is to extend the 2013 survey to cover the whole burial ground given the wealth of anomalies identified during the previous GPR survey and subsequent excavations.

As expected the large number of burials across the site dominates the results. Several trends and anomalies have been detected within the outer graveyard and show correlation with a 1790 plan of a croft on the site and associated enclosures.

Numerous anomalies have been detected in the northeast of the inner graveyard. These are most evident within the deeper depth slice maps. However, as with the outer graveyard, the extensive burials across the area have resulted in a confused data set. While a natural origin for these anomalies cannot be dismissed, their form suggests they may be archaeologically significant and show some correlation with the results from the 2014 survey. Although a few discrete anomalies have been detected immediately adjacent to the church they are thought to be associated with burials. Unfortunately dense vegetation between the church and the Heras fencing has reduced the efficacy of the technique in the area immediately to the north of the church.

Survey:	Tullich Kirkyard, Ballater
Client:	Aberdeenshire Council
Date of Survey:	18th – 20th September 2015
Survey Personnel:	Dr S M Ovenden and A S Wilson
Date of Report:	11th September 2015
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1. Introduction

1.1 Following a Ground Penetrating Radar (GPR) survey at Tullich Burial Ground in 2013 (RGC1273TBG) as part of a wider archaeological evaluation prior to the extension of the burial ground, a further GPR survey was carried out within the graveyards as indicated on Figure 1.

1.2 The primary aim of the survey was to map any anomalies close to the Church walls prior to consolidation work. A secondary aim is to extend the 2013 survey to cover the whole burial ground given the wealth of anomalies identified during the previous survey and subsequent excavations.

1.3 The survey was undertaken as two separate areas, as indicated on Figure 1. Numerous extant gravestones have resulted in gaps within the data but this has not diminished the overall efficacy of the survey. In addition, some areas at the limits of the modern, outer, graveyard, could not be surveyed due dense shrubs and trees. Survey within the Church was not possible due to overgrown vegetation and limited space. Some of the area covered is scheduled and Section 42 Scheduled Monument Consent was obtained prior to survey.

1.4 The data are displayed as a series of depth maps which display horizontal 'slices'/plans through the ground. High amplitude reflections (black/dark) indicate a strong response i.e., stone/rubble, path/foundations, compacted or well-drained soil, etc. White/pale areas indicate attenuation of the signal, due to increased moisture content e.g. ditch fill. An accompanying interpretation is provided for each slice. These form Figures 2 - 21 and are all at a scale of 1:500. Selected individual radargrams are displayed in Figure 22.

1.5 For completeness the data plots and interpretation diagrams from the 2013 survey are also displayed in the Figures, although the results are not discussed unless relevant.

2. Methodology

2.1 Prior to data collection a series of markers were established across the site and tied-in to hard features.

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2.2 The Ground Penetrating Radar (GPR) survey was carried out using a Mala Ramac X3M system with a 500MHz antenna. This antenna was selected on the basis of ground conditions, the nature of the soils and expected targets. Data was collected at 0.02m intervals along parallel traverses 0.5m apart.

2.3 In GPR surveys pulses of electromagnetic energy are directed downwards into the earth. The transmitted wave is affected by variations in the electrical properties of the subsurface, specifically the dielectric constant and the conductivity of the subsurface.

2.4 Contrasts in these properties cause differential reflection of the energy wave creating an anomaly. The subsurface is mapped by recording the amplitude of this reflected energy and its travel time. The travel times were converted to depth using a calculated constant velocity. While the depths provided should be a reasonable estimation of the depth of features, there may be some variation as a constant value has been applied and the velocity can vary vertically and laterally within the subsurface.

2.5 The data was processed using GPRSlice software. The data were collected and processed as individual traverses. All the traverses were then assembled into a block of data and processed and displayed as a series of time slice or depth maps in Figures 2 - 21. This type of data processing and visualisation allows more subtle features and relationships between features to be analysed more easily.

3. Results of Ground Penetrating Radar Survey

Anomaly numbers referred to below are shown on the accompanying interpretation diagrams and selected radargrams.

3.1 0.00m - 0.25m (Figures 2 & 3)

3.1.1 The strongest, most coherent, response within this depth slice is due to the gravel path (1) within the inner graveyard. The broader area of increased response (2) in the north of the inner graveyard is thought to be caused by natural variations in the subsoil due to tree roots, soil compaction, etc.

3.1.2 Within the outer graveyard this surface depth slice is dominated by well-defined rectangular high amplitude anomalies (3) which indicate burials. Only the most prominent of these have been noted on the interpretation diagram. These clearly respect the grave markers within the outer graveyard. The linear trends (4) associated with the burials indicate the narrow zones of undisturbed ground between burials.

3.1.3 Although similar anomalies indicative of burials are visible in the inner graveyard, they are less well-defined. This is likely to be due to the numerous burials, not all of which are marked, their age, and the less systematic internment of burials.

3.1.4 The linear anomaly (5) in the northwest of the survey area is thought to be associated with a former footpath or fence. The more ephemeral linear trends (6) in the west of the survey area coincide with an 'access drive' through the graveyard and the location of a former field boundary.

3.1.5 Two amorphous zones of high amplitude reflections have been detected to the north and west of the graveyard wall. The responses (7) adjacent to the entrance of the inner graveyard are likely to be due to a former path and / or landscaping in this area. The origin of anomaly (8) to the west of the church is unclear. The response within the churchyard may be due to burials while the more discrete response adjacent to the external face of the wall may be associated with the wall itself.

3.1.6 The narrow band of high amplitude reflections (9) along the southern edge of the church is thought to be associated with the church foundations. The data adjacent to the north elevation of the church is noticeably 'quiet' which is most likely due to the longer vegetation in this area.

3.2 0.25m - 0.50m (Figures 4 & 5, 22)

3.2.1 Responses from the path (1) and graves (3) are still evident within this depth slice. In general the data within the inner graveyard is more uniform, aside from the voids/slabs associated with burials, which is not surprising given the extensive internments within this graveyard.

3.2.2 There is some suggestion that the path within the inner graveyard had a different layout in the past with a longer east-west extent (10). However, this could be an aliasing effect due to burials. The westward extension of (10) may account for some of anomaly (8) in the previous depth slice.

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3.2.3 Immediately to the east of the church, within the area of the modern gravel path, a cluster of discrete high amplitude reflections (11) has been noted. Their rectilinear nature, and proximity to the church, suggests they may be archeologically significant. However, such an interpretation is cautious; these responses may simply be due to burials beneath the modern path. It is clear from the example radargram in Figure 22, that the reflections are not particularly coherent.

3.2.4 An ephemeral, north-south aligned trend (12) extending to the south of the church is just discernible. Although this may be related to a former path, or possibly a drain, it is likely that it is simply due to undisturbed ground between burials.

3.2.5 A well-defined rectangular anomaly (13) has been detected adjacent to the northwest corner of the Church. It is not clear if this is due to a burial or church foundation, or simply associated with the burial enclosure immediately to the east.

3.2.6 A short linear anomaly (14) has been detected in the south of the outer graveyard. This appears to be a continuation of the inner edge of the ditch detected in the previous survey to the south. Unfortunately bushes and trees prevented survey further to its south and as a result the continuation of the outer ditch edge is not apparent. Also within this area a curving trend (15) is visible in the data. This approximately follows the graveyard wall and may be associated with the bank on which this 'modern' wall sits. Similarly the area of increased response (16) immediately to the northwest of the graveyard wall is thought to be due in part to burials possibly cutting into the earlier bank.

3.2.7 Towards the centre of the outer graveyard a discrete area of coherent anomalies (17) has been noted. There are no burials in this area and these responses are thought to indicate remnants of enclosures associated with a croft shown on a plan from 1790.

3.2.8 Numerous anomalies (18) are apparent along the northern edge of the survey area within this depth slice. These are thought to be a combination of modern ground disturbance associated with the road and the outbuildings, and the earlier croft.

3.2.9 The linear trend (19) in the southwest of the survey area may be significant, but interpretation is cautious. The anomaly appears to mark a slight change in the level of response and there is some correlation with former field divisions within this area. However, it could simply be due to the lack of burials and removal of shrubs etc.

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3.3 0.50m - 0.75m (Figures 6 & 7)

3.3.1 There are few coherent, well-defined, anomalies within this depth slice. The variations within the data are primarily due to the numerous burials.

3.3.2 The path is still visible at this depth but this is due to 'ringing' of the signal. This occurs when there is a very marked near surface contrast (such as gravel) and results in the signal 'bouncing' back and forth between the antenna and the surface causing in the response to appear at a greater depth than it actually exists.

3.3.3 The anomalies immediately to the northwest (13) and southeast (11) of the church seen in the previous depth slice have largely disappeared by this depth, although week trends are discernible within the data.

3.3.4 The trends (15) and (19) in the south of the outer graveyard are still clear within this depths slice.

3.3.5 Numerous anomalies (20) have been detected within the outer graveyard. It is likely that these anomalies, like (17) in the previous slice, are associated with the former croft. However, interpretation is extremely cautious as this could just be an aliasing effect of the graves and the undisturbed areas between the rows of burials.

3.3.6 A well-defined anomaly (21) is apparent in the north of the survey area. This appears to show some correlation with croft buildings shown on the 1790 plan. However, given its location, it could be associated with earlier layouts of the graveyard.

3.4 0.75m - 1.00m & 1.00m – 1.25m (Figures 8 – 11, 22)

3.4.1 Although several discrete anomalies (22) are apparent throughout this depth slice, the majority are due to burials. However, some of the anomalies (23) are thought to be associated with the former croft. However, it is possible that the anomalies are a combination of grave cuts and remnants of the features associated with the croft.

3.4.2 A series of linear anomalies and trends (24) are visible in the northeast of the inner graveyard. While these may all be associated with the modern path, and possibly early forms of it, the radargrams suggest it may be associated with the ditch detected in the previous survey immediately to the northeast.

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3.4.3 Several other trends have been noted throughout the survey area (e.g. 15 and 19) which were apparent in the shallower depth slices

3.5 1.25m - 1.50m & 1.50m – 1.75m (Figures 12- 15, 22)

3.5.1 The majority of the responses within these depth slices appear to be associated with burials.

3.5.2 In the north of the outer graveyard there is a zone of increased response (25). This is thought to be predominantly due to burials cut into deposits associated with the former croft.

3.5.3 Within the inner graveyard there two zones of increased response. The anomalies in the west (26) are thought to be associated with burials and the adjacent wall.

3.5.6 The origin of the responses (27) in the east of the inner graveyard is unclear due to the strong response from the modern gravel path and the burials. However, the anomalies (see radargram A_219, Figure 22) suggest deeper deposits which may be associated with those to the east beyond the graveyard wall. However, a natural origin cannot be dismissed.

3.6 1.75m - 2.00m (Figures 16 & 17)

3.6.1 The anomalies apparent within the outer graveyard are predominantly due to the grave cuts.

3.6.2 A short linear anomaly (28) is apparent in the south of the area and is thought to be associated with former field divisions.

3.6.3 Numerous anomalies are apparent in the northeast of the inner graveyard. These include coherent, discrete, anomalies (29) which do not appear to be associated with burials. They are consistent with anomalies detected in the previous survey to the east, however a natural origin cannot be dismissed.

3.6.4 There are suggestions of parallel linear anomalies (30) on a northwest-southeast alignment. Although these responses are comparable to the ditch revetments detected in the 2013 survey, they may have a natural origin.

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3.7 2.00m- 2.25m & 2.25m - 2.50m (Figures 18 - 21)

3.7.1 The cluster of anomalies (29) and the linear anomalies (30) are still discernible within these depth slices. However, given the depths these could simply be due to natural pedological / geological variations

3.7.2 There is a suggestion of sub-circular trends (31) in the outer graveyard. Although these may be associated with the former croft, the depth of the responses suggests a possible natural origin.

3.7.3 The responses (32) in the south of the area are thought to be due to the bank and former layouts (e.g. fences, shrubs) in this area.

4. Conclusions

4.1 As expected the large number of burials across the site dominates the results.

4.2 Several trends and anomalies have been detected within the outer graveyard and show correlation with a 1790 plan of a croft on the site and associated enclosures. However, the numerous subsequent burials have resulted in a somewhat confused data set.

4.3 Although a few discrete anomalies have been detected immediately adjacent to the church they are thought to be associated with burial plots and possibly foundations to the south. Unfortunately dense vegetation between the church and the Heras fencing has reduced the efficacy of the technique in the area immediately to the north of the church.

4.4 Numerous anomalies have been detected in the northeast of the inner graveyard. These are most evident within the deeper depth slice maps. However, as with the outer graveyard, the extensive burials across the area have resulted in a confused data set. While a natural origin for these anomalies cannot be dismissed, their form suggests they may be archaeologically significant and show some correlation with the results from the 2014 survey.

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