Lake Hamilton Cemetery Survey

Figure 1: Monument in centre of cemetery.

1 Background

This geophysical survey of the Lake Hamilton Cemetery was undertaken on July 12, 2019, with the aim of identifying locations that may contain unmarked graves.

This survey was undertaken by Andrew Frost, from Flinders University Archaeology Department.

1.1 Site Description

The site is located on Lot 166 Pine Grove Rd, Kiana. The site contains some 8 grave markers, these are presented as groups of limestone, presumed to have been sourced from local paddocks.

The surface of the site was covered with small plants and debris, with a line of large trees along the boundaries. Small clusters of limestone presumed to be grave markers were also scattered across the site. The surface was raked to remove the larger plant debris before the survey. Pine Grove Rd is adjacent the southern boundary of the cemetery.

The soil of the site is classified within the Dept. of Environment Water and Natural Resources State Land & Soil Mapping Program (Hall et al 2009) as comprising 55% shallow calcareous loam on calcrete and 45% shallow sandy loam on calcrete. The immediate area surrounding the site is characterised by grazing land dominated by limestone outcrops and wetland sedge.

The site survey was carried out in in what proved to be challenging conditions. The nearest weather station (Mount Hope) recorded 90 mm of rain for the month of July, along with winds 30 – 40 km/h on the day of the survey.

1.2 Site history

Local historian Gail Wiseman (2019) records that the first burial in the Lake Hamilton Cemetery was in 1849, with this cemetery in use until 1880, when the Sheringa Cemetery was established. Many children were reportedly buried (n=11) here due to the high child mortality rates of the late 19th century. A memorial is located in the centre of the cemetery with five names inscribed (see Figure 1). There are no indigenous graves known to be within this site.

2 Description of Methods

The geophysical methods used within this site are non-invasive and non-destructive. After processing data captured by Ground Penetrating Radar (GPR), disturbances in the stratigraphy of the soil to the target depth are sought (Conyers 2012). Often within the GPR traces the edges of any possible graves can be seen. Any disturbances in the stratigraphy that conform to a predefined size and shape are classified as 'possible'. As only one method was used in this survey, any breaks in stratigraphy can only be termed as possible. (see section 4).

It should be noted that neither of these methods carry an absolute guarantee of success (Bevan 1990), and that for the geophysical prospection of individual graves there are no clear-cut guidelines (Sarris & Papadopoulos 2012).

2.1 Ground Penetrating Radar (GPR)

Ground Penetrating Radar (GPR) is one of the most favoured methods to map burial sites, as it can map both physical and chemical changes in the ground. The GRP uses electromagnetic radiation found in the microwave band (typically 10 MHz to 2.6 GHz) to send pulses into the subsurface profile, these are reflected off sub-surface discontinuities. The GPR unit comprises of both transmitter and receiver antennae. The returning pulses are measured in elapsed travel time.

3 Data Acquisition

3.1 Survey Design

Three survey grids were setup at this site, with further trace lines run between the trees. Grids one and two were functionally the same with the trace lines in grid two carried out perpendicular to those of grid one. Grid three is located in the roadway adjacent to the southern boundary of the cemetery. This was in response to the recording of two possible graves by Gail Wiseman.

All points within the survey sites were captured with a Trimble TSC2, in conjunction with a Trimble R8 GPS receiver.

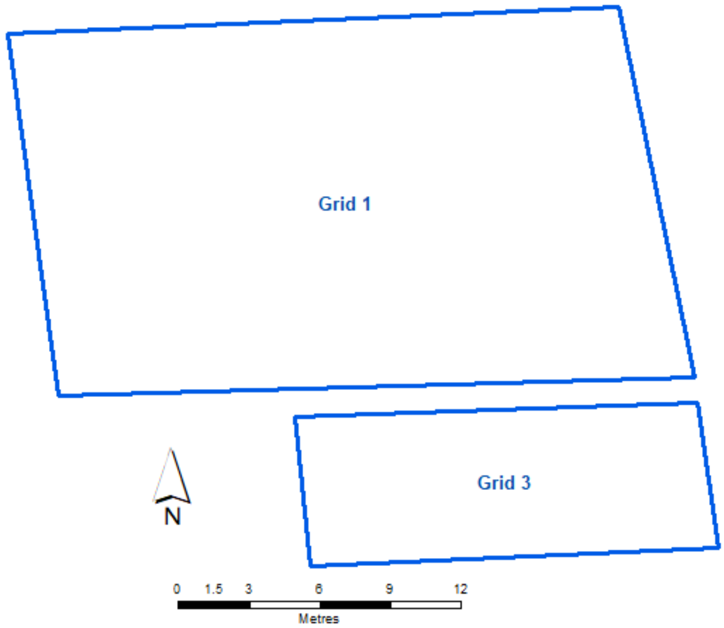

Figure 2: Overview of grids within the Lake Hamilton Cemetery

3.2 Ground Penetrating Radar

GPR scan lines were set at 0.5 m for all grids. Grids 1 & 3 were scanned in a North - South orientation, Grid 2 was orientated east – west. Sample frequency was set at 450 MHz, trace interval was 1cm. As the surface of the site was littered with small plants and debris, and the site contained small clumps of rocks assumed to be existing graves most GPR traces were carried out in challenging circumstances.

3.2.1 GPR Data Process

The ground penetrating radar data was processed using the ReflexW v9.0.5 data processing software. In all 117 radar scan lines were processed. A standard process flow was applied to all traces.

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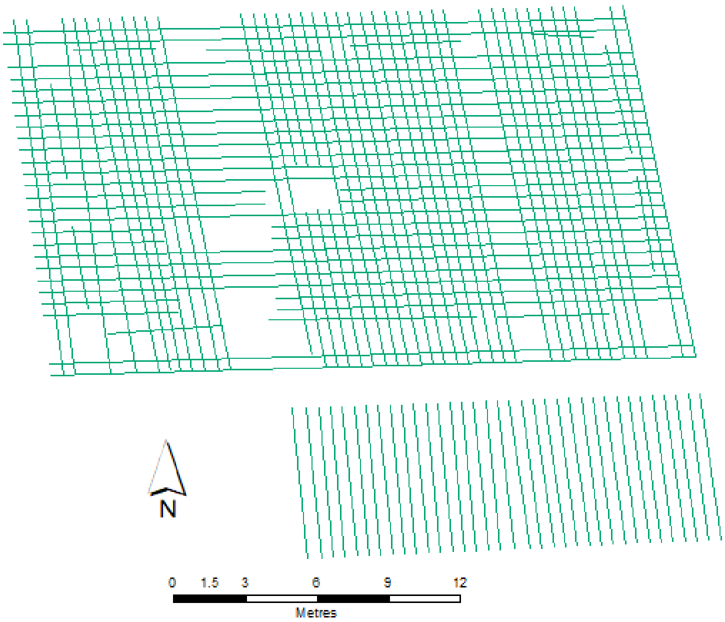

Figure 3: Overview of GPR trace lines.

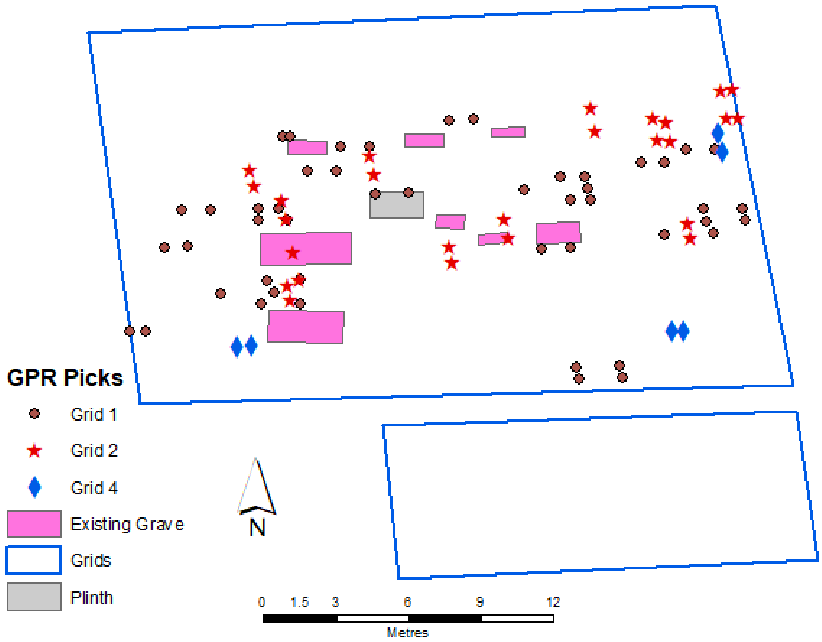

Figure 4: Stratigraphic breaks identified by GPR.

.4 Data Analysis

4.1 Ground Penetrating Radar

117 radar scans were processed. In total 81 breaks in stratigraphy were identified. Once spatially displayed within a GIS these 'picks' were assessed for their spatial relationship to adjacent picks. Picks that conformed spatially to an approximate 1.8 m x 0.7 m rectangle were marked as possible grave sites. No stratigraphic breaks were identified in Grid 3, which was located in Pine Grove Rd.

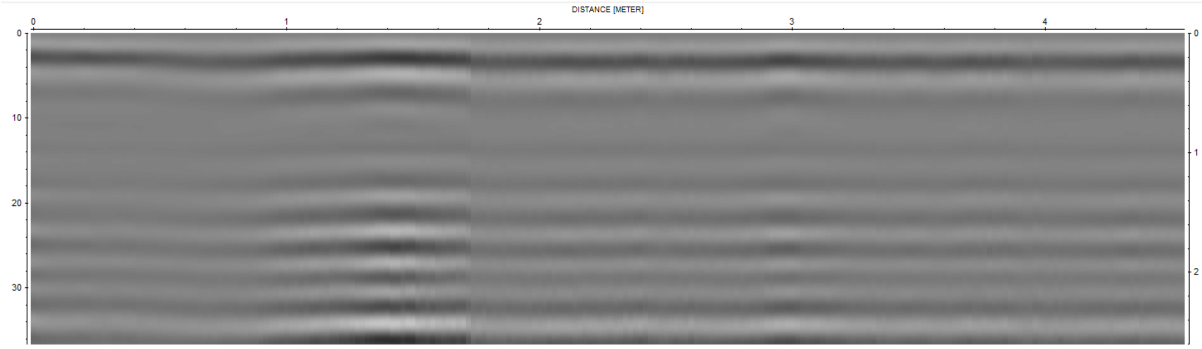

Figure 5: Example of GPR trace from Grid 3. This is indicative of all traces along Pine Grove Rd.

Figure 6: Example of GPR trace with shallow disturbance.

5 Conclusions and recommendations

81 occurrences of stratigraphical breaks were identified by using the GPR. Of these 81 GPR picks 49 were located in grid 1, 26 located in grid 2 and a further 6 were identified in traces between the trees. No stratigraphical breaks were identified in the roadway adjacent the southern boundary of the cemetery. As only one Geophysical method was used, further confirmation was not available

Of these 81 stratigraphic disturbances a total of 9 possible grave sites were identified. Several of the limestone arrangements that are presumed to be existing graves were assessed with no clear results. This is mainly due to the GPR bouncing over the limestone as the signal is disturbed and a clear trace does not result. Moving these rocks on sites that have some doubt as to their validity would allow a more thorough survey to be undertaken. This would not be done unless explicit permissions were given.

Children's graves are hard to identify due to the reduced area of stratigraphic disturbance, but it is interesting that two incidences of quite shallow stratigraphic breaks were identified and are presumed to be graves of children. Further investigation and methodology refinement is required to further this knowledge.

It is suggested that if possible, additional methods are employed to further confirm the location of any possible stratigraphic breaks. Methods such as Electrical Resistivity Tomography (ERT) or Earth Resistance can provide further evidence. This survey was carried out after a prolonged wet period, so further survey would be of interest in different conditions, to compare the effects that soil moisture have in the methods employed.

It is also suggested that if more precise methodologies are developed in the coming years, these methods could be employed to reassess the findings of this report.

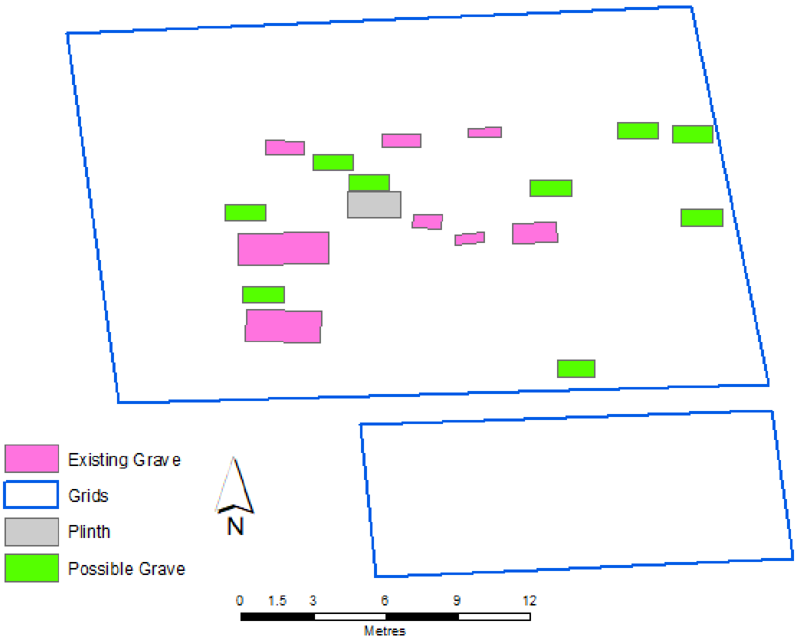

Figure 7: Possible burial sites within the survey grids.

References

Bevan, B.W. 1991, 'The search for graves', *Geophysics*, vol. 56, no. 9, pp. 1310 – 1319.

Conyers, L.B 2016, *Interpreting Ground – Penetrating Radar for Archaeology*, Routledge.

Hall, JAS, Maschmedt, DJ and Billing, NB 2009, The soils of Southern South Australia. The South Australian Land and Soil Book Series. *Bulletin*, vol. 56

Reynolds, J 2011, *An Introduction to Applied and Environmental Geophysics*, 2nd. ed., Wiley-Blackwell, Oxford.

Sarris, A. and Papadopoulos, N. 2012, 'Looking for graves: Geophysical prospection of cemeteries'. *Proceedings of the 17th International Conference on Cultural Heritage and New Technologies.*

Wiseman, G 2019, Lake Hamilton Cemetery, unpublished history.