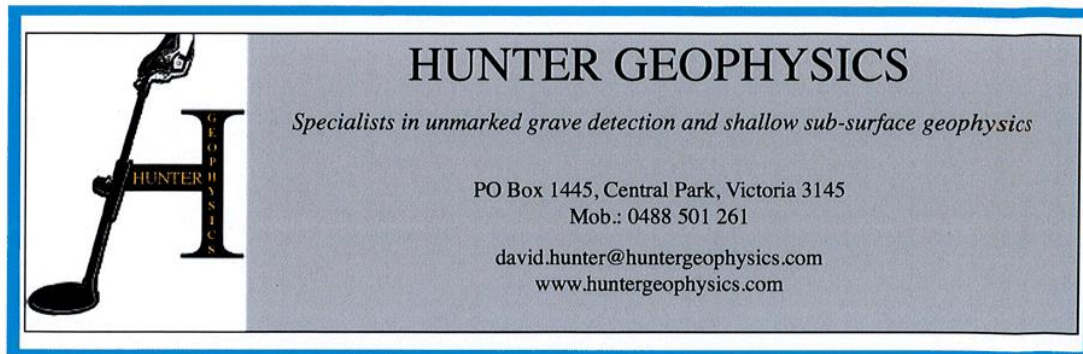


APPENDIX 2



GEOPHYSICAL SURVEY REPORT

| | |
|---|------------------------------|
| SITE NAME | Melton Cemetery |
| HUNTER GEOPHYSICS SITE CODE | 2020-21 |
| CLIENT | Melton City Council |
| SURVEYORS | David Hunter, Shannon Hunter |
| SURVEY DATES | 4th - 8th June 2020 |
| REPORT SUBMISSION DATE | 17th June, 2020 |
| REPORT AUTHOR | David Hunter |
| HERITAGE VICTORIA ARCHAEOLOGY REPORT NUMBER | N/A |



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Statement of indemnity

The results and interpretation of the geophysical surveys described herein should not be considered an absolute representation of the underlying soil or archaeological features, but instead as a hypothesis yet to be verified. Confirmation of geophysical interpretations is only possible through careful (preferably archaeological) excavation. Every effort is made to ensure that these risks are minimized, but Hunter Geophysics does not guarantee that the interpretations of geophysical data provided herein are accurate.

While Hunter Geophysics aims to produce accurate interpretations of geophysical surveys, numerous unforeseeable issues may arise that may limit the accuracy of interpretations. These may include unforeseen soil or geological conditions, the presence of rabbit or other animal burrowing, the presence of tree/plant root systems, ploughing, site drainage and interference caused by variations in the Earth's magnetosphere and ionosphere, or interference caused by nearby radio transmitters or solar weather.

Of particular importance is the similar appearance of tree roots and rabbit burrowing with unmarked graves. These factors may have influenced the geophysical data described in this report.

Other areas of unknown soil disturbance may be noted in the report. These areas generally do not exhibit the same characteristics as unmarked graves; however, it is possible that these areas actually contain multiple burials, at different depths and on different alignments, which may obscure individual graves. Therefore, these areas should also be treated as if they are unmarked graves.

Important notice: the precision of the location of detected features within all survey areas is within 0.2 metres.

This survey was specifically designed for the detection of unmarked graves. The location or nature of any other detected buried feature, especially buried utilities, cannot be guaranteed. The client is advised to employ a buried utility/pipe/cable locator should they require the precise mapping of buried utilities (especially prior to any excavation the client may undertake).

Front cover image: photograph taken by the author overlooking part of the surveyed area at the Melton Cemetery.



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Executive summary

An intensive geophysical survey was undertaken by Hunter Geophysics at the Melton Cemetery for the purposes of locating unmarked graves. The geophysical investigation has determined the location of numerous unmarked graves.

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Introduction

Hunter Geophysics was commissioned by the Melton City Council to undertake a geophysical survey covering specific areas at the Melton Cemetery, Centenary Avenue, Melton, Victoria.

Aims

The geophysical survey was requested to determine the location of any unmarked graves within specified survey areas at the Melton Cemetery.

Geography and topography

The Melton Cemetery is bounded by Centenary Avenue, Oneills Road, Cadross Avenue, and Arawata Parade, in the town of Melton, Victoria (approximately 35km northwest of Melbourne and 64km southeast of Ballarat). The cemetery is on a flat plane; topographic corrections of geophysical data were not required.

Site geology

Please refer to the geological map on page 5. The site is situated on the Quarternary Newer Volcanics basalt typical of western Victoria. The local soil contains clay, but drainage appeared to be good.



Figure 1: an aerial photograph (courtesy of Google, Inc.) showing the Melton Cemetery, Centenary Avenue, Melton, Victoria.

Site weather conditions

The geophysical survey was conducted on the 5th June 2020 to the 8th June 2020. The Bureau of Meteorology records the following weather data at Melbourne Airport, considered indicative of weather at the cemetery:

| Date | Minimum temperature (°C) | Maximum temperature (°C) | Rainfall (mm) |
|---------------|--------------------------|--------------------------|---------------|
| 3rd June 2020 | 8.8 | 13.7 | 0.0 |
| 4th June 2020 | 7.3 | 13.8 | 0.0 |
| 5th June 2020 | 2.0 | 14.1 | 0.2 |
| 6th June 2020 | 4.6 | 13.9 | 0.0 |
| 7th June 2020 | 7.1 | 11.1 | 0.2 |
| 8th June 2020 | 1.9 | 12.4 | 0.2 |

Weather has not negatively affected the viability of the employed geophysical methods at this site.

Geophysical data from discrete survey areas were processed and interpreted individually rather than as a whole in order to prevent any degradation (e.g. mosaic noise) in data.

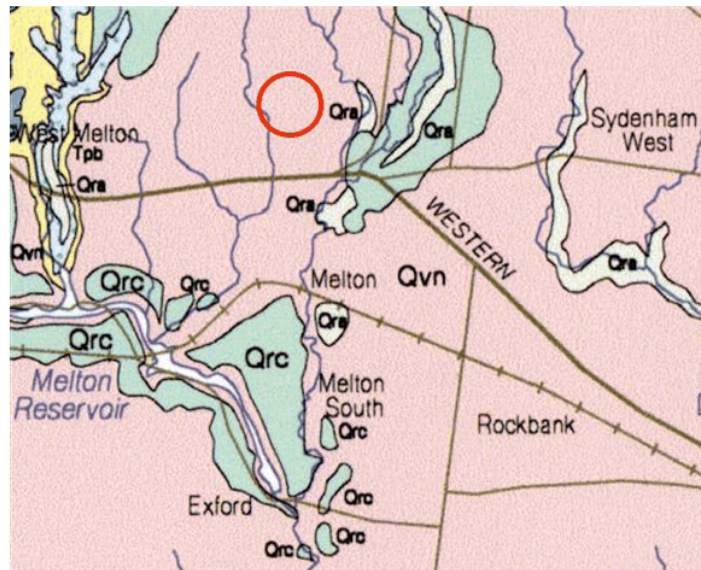


Figure 2: geological map with the approximate location of the site marked with a red marker.

Geological map © State of Victoria, Department of Natural Resources and Environment 1997 and Department of Environment and Primary Industries 2016. Reproduced with permission.

DEPI disclaimer: the advice provided in this publication is intended as a source of information only. Always read the label before using any of the products mentioned. The State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.

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Methodology

Data collection

Hunter Geophysics specified the areas to be covered by the geophysical survey (as seen in figure 5). Additional areas were also covered by the geophysical survey; please refer to figure 6 for a map of all areas covered by the geophysical survey.

Ground-penetrating radar (GPR) data were collected by Hunter Geophysics using a Sensors and Software Noggin Utility SmartCart system and a Noggin antenna with a central transmitting frequency of 250MHz. Survey areas were staked-out using a Leica GS-18T GNSS receiver; a Leica TS-16 robotic total station was used to collect geographic data pertaining to every fourth ground-penetrating radar trace (i.e. latitude, longitude and elevation values were collected for every fourth geophysical measurement) where sufficient line-of-sight was possible.

All survey traverses were staked-out using brick-layers string to ensure complete survey grid coverage. Traverses were spaced at 25cm intervals, with each GPR trace being recorded at 5cm intervals along each traverse. Each GPR trace was recorded with a time-window of 132.4 nanoseconds.

Data were collected automatically by a computer using an odometer wheel calibrated at the beginning of the survey. In this manner, GPR traces are recorded autonomously as the surveyor pushes the GPR system along the traverse. The data were stored in an internal data logger and downloaded to a field computer via the system's memory card.



Figure 3: a map of the Melton Cemetery.



Figure 4: a map of the Melton Cemetery, focused on the southeast corner of the cemetery.

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Figure 5: site map showing the location of all areas to be covered by the geophysical survey (in green).

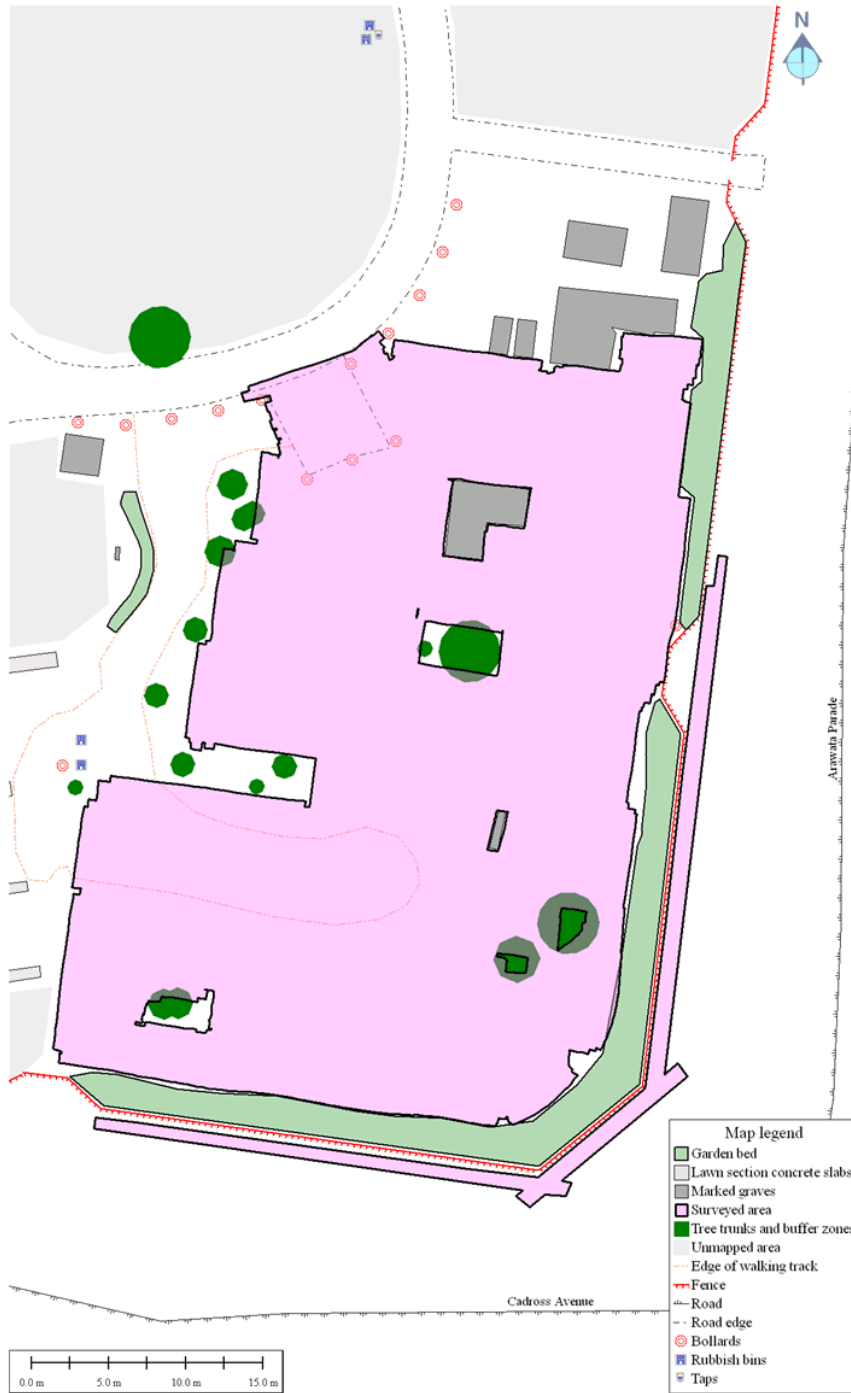


Figure 6: site map showing the location of all areas actually covered by the geophysical survey (in pink).

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Data processing

The ground-penetrating radar data were downloaded onto a computer and were arranged into separate folders based on the survey grid number.

Please refer to figure 6 on the previous page, or to the GIS data on the accompanying USB memory stick (refer to page 14), for a map showing where each survey grid was located.

The data were processed in the Geophysical Archaeometry Laboratory's GPR-SLICE software. Data processing routines were applied to the raw data in order to remove noise and enhance clarity. Topographic corrections were then applied to the processed radargrams, which were then sliced horizontally and plotted into XYZ tables.

Image maps ("depth slices") were created from the tables and were used to create a three-dimensional volume of the data, which was then interpreted, using the radargrams, depth slices, and X- and Y-slices as an aid. Interpretations were drawn onto the three-dimensional data volume in GPR-SLICE and then exported to DXF files, which were then imported into Global Mapper GIS software for inclusion in the site map.

Reporting, mapping and archiving

The geophysical survey and report follow the recommendations outlined in the English Heritage Guidelines (David 1995) and IFA Paper No. 6 (Gaffney et al. 2002) as a minimum standard. Mapping was performed using a Leica GS-16 real-time kinematic global navigation satellite system (RTK GNSS), and/or a Leica TS-16 robotic total station, providing a precision of less than one centimetre in the horizontal plane, and less than two centimetres in the vertical plane. This is of a higher precision than that required by the English Heritage Guidelines and Aboriginal Affairs Victoria requirements (both of which require a half-metre precision as a minimum).

Geophysical data, figures and text are archived in-house following the recommendations of the Archaeology Data Service (Schmidt 2001). All data, figures and text are also provided to the client and are submitted to Heritage Victoria for archival.

Results

Ground-penetrating Radar survey

The ground-penetrating radar survey revealed the location of unmarked graves within the survey areas. A total of 112 unmarked graves have been located, and four areas of unknown soil disturbance. Please note that these interpretations are subject to a level of uncertainty as explained on page 2.

Please refer to the maps on the following pages, which show the location of all detected unmarked graves (in black) and unknown soil disturbances (in red). An accompanying memory stick contains digital maps and GIS mapping data. Please refer to page 14 for details.

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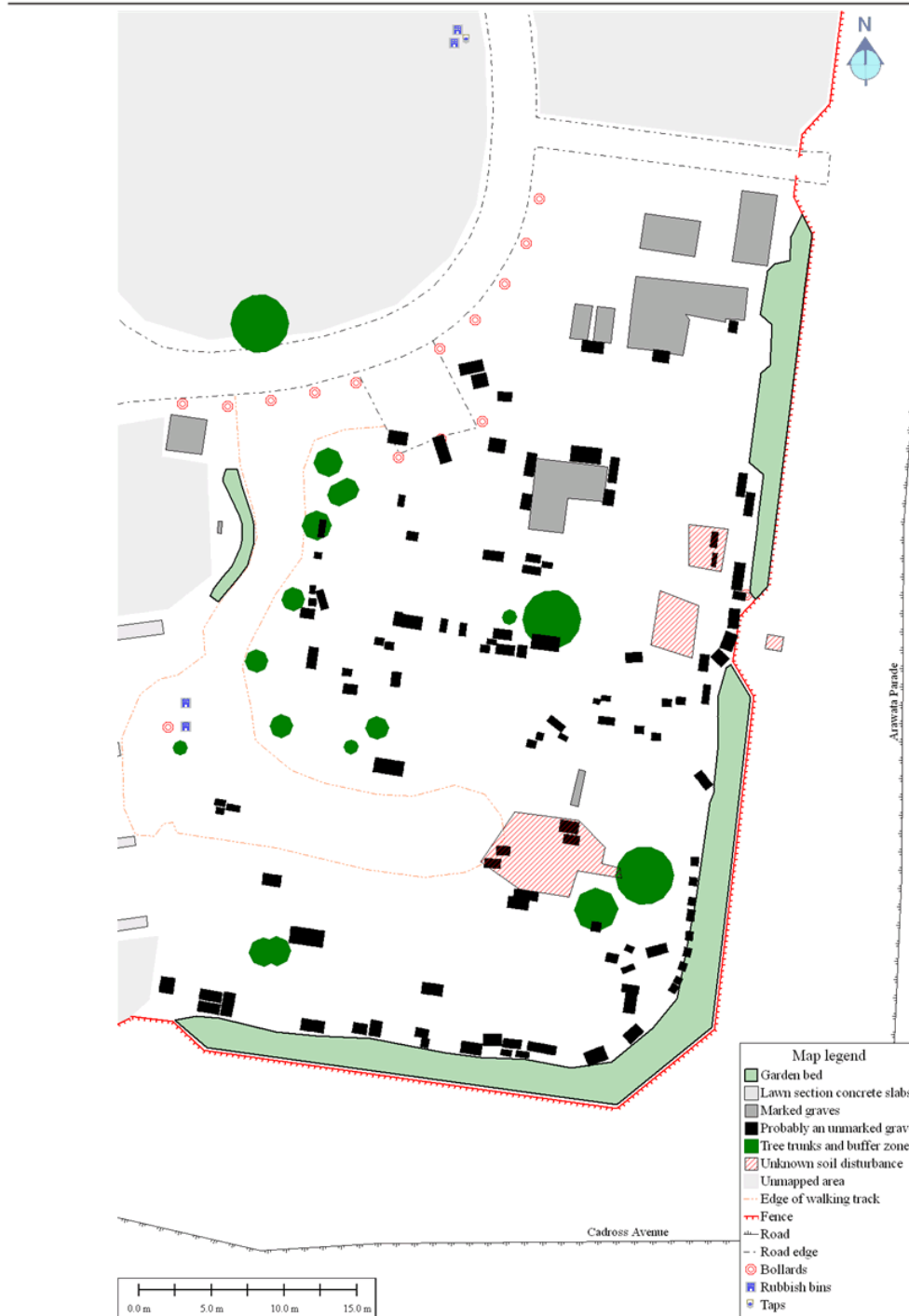


Figure 7: map showing all unmarked graves detected within the search areas in the Melton Cemetery.

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Figure 8: detailed map showing the location of unmarked graves to the west of the surveyed areas.

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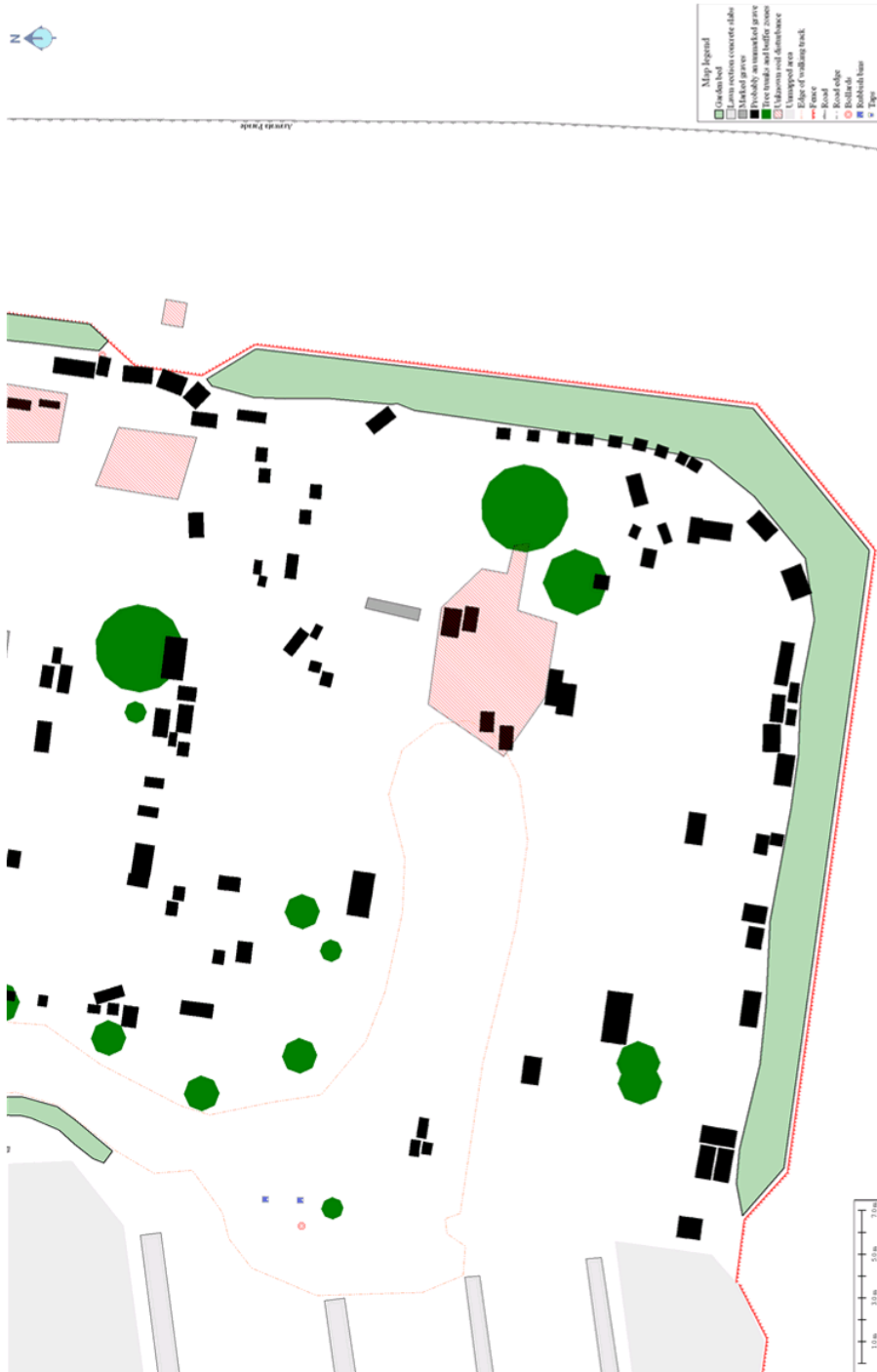


Figure 9: detailed map showing the location of unmarked graves to the east of the surveyed areas.

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Acknowledgments

| | |
|-------------------|--------------------------------|
| Fieldwork: | David Hunter Shannon Hunter |
| Report: | David Hunter |

Conclusion

Satisfaction of objectives

The geophysical survey undertaken for this project has successfully located suspected unmarked graves present within the areas searched at the Melton Cemetery (as defined in figure 6 on page 9).

Summary of results

The survey has located 112 areas of disturbed soil most likely to be associated with unmarked grave shafts and funerary urn burials.

Dissemination

This report was submitted to the Melton City Council in June 2020.

Recommendations

Hunter Geophysics recommends expanding the search for unmarked graves in the northwest corner of the cemetery, near the toilet building, where unmarked graves are also suspected.

What's on the USB

A Universal Serial Bus v3 (USB) memory stick is included with this report. The following files may be found on the memory stick in digital form:

All figures included in this report.

The report itself in Adobe InDesign v8 format and also in Adobe Portable Document Format (PDF).

Site map file (with a .gmp file extension) for use with Global Mapper v19 or later.

All geophysical datasets in their own proprietary digital formats.

N.B.: A demonstration version of Global Mapper - which allows viewing of site map .gmp files - is available from the Blue Marble Geographics website at <http://www.bluemarblegeo.com/products/global-mapper-download.php>.

Should GIS data be required in other formats, please contact Hunter Geophysics directly.



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