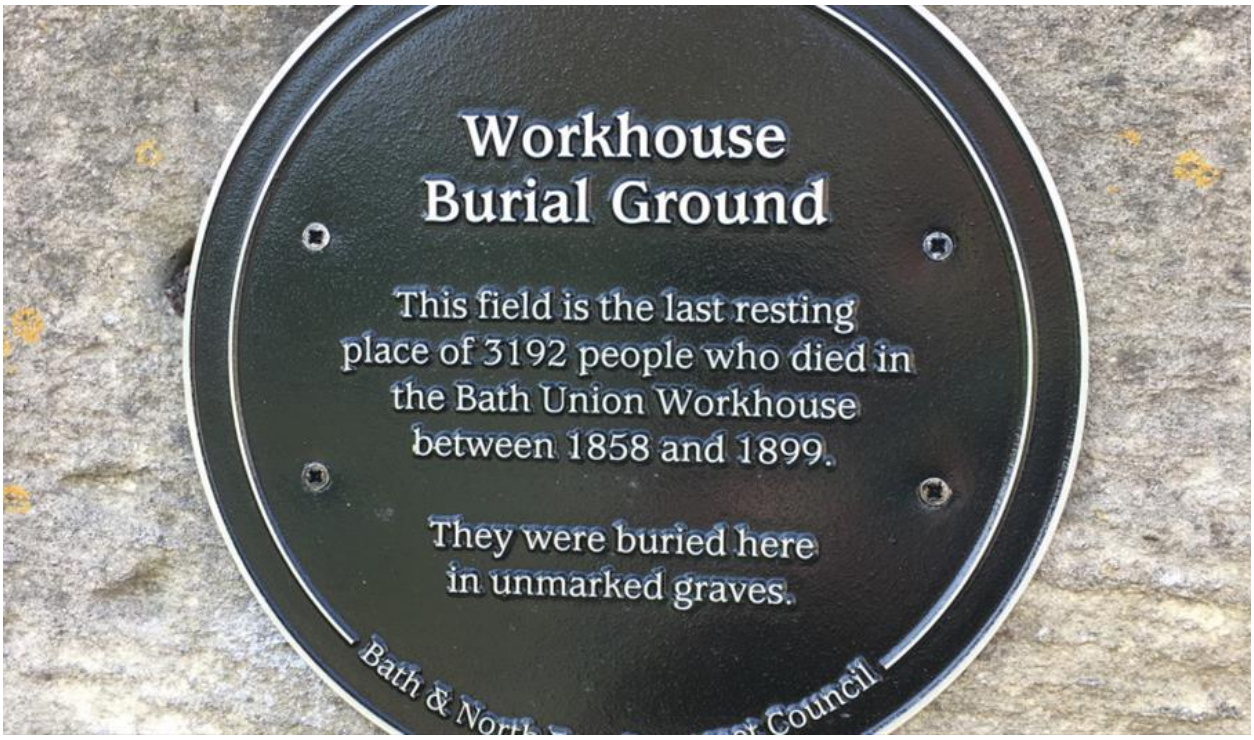
BATH AND COUNTIES ARCHAEOLOGICAL SOCIETY



Bath Workhouse Burial Ground Geophysical Survey 2022

John Richards and John Oswin

Abstract

BACAS was invited by friends of Bath Workhouse Burial Ground and Bathscape to carry out a survey of a green field next to the Wellsway, Odd Down, Bath. This land is where 3,192 bodies were buried between 1858 and 1899 in unmarked graves. They were inmates from the Bath Union Workhouse on Frome Road.

The survey was carried out in November 2022. We hoped to identify if there were any signs of burial plots or pits. Although we did not identify the outlines of any pit, we were able to show there were cuts into the bedrock consistent with the use of pits. We were also able to confirm the arrangement of formal paths and the original boundary of the burial ground.

An area of 80m by 60m was surveyed, from just north of the current footpath, to within five metres of the southern wall. It is known that the topsoil was shallow, descending on to Bath stone strata. The original site was contained by stone walls, of which the southern and western survive. Footpaths also crossed it. There was one marked formal grave, that of the chaplain, the Reverend John Scott (d.1865), probably placed at the intersection of the paths.

Magnetic survey was compromised by large patches of ferrous interference, suggesting that burials were in nailed wooden coffins.

Twin-probe resistance survey revealed areas of high and low resistance near the surface, with the ground all over heavily disturbed with small patches of disturbance. Resistivity pseudo sections across a number of these features revealed vertical cuts through the stone to depths greater than two metres, and also a lot of near-surface disturbances, which could be over pits or over stone.

The vertical cuts could occupy several metres. It is inferred that the dead were buried mainly communally in large pits cut deep through the stone but there may also be a number of very shallow burials resting on stone which was only 0.5 metres down.

Bath Workhouse Burial Ground, Geophysical Survey 2022

John Richards and John Oswin

Bath and Counties Archaeological Society © 2023

Contents

1. Introduction 1
   1.1 Location 1
   1.2 Dates 3
   1.3 Personnel 3
   1.4 Background to the survey 3
2. Historical Background 4
   2.1 The Bath Workhouse and Pauper Burials 5
   2.2 Site Description 6
3. Archaeological Method 13
   3.1 Gridding 13
   3.2 Magnetometry 13
   3.3 Twin-probe resistance 14
   3.4 Resistivity profiling 15
   3.5 Earthwork survey 17
   3.6 Processing 18
4. Results 19
   4.1 Magnetometry 19
   4.2 Twin-Probe Resistance 20
   4.3 Resistivity Profiling 21
      4.3.1 West-East profiles 21
      4.3.2 South-North profiles 23
      4.3.3 Diagonal Profile 26
5. Discussion 27
6. Comment and conclusions 29
7. Bibliography 30

Appendix A: Details of gridding 31
   A1 Gridding 31
   A2 Magnetometry 32
   A3 Twin-probe resistance 32
   A4 Resistivity profiles 34

Appendix B: Poor data collection in Profile q4 35

List of Figures

Figure 1-1: General location 1
Figure 1-2: OS maps of the locality, with site indicated. 1 km sided squares. © Crown Copyright. 2
Figure 2-1: the information board (photo: ODCA) 4
Figure 2-2: OS 25" to 1 mile, 1886 6
Figure 2-3: The gateway to the Burial Ground. This would have been the main entrance from Wellsway, opposite the present Oolite Road, leading straight into the central path. The gateposts are marked by their square tops. Photograph: Alistair Durie (Chislett, 2007) 7
Figure 2-4: OS 25" to 1 mile, 1904 8
Figure 2-5: OS 25" to 1 mile, 1932 9
Figure 2-6: the location of the paths intersection and the probable location of the Scott memorial stone 10
Figure 2-7: Aerial photo, 1946. RAF_3G_TUD_UK_25_V_5106 11
Figure 3-1: Magnetometer survey 13
Figure 3-2: Frobisher TAR3 resistance meter and frame used for twin-probe resistance survey 14
Figure 3-3: Comparison plots of south-north traverse (left) and east-west traverse (right) showing how the form of the ground features was retained. 15
Figure 3-4: Resistivity profiling 16
Figure 3-5: The profiles overlaid on the resistance plot and numbered. Note that profile q4 has been omitted as the data were poor. 16
Figure 4-1: Magnetometry plot 19
Figure 4-2: Twin-Probe resistance plot 20
Figure 4-3: West-East profile q12. Top: 20 Ωm scale; bottom: 40 Ωm scale 21
Figure 4-4: West-East profile q3. Top: 20 Ωm scale; bottom: 40 Ωm scale 22
Figure 4-5: South-North profile q5. Above: 10 Ωm scale; below: 40 Ωm scale 23
Figure 4-6: Profile q6. Top: 10 Ωm scale; bottom: 40 Ωm scale 24
Figure 4-7: Profile q6910, concatenated profiles 6, 9 and 10. Top: 10 Ωm scale; bottom: 40 Ωm scale 24
Figure 4-8: Profile q7. Top: 10 Ωm scale; bottom: 40 Ωm scale 25
Figure 4-9: Diagonal profile q8, through the formal grave of Revd Scott. Top: 20 Ωm scale; bottom: 40 Ωm scale 26
Figure 5-1: Hill-shaded image generated from LiDAR data: azimuth 315°, altitude 25°, Z-factor 10 28
Figure A-1: Setting up the grid 31
Figure A-2: Magnetometry. Grid pattern walked. Top of plot is next to footpath. 32
Figure A-3: Twin-probe resistance grid patter walked. Footpath is just beyond top. 33
Figure A-4: Starting points of grid 10 and grid 21 indicated by arrow position, with arrow direction showing direction of first line. 33
Figure B-1: Profile q4, showing in the top plot the poor data points, followed by the software replacement of those poor points, and then the resulting resistivity profile. 35

Preface

BACAS was invited by the Friends of Bath Workhouse Burial Ground and Bathscape to carry out a survey of a green field next to the Wellsway, Odd Down, Bath. This land is where 3,192 bodies were buried between 1858 and 1899 in unmarked graves. They were inmates from the Bath Union Workhouse on Frome Road.

Historian and poet Dr John Payne held an exhibition in 2017 about the Workhouse at the Museum of Bath at Work. Since then, the Friends have researched the history and identified the names of those buried there. There is now a plaque and an information board so that visitors can read what happened there.

The Bathscape Scheme was launched in October 2018 to promote better management and use of the Bathscape, the beautiful natural landscape surrounding the historic city of Bath. It aims to restore and enhance the Bathscape, to make it more accessible and help ensure it is appreciated and actively enjoyed by more people in Bath, both residents and visitors alike.

Thanks to the vital support of the National Lottery Heritage Fund, The World Heritage Enhancement Fund, Network Rail, Bath & North East Somerset Council and partner organisations, the Bathscape Scheme has received funding of £2.2 million to cover its many different activities.

Acknowledgements

BACAS would like to thank the Bath and North East Somerset Council Parks Department for their permission to carry out a geophysical archaeological survey on the burial ground.

We wish to thank and acknowledge the Bath Workhouse Burial Ground Project, the Odd Down Community Association, and the Walking the Names Project, including John Payne, Aileen Thompson, Elizabeth May Vincent, and Richard White of Bath Spa University.

Thanks also to the Bathscape Project (supported by the National Lottery Heritage Fund), and Dan Merrett and Lucy Bartlett, for their support and for the provision of new equipment.

Thanks are also due to National Monuments Record (NMR) for aerial photographs, Google Earth, Ordnance Survey for use of their maps (Licence Number 100060399), National Library of Scotland for older Ordnance Survey maps.

Special and grateful thanks are due to members of BACAS who undertook the survey who include the following: -

Chris Higgs, John Knapper, Elpitha Lemos, Liz Paul, Sharn Pepperell, Les Phillips, Andrew Plumbly, Janet Pryke, Claire Radnedge, Wendy Russ, Nancy Sampson, Louise Williamson.

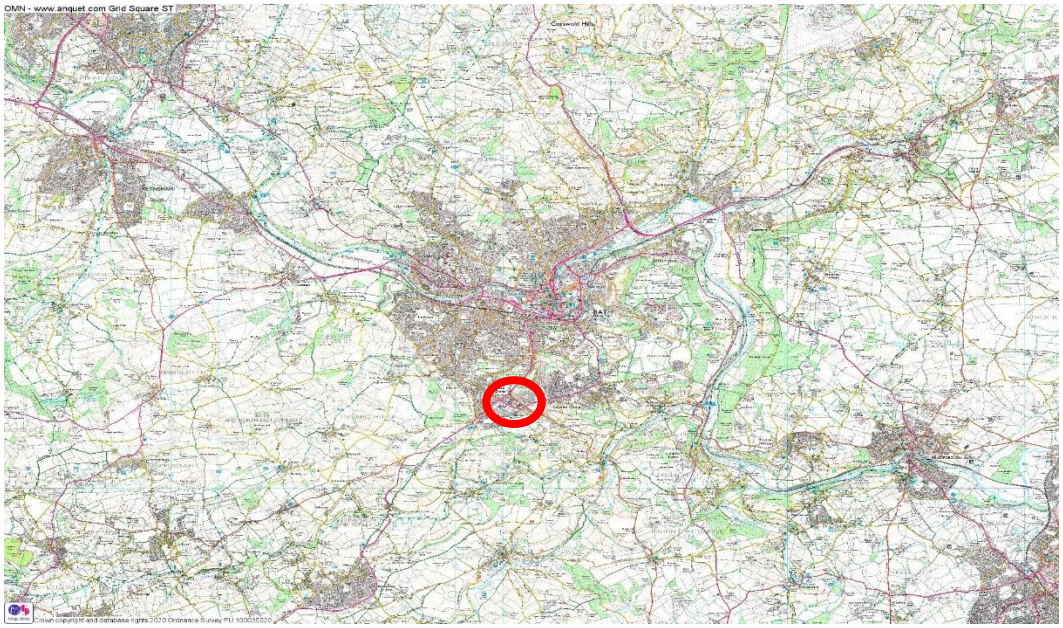
1. Introduction

1.1 Location

There is a burial ground (ST 738 621) on the Wellsway, Odd Down, Bath, where 3,192 bodies were buried between 1858 and 1899 in unmarked graves. These were inmates from the Bath Union Workhouse on Frome Road. In 1855 the Board of Guardians purchased the field because the cemetery adjoining their chapel was full. Pauper labour was used to clear stone from the field and these stones were used to build the wall that is still there today.

The Workhouse Burial Ground is now open space in the care of the Parks Department at Bath and North East Somerset Council. It is still consecrated ground. The names of the dead are in the list of burials carefully preserved and transcribed in the Bath Record Office in the vaults of the Bath Guildhall.

Figure 1-1: General location



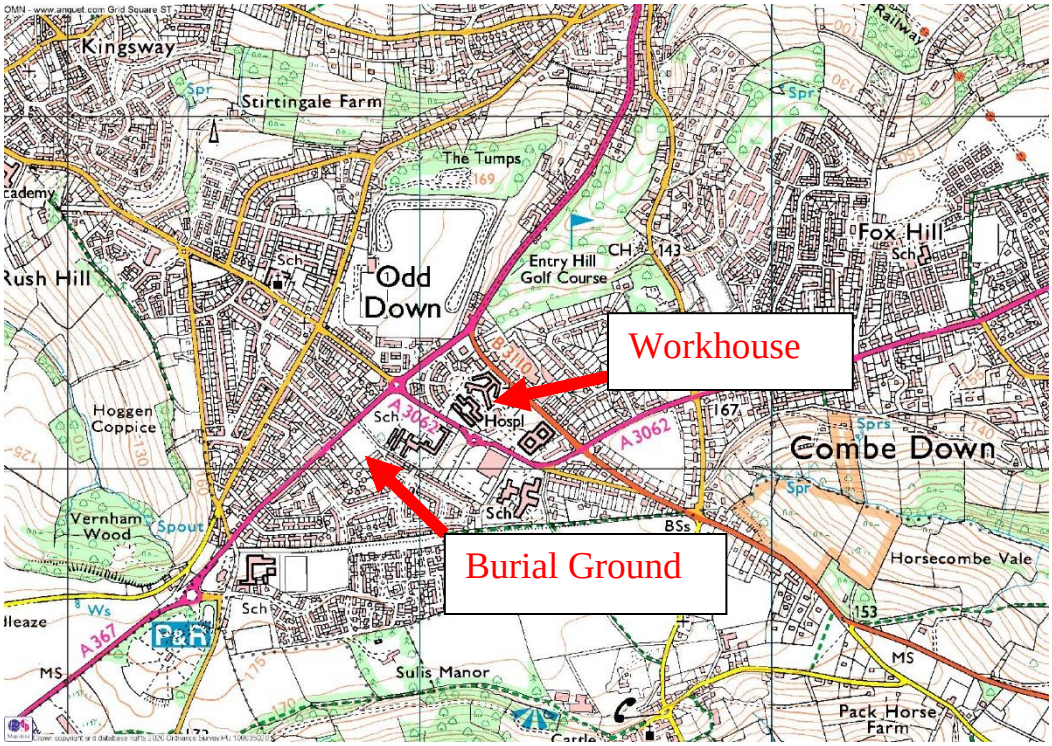


Figure 1-2: OS maps of the locality, with site indicated. 1 km sided squares. © Crown Copyright.

1.2 Dates

The survey was set for six days: Tuesday, Wednesday and Thursday 14th, 15th and 16th November; and Tuesday, Wednesday and Thursday 21st, 22nd and 23rd of November 2022.

The first day was written off because of bad weather, as was the final Thursday afternoon, leaving 4 ½ days total working time. This proved sufficient to carry out surveys using magnetometer, twin-probe resistance and resistivity profiling (also known as electrical resistivity tomography, ERT) and also attempt an earthwork survey.

1.3 Personnel

The project was led by John Richards, with technical oversight by John Oswin and logistic support by Janet Pryke, all members of BACAS. The following BACAS members assisted in the work: Chris Higgs, John Knapper, Elpitha Lemos, Liz Paul, Sharn Pepperell, Les Phillips, Andrew Plumbly, Janet Pryke, Claire Radnedge, Wendy Russ, Nancy Sampson, Louise Williamson. Members of the Odd Down Community Association also offered support.

1.4 Background to the survey

The survey was carried out in association with the Bath Workhouse Burial Ground Project and the Bathscape Project (supported by the National Lottery Heritage Fund). We hoped to identify if there were any signs of burial plots or pits. The dates allocated were Tuesdays - Thursdays, November 15-17 and 22-24, 2022.

2. Historical Background

The Bath Union Workhouse Burial Ground lies just by the Wellsway, Odd Down.

Most passers-by do not realise that the field is a burial ground. There are over 3100 bodies lying in unmarked graves, the last remains of those who died of poverty in the Bath workhouse between 1858 and 1899. The only memorials are a metal plaque (see front cover) and a newly-erected information board (Figure 2-1), funded by the Odd Down Community Association and the Bathscape Project.

Figure 2-1: the information board (photo: ODCA)

The New Poor Law of 1834 was intended to cut the cost of poor relief and address what were seen as abuses of the old system, including the giving of ‘out-door’ relief to the able-bodied. The new system stipulated relief would only be given in workhouses, and the conditions would be such to deter any but the truly destitute from entering.

“Into such a house none will enter voluntarily; work, confinement, and discipline, will deter the indolent and vicious; and nothing but extreme necessity will induce any to accept the comfort which must be obtained by the surrender of their free agency, and the sacrifice of their accustomed habits and gratifications." (Senior and Chadwick, 1834)

Parishes were grouped into Poor Law Unions, and there was an upsurge in the construction of workhouses in the next few years.

2.1 The Bath Workhouse and Pauper Burials

Opened in 1838, the Bath Workhouse was located between the Midford Road and Frome Road. Surviving buildings include the original hexagon shaped block, the chapel, the infirmary, the mental health block and the bakery. The burial ground was used from 1858-1899.

The Bath Workhouse Chapel and Burial Ground

Before 1847 the bodies of those who died in the workhouse were returned to the parish where they had lived. Once the chapel had been built, burials took place in unmarked graves on the land next to the chapel. 1107 bodies are buried there.

In 1855 the Board of Guardians purchased a further field on the other side of Frome Road, adjoining Wells Road. Pauper labour was used to clear stone from the field. These stones were used to build the wall that is still there today. The new burial ground was opened in 1858 and 3182 bodies were buried there between 1858 and 1899 in unmarked graves. There was a tunnel under Frome Road through which coffins were carried.

The Workhouse Burial Ground is now open space in the care of the Parks Department at Bath and North East Somerset Council. It is still consecrated ground.

Extracts from Workhouse to Hospital: A brief account of the Odd Down site of Bath Workhouse*, by John Payne. The publication is for sale at Oldfield Park bookshop and all money from sales goes to the memorial fund administered by Odd Down Community Association.*

When someone died in a workhouse there were three possible outcomes for the body (Higginbotham, 2012: 76-77). First, any known next-of-kin were contacted so that they could, if they wished, organise a funeral themselves. Often this opportunity had to be declined owing to lack of funds. The 1832 Anatomy Act permitted a workhouse to sell an unclaimed body for medical research, though it is not known if, or how often, the Bath Workhouse availed itself of this option. The remaining outcome was for the body to be placed in a shroud and a cheap coffin and buried in an unmarked grave with a very simple ceremony; sometimes several coffins being interred on the same occasion. Initially, the Poor Law Commissioners decreed that such burials should be carried out as cheaply as possible, without even a bell being tolled. But public anger at this stance meant that the aim was changed to make pauper burials equivalent to those of the lowest classes outside the workhouse.

Pauper burials were intended to degrade and to strip away any form of identity and prevent any expression of remembrance. People feared a pauper burial and craved a respectful one. The bereaved were denied the possibility of laying out the dead, viewing the corpse, and taking part in a funeral procession. Some relatives, who were unable to afford a funeral at the time, raised the money and then petitioned for an exhumation from the pauper grave in order to conduct a ‘proper’ burial (Strange, 2003; Hurren & King, 2005).

2.2 Site Description

The Workhouse Burial Ground is rectangular with its long axis pointing roughly north west to south east. The north west boundary is a stone wall alongside the Wellsway. The south west boundary is a wall made of similar stone that has recently been extensively repaired to the rear of houses on Oolite Grove. The south east boundary consists of a modern metal fence bordering the back gardens of houses on Lympsham Green. The north east boundary is a modern metal fence bordering school playing fields. Parallel to this boundary is a path connecting the Wellsway to Lympsham Green.

Figure 2-2: OS 25" to 1 mile, 1886

An early map showing the burial ground is the 1886 OS 25 inches to 1 mile map (Figure 2-2). There are two houses close to the west corner that are still there. The area that is now the school playing fields used to be considerably less pleasant, being shown as containing ‘sewage hydrants’, and so evidently some kind of sewage treatment plant. The burial ground is shown with a few trees, with paths on three sides and a cross-shaped pair of paths, the longest bisecting the area and reaching the Wellsway boundary at a point where there used to be an entrance in the wall with a width of 2.5 metres. The lines where the entrance was filled in are still evident (see Figure 2-3). The shorter of the pair of paths crosses the longer one about three quarters of the distance from the Wellsway. Where it reaches the north east boundary, it aligns with a path that

runs across the sewage area and reaches a tunnel under the Frome Road that leads to the workhouse. This was the route that was used to transport the dead to the burial ground and there would have been an entrance on this side. The purpose of the entrance on the Wellsway is unclear, though it may be that the direct route from the workhouse was inappropriate for some visitors.

Figure 2-3: The gateway to the Burial Ground. This would have been the main entrance from Wellsway, opposite the present Oolite Road, leading straight into the central path. The gateposts are marked by their square tops. Photograph: Alistair Durie (Chislett, 2007)

We were able to confirm the path layout as shown on the old maps in the resistivity survey: a cross shape of paths intersecting at the 'monument', with a path running round the outside. It should be noted that the burial ground was smaller than it appears today. It was about 92 metres by 65 metres originally, and it is now 92 metres by 73 metres. An 8 metre strip of land has been added at some time on the north east side (the school side) where today's path runs. It also means that the metal fence on the south east side marks the original boundary (we did wonder if some land had been lost when the houses were built there - it seems not).

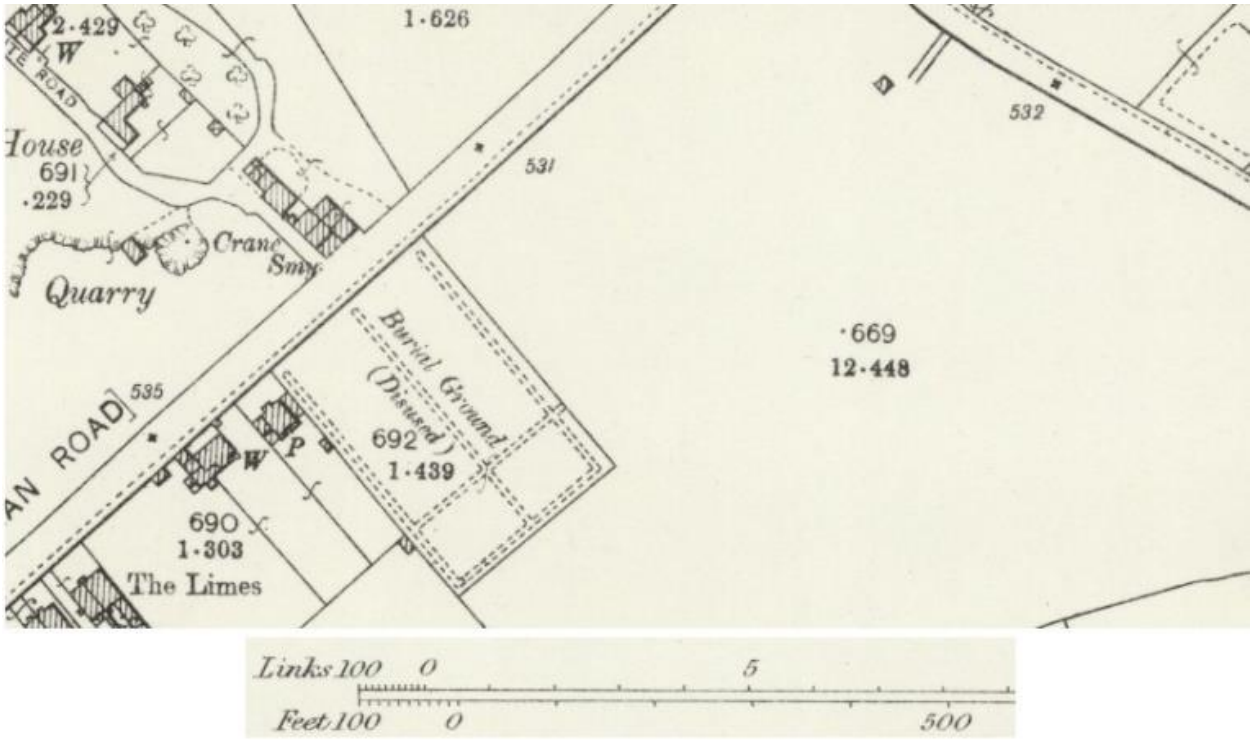


Figure 2-4: OS 25" to 1 mile, 1904

The 1904 map (Figure 2-4) does not add anything, apart from labelling the Burial Ground as disused. The path to the workhouse is no longer shown, but the tunnel still exists.

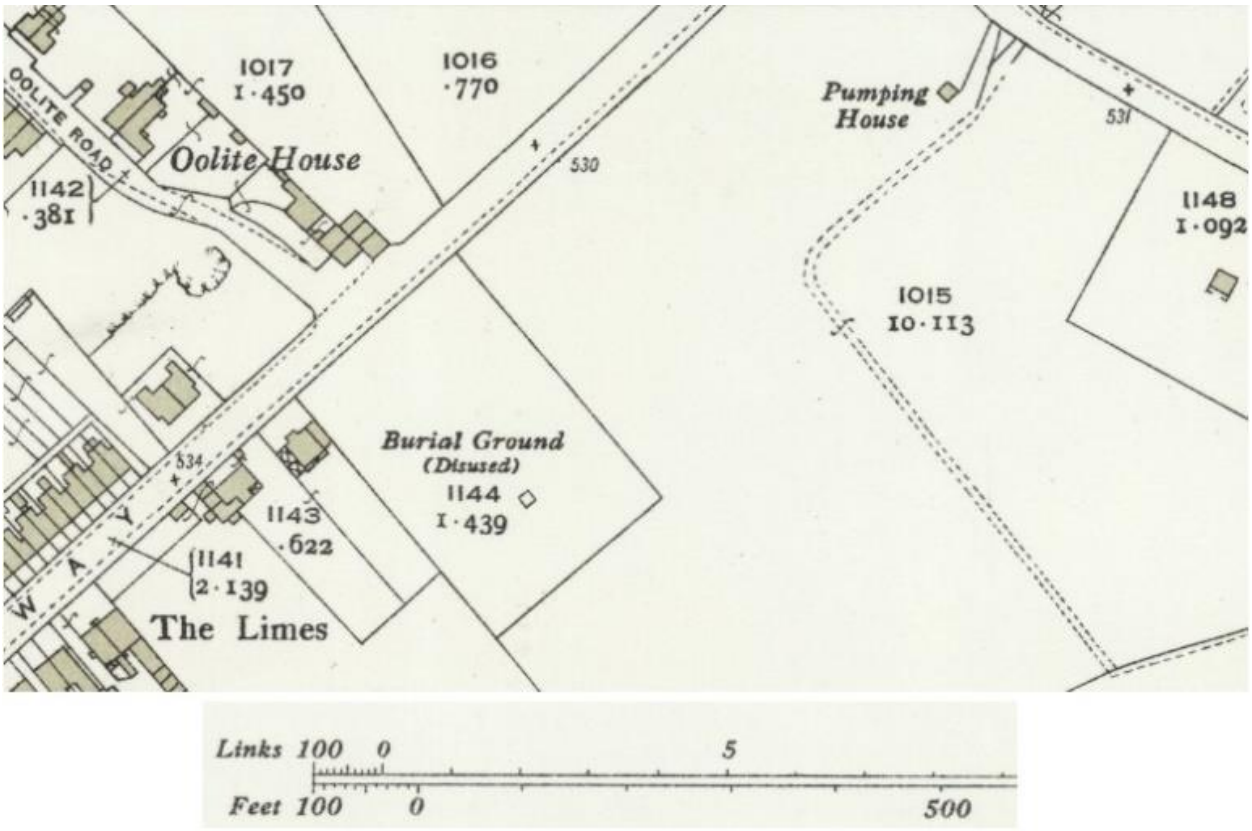


Figure 2-5: OS 25" to 1 mile, 1932

The 1932 map (Figure 2-5) has even less detail, omitting all the paths, leaving a small square at the intersection of the paths. Today, there are a few small rocks and a small fir tree there (Figure 2-6). It is likely that this is the site of a monument to Reverend John Scott. Scott was the workhouse chaplain who must have officiated at many burials. He expressed his wish that he be buried in the same ground as the paupers. He died in 1865.

Figure 2-6: the location of the paths intersection and the probable location of the Scott memorial stone

"From the chapel one must take a walk through the grounds and through a tunnel running under the Frome Road to the old workhouse burial ground, where, says Mr. Williams, there must be several thousand people buried.
"This burial ground, long since disused contains no forest of elaborate stones; the people buried there were poor; they lie under only long, matted grass.
"In the centre, however, there is one stone, lichened and rough, on which can just be traced the name of "Scott" and the date 1865.
"In 1853, ..., the Rev. John Scott came to St. Martin's as chaplain and for 12 years he worked among the poor people who came there for help.
"He never left them, for when he died, at the age of 57, he directed in his will that he should be laid to rest among the poor whom he loved. This accounts for the one stone which, though laid for one man, must surely commemorate them all."
Bath Chronicle, 20 September 1947

Figure 2-7: Aerial photo, 1946. RAF_3G_TUD_UK_25_V_5106

The 1946 aerial photo (Figure 2-7) shows the line of the old path from the tunnel to the burial ground. The 'monument' is also visible, but none of the paths within the burial ground itself.

The Burial Ground is in a stone quarrying area, and there were a number of quarries on Odd Down. The limestone was of 'fair quality', but not the finest. It often contained small clay holes and lay in thin beds. The largest quarry in the area was the Horsecombe or Wansdyke Quarry (ST738619) which lay just south of the Burial Ground. Its main product was walling stone (Wooster, 1978). The stone lies just a few centimetres below the surface, which would have made the job of digging graves a difficult one.

There were some government regulations about the depth of graves that were issued in 1863. A coffin had to be at least 4 feet from the ordinary level of the ground, unless it contained the body of a child under 12 years of age, when it had to be no less than 3 feet below that level (Boulnois, 1883: 356; Local Government Board, 1882: 17). The regulations may not have been followed on all occasions. In *Bleak House* (published in 1852-3, five years before the burial ground was opened), Charles Dickens decries the burials for the poor. He includes a burial ground where "they lower our dear brother down a foot or two", and Jo the crossing-sweeper describes Mr. Nemo's grave: "they put him very nigh the top. They was obliged to stamp upon it to git it in..."

The method of interment is not known, but some calculations can be done. The burial ground was 92 x 65 metres, or 5980 m^2. The paths would have taken up some space, so assuming this accounted for 10%, the available area reduces to 5382 m^2. The 3192 burials would thus have had an average of just 1.69 m^2 of land each, meaning that individual plots would not have been

possible and coffins were placed on top of each other. If we assume at least a metre of depth would be wanted above the topmost coffin, this would have meant excavating a large amount of limestone as it sits just a few centimetres below the surface. It is likely that a largish trench would be cut in one operation and used until it was full.

3. Archaeological Method

3.1 Gridding

The field was gridded out into 12 squares of 20 m each. The top four were set at the northern end approximately 30 cm south of the path connecting the Wellsway with the housing estate. Exact measurements are shown in Appendix A. This allowed for three rows each of four grids. A small area at the western end beyond the fourth squares was excluded, as trees there were sufficient to hinder surveying. The far south-eastern corner had been cordoned off by the Parks Department because of a dangerous tumbled wall. This only excluded some 10 m^2 from the survey.

Note that grid north was at an angle of about 120° west of true north.

The orders in which the grids were surveyed by magnetometry and by resistance are shown in appendix A.

3.2 Magnetometry

The survey used a Bartington 601-2 dual fluxgate gradiometer recording at four points per metre along lines one metre apart, giving 1600 readings per full square. Areas along the eastern edge and the north-east corner were not surveyed as they were too close to iron fences.

The magnetometer in operation is shown in Figure 3-1.

Figure 3-1: Magnetometer survey

3.3 Twin-probe resistance

Twin-probe resistance measurement was conducted using a Frobisher TAR3 resistance meter with probes set at 0.5 m separation. Readings were taken at half metre intervals along lines one metre apart, giving 800 readings per square.

The device is shown in Figure 3-2.

Figure 3-2: Frobisher TAR3 resistance meter and frame used for twin-probe resistance survey

The pattern generally obtained across the site was somewhat mottled. In order to check that this was a ground effect and not an artefact of the meter, grid 10 was repeated using east-west traverses rather than south-north traverses. Some differences were to be expected due to differences in reading spacings in each direction but a similar plot of ground features was to be expected. This was indeed obtained, as shown in Figure 3-3, demonstrating that the mottling was a real ground effect.

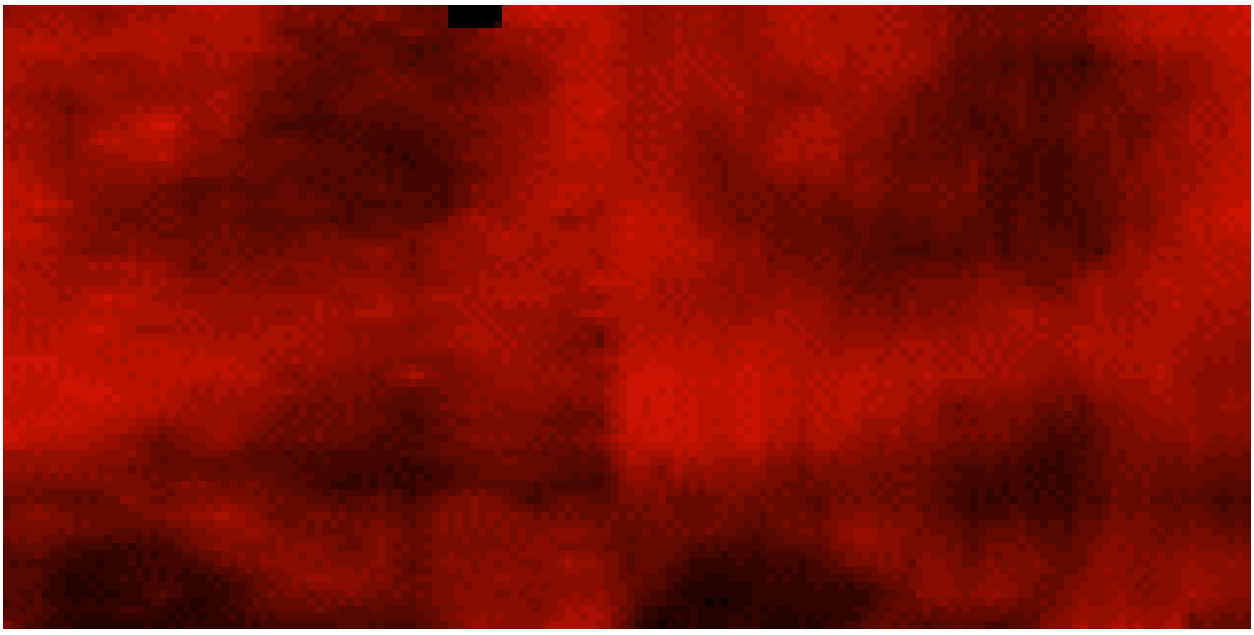


Figure 3-3: Comparison plots of south-north traverse (left) and east-west traverse (right) showing how the form of the ground features was retained.

3.4 Resistivity profiling

Resistivity profiling was done using the same Frobisher TAR3 meter in Line mode. 32 probes were generally available, although Line 2 was shorter. The lines are described below. In some cases, lines were concatenated to former a longer continuous line. Half-metre probe spacing was used in order to provide quarter metre vertical resolution. Lines were thus 15.5 m long. Where concatenation was used, crossover was done at 10 m. Although there were slight surface undulations, the profiles were treated as flat, with no surface height correction.

The lines are listed below, and the profiler arrangement is shown in Figure 3-4. Positions of lines are shown in Figure 3-5.

Figure 3-4: Resistivity profiling

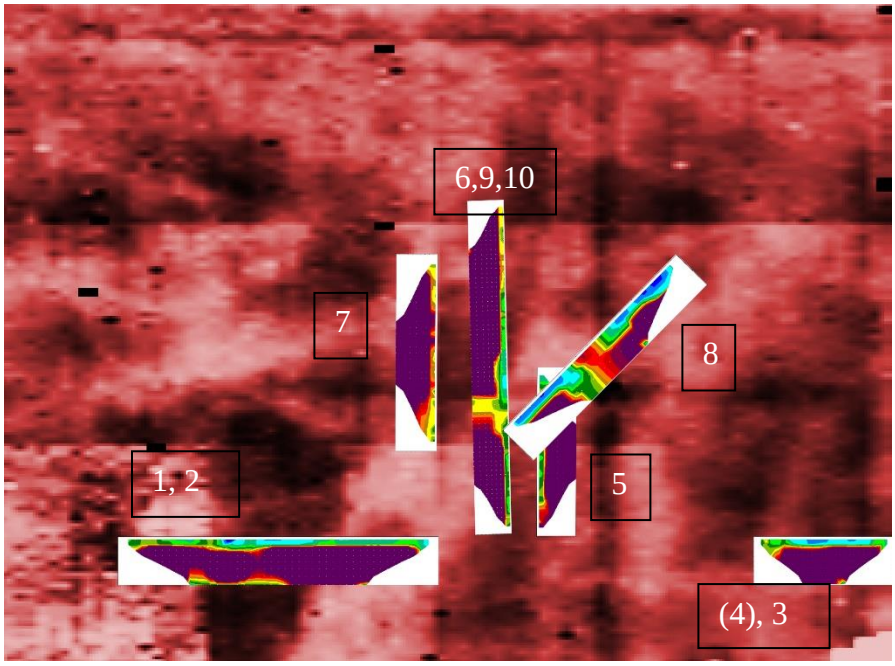


Figure 3-5: The profiles overlaid on the resistance plot and numbered. Note that profile q4 has been omitted as the data were poor.

Q1 This was on a line 12 m north of the southern baseline, starting 10 m east of the western edge of the grid, extending 25.5 m east along the line. It was intended to pass through an area of low resistance in the midst of high resistance.

Q2 This overlapped with q1, allowing concatenation. It started 20 m east of the western edge. The line was not set up correctly and was limited to 28 probes, so it extended only to 33.5 m.

Q3 This was also on the 12 m north line but at the far eastern end. It extended from 65m to 79.5 m along the line. It ran over a line of higher resistance.

Q4 This started at 55m along the line and was intended for concatenation with q3 at 60 m. However, it was found on processing to contain a very large number of misreadings and this cast doubt on the validity of the profile. It was not included in the full analysis.

Q5 This also started on the 12 m north line but extended north from 12 m to 27.5 m. It was set at 52 m along the line, where there appeared to be extensive mottling.

Q6 This also started on the 12 m north line but at 50 m along the line, also in an area of mottling. On processing, this line showed interesting effects at depth, so lines were concatenated to it.

Q7 This was also a north-heading line through mottling, but it was set starting on the 20 m north line, at 39 m east.

Q8 This was set to pass over the one known grave: that of the Revd Scott, a chaplain at the workhouse. His grave had been dug at the intersection of east-west and north-south paths so direct passes through it would show paths rather than burials outside the area of the grave. This profile was therefore set at a diagonal, extending from 20 north, 50 east to 30 north, 60 east with a small extension beyond this to use all 32 probes.

Q9 This headed northward, starting at 50 west, 22 north so that it could be concatenated with q6, continuing to 37.5 m north.

Q10 This continued the northward line, concatenated to q6 and q9 to extend to 47.5 m north.

3.5 Earthwork survey

Although the field was very flat, slight undulations could be seen in it, particularly at the northern end. These were typically only 5 or 10 cm high but were visible in low winter sunlight and could be felt under the feet. Undulations were typically about 5 m wide. The north-south and east-west path were also evident as slight earthworks.

A survey was started using a Sokkia SET5W total station to survey in the lines of the dips. However, the meter malfunctioned part way through the survey, and the survey had to be abandoned.

3.6 Processing

Data from the magnetometer and twin-probe resistance meter were processed using INSITEv3 and this still required the use of a computer running XP. BACAS still prefers to use this software, with its visual approach.

The profiles were processed using Geotomo RES2DINV software, using version 3.117 in the full operating version.

4. Results

4.1 Magnetometry

Magnetometry was the first task to be completed. The results are shown in Figure 4-1 below.

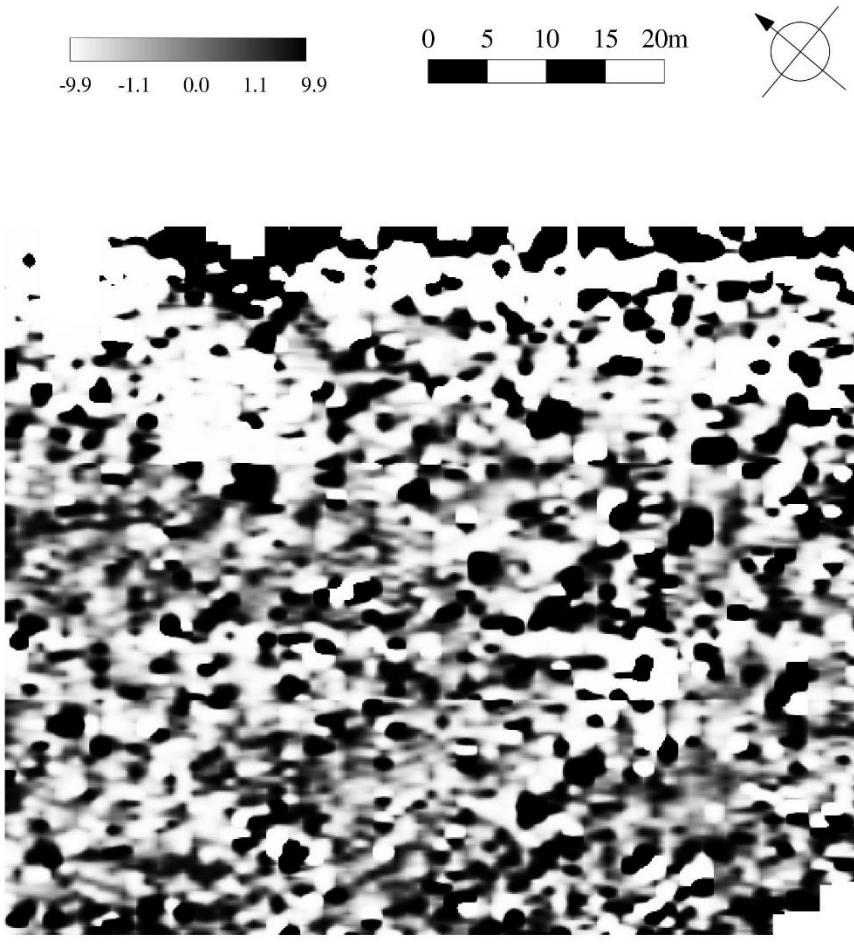


Figure 4-1: Magnetometry plot

Initial thoughts were that the bodies were most likely wrapped only in shrouds, so it came as a surprise to see large amounts of ferrous interference. The strong signals along the top may be due to the presence of a large iron fence about 5 m beyond the top line. For similar reasons, the last four lines of the east grids 2, 4 and 6 as a similar fence was just beyond the edge of the plot.

Signals ranged positive and negative, generally in the range 8 to 30 nT, but could exceed the 100 nT limit set on the machine.

It was initially thought that the ground may have been seeded metallically in order to deter illegal metal detectors, but this would most likely give a more even spread. These were then considered

to be spreads of coffin nails. Documentation found subsequently indicated that it was usual workhouse practice to bury inmates in coffins, albeit of the most minimal standard.

4.2 Twin-Probe Resistance.

The resistance plot is shown below in Figure 4-2.

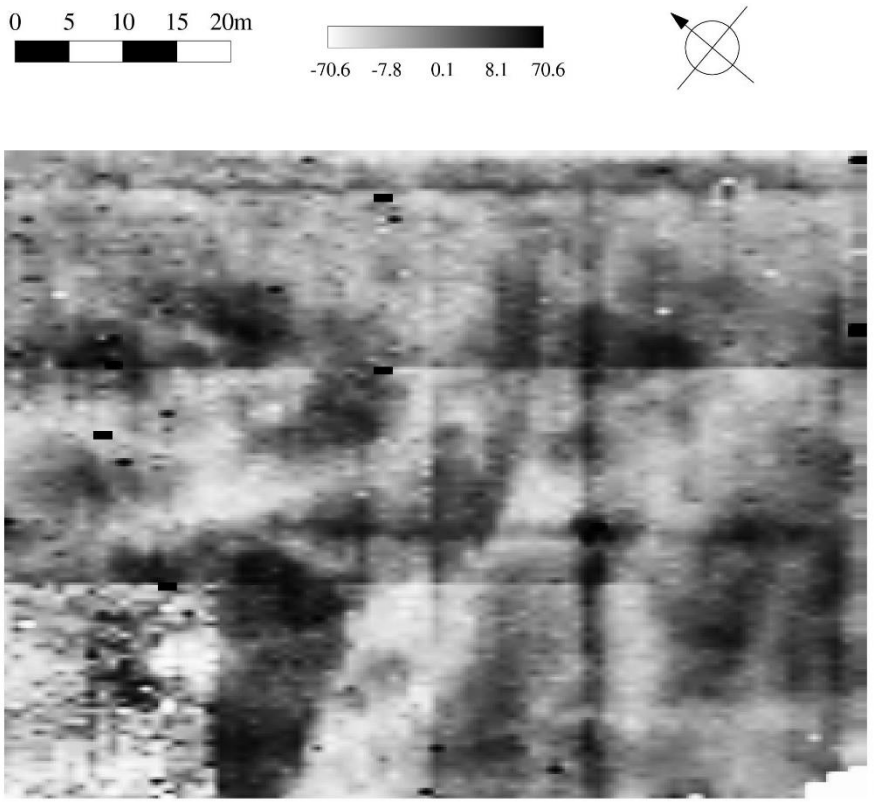


Figure 4-2: Twin-Probe resistance plot

Study of nineteenth century Ordnance Survey maps indicated that the line across the top of the plot was the original graveyard boundary. The two dark lines crossing represent paths through the cemetery, with an extra path along the eastern edge. The southern cemetery wall is a few meters south of the grid baseline, so although it is not obvious from this plot, the east-west path is exactly half way down the ground, and leads at its western end to the original gateway, now blocked (see Figure 2-3). At the intersection of the two paths (Figure 2-6) is the one marked, formal grave: that of the Reverend Scott, a chaplain to the workhouse.

The plot also indicates areas of higher and lower resistance, which may be either patches in the ground, or may be the underlying rock varying in depth below the surface.

Of greater interest is the ‘mottling’ which is visible on close inspection across a lot of the area. This appears generally as darker mottles, but in some areas appears as lighter patches. This is not a function of the meter, as demonstrated in figure 3.5. It therefore represents patches of ground typically 2 m by 0.5 m of varying resistance and is taken here to indicate burials. These appear to align with the bounds of the cemetery, rather than true east-west. That could be affected by the quantisation of the readings but is most likely the way they were laid out in order to maximise useful space. It is also possible that variation in compass north over the years, which is greater than 20 °, may also have reduced the apparent deviation.

4.3 Resistivity Profiling

The profiles were designed to add depth information to the resistance plot. Each profile is located and described in section 3.4 and located in Figure 3-5. Profiles may each be displayed more than once, using differing resistivity scales, where this provides more information.

4.3.1 West-East profiles

Figure 4.3 shows profiles q1 and q2 concatenated to form q12. These were on a line 12 m north of the baseline, starting 10 m east of the western edge.

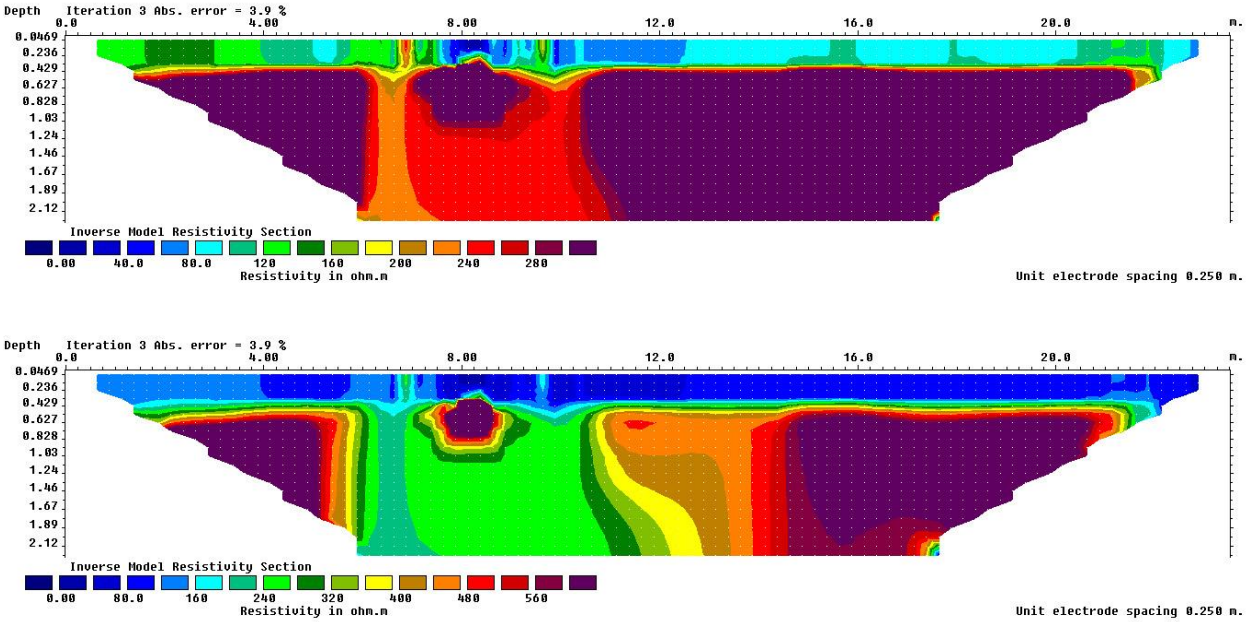


Figure 4-3: West-East profile q12. Top: 20 Ωm scale; bottom: 40 Ωm scale

The low resistivity from 8 to 15 m corresponds with the low resistance area to be seen surrounded by high resistance in the south-west corner. Note also that there is a slight depression in the underlying bedrock in this area. The important thing to note is that the bedrock occurs at only 0.5 m below the surface generally, but this appears to have been cut through from 6 m to 16m, and back-filled with material of intermediate resistivity, possibly rubble from the stone extracted and possibly containing human remains.

Most important to see is that the top half metre is not uniformly low-resistance, but there are raised resistance features at 2 m, 7 m, 9 m, 15 m and 22 m. These may possibly represent very shallow burials at the top of the cut.

Figure 4.4 shows profile q3, which started at 65 m along the line 12 m north, so it ended 0.5 m beyond the eastern bound of the survey. Note that profile q4 was set 10 m further west and was designed to be concatenated with profile q3 to provide a longer section but this survey was badly affected by multiple false high readings. The RES2DINV software was able to remove these and provide interpolated values, but there were so many of these that the profile was compromised badly, and it was decided not to use it.

The reason why this profile only was so badly affected is not understood. The effect was not noticed as the profile was in progress, and this degree of disturbance did not occur on other lines that day. Appendix B shows the initial readings, with the software's corrections and subsequent inversion.

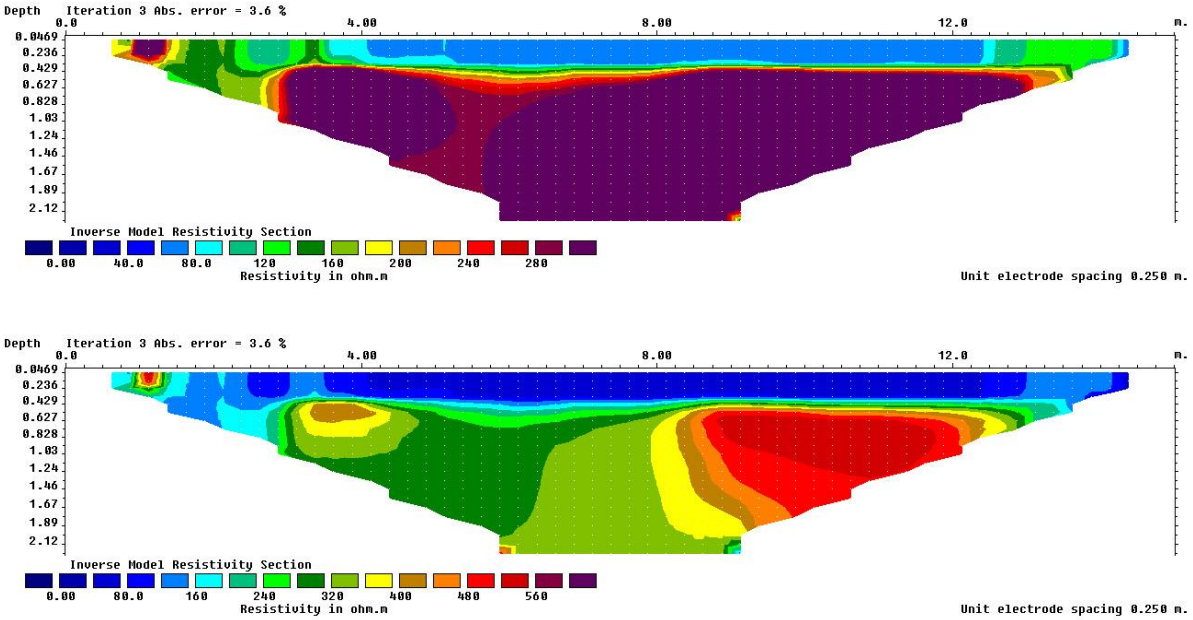


Figure 4-4: West-East profile q3. Top: 20 Ωm scale; bottom: 40 Ωm scale

The cut-off at 13.5 m is likely an artifice of the software, but the dip at 2 m is likely to be genuine. It is a pity that profile q4 failed. Otherwise, the bedrock is seen to be just 0.5 m below the surface.

Within this profile, there are nonetheless possible shallow burial features at 1 m and 3 m.

The very high resistance patch around 10 m may represent very high resistance rock as it shows as a feature in the resistance plot, Figure 4-2. The area to the west of this may represent another cut into the rock, but this is less clear than in the case of profile q12 (figure 4.3).

4.3.2 South-North profiles

Profile q5 started from the 12 m north line, but headed north at 52 m east. This corresponded with mottling visible on the twin-probe resistance plot. The plot is shown below as Figure 4-5.

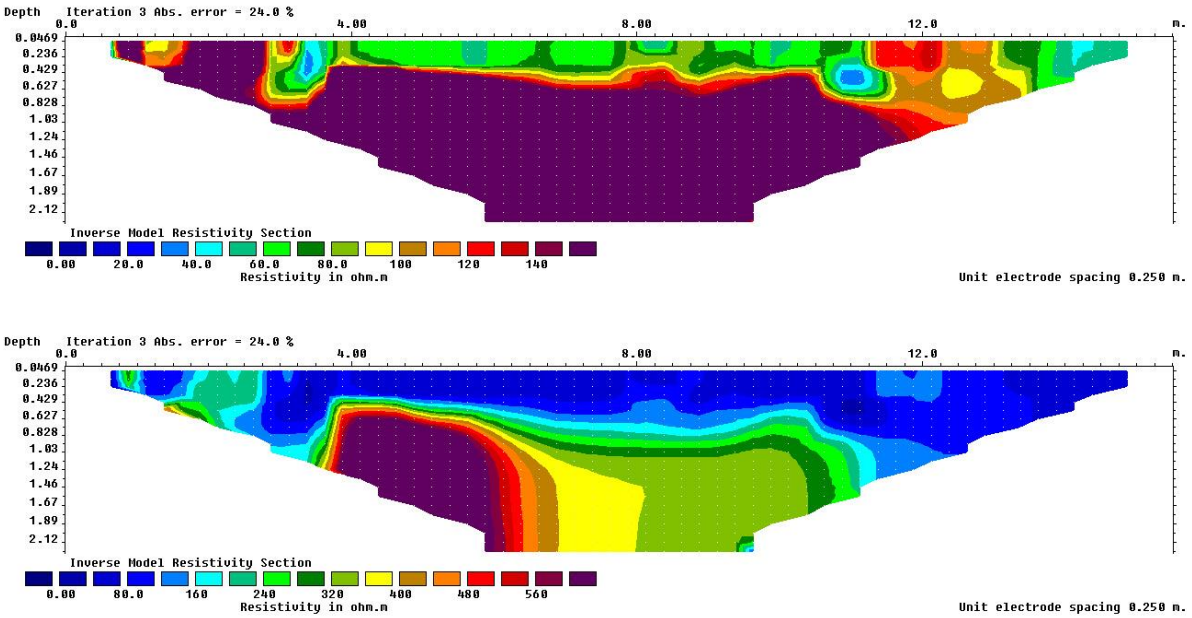


Figure 4-5: South-North profile q5. Above: 10 Ωm scale; below: 40 Ωm scale

The bedrock is observed to dive down to 1 m depth at the plot's northern end, from 10 m. The feature at 12 m extending to the surface is the east-west central pathway through the burial ground.

Higher readings in the surface zone are visible at 2 m (very high resistivity), 4 m, 6.5 m, 7.5 m and 9 m (medium resistivity, but higher). These may again represent shallow burials, but seen in south-north section.

It also looks as if the bedrock has been cut into and back-filled from 6 m up to the point where it tapers into the very low resistance. The low resistance may be a natural feature. It has the pathway going through it, although the location of that was determined more by the geometry of the cemetery than geology.

Profile q6 was laid south-north just two metres further west on the 12 m line, at 50 m east. This appeared to show a more pronounced drop in bedrock towards the northern end, so it was extended further by 10 m with profile q9 the following day, and then extended a further 10 m north with profile q10. Figure 4-6 shows profile q6, while Figure 4-7 shows the concatenated profiles as q6910.

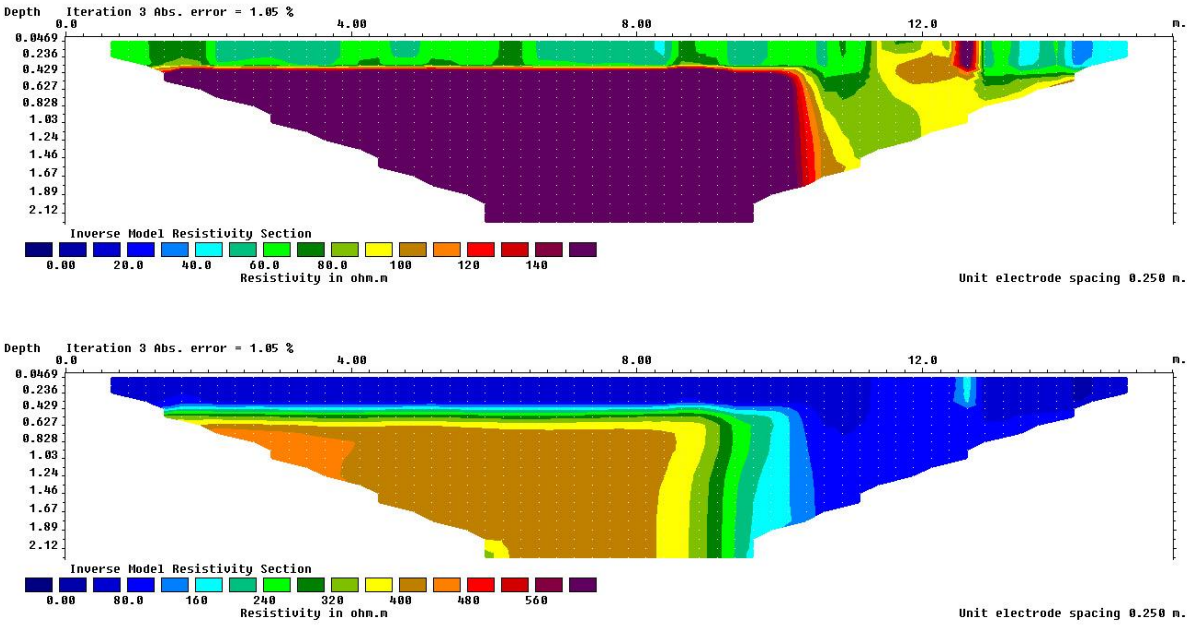


Figure 4-6: Profile q6. Top: 10 Ωm scale; bottom: 40 Ωm scale

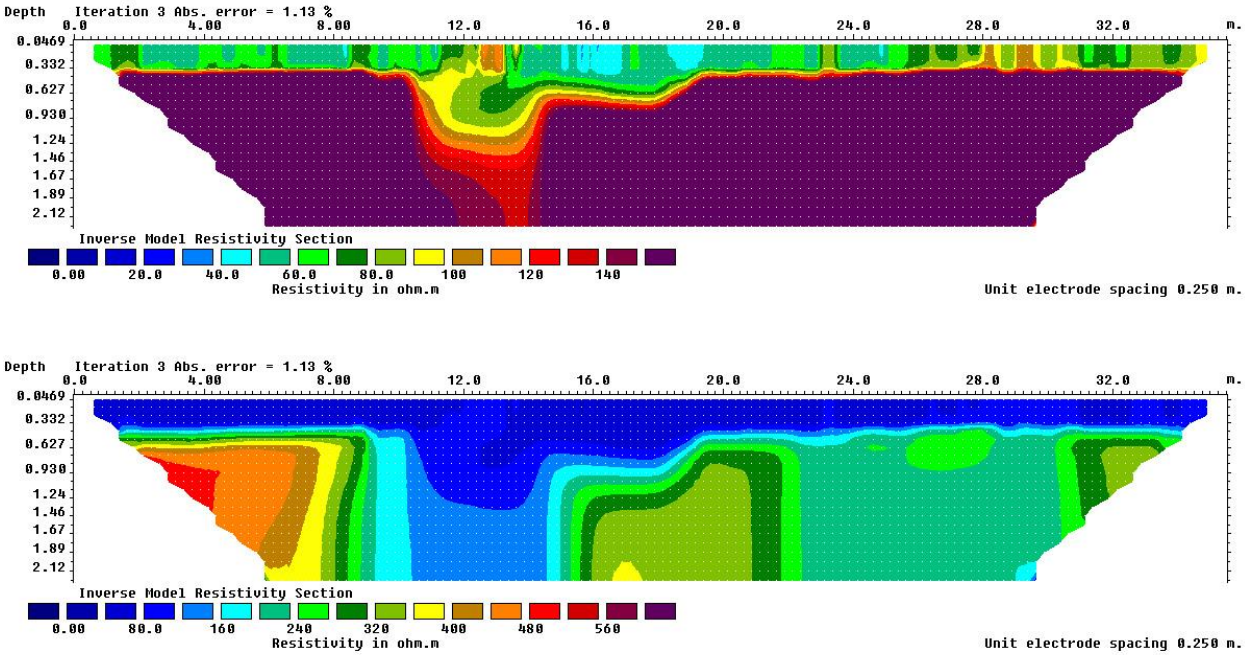


Figure 4-7: Profile q6910, concatenated profiles 6, 9 and 10. Top: 10 Ωm scale; bottom: 40 Ωm scale

There does appear to be a deep rift through the rock at about 14 m although its location is in slight doubt when Figure 4-6 and Figure 4-7 are compared. This may be a function of imposition of boundary conditions with the longer plot. There is also slight uncertainty from the concatenation, in the alignment of the 12 m north line on differing days. A discrepancy of nearly a metre was observed when the line was re-set on the second day.

The rise in resistivity at 12 m along the profile can still be observed, showing the location of the east-west path.

Surface patches of higher resistivity can be seen at 2, 4, 6 and 9 m, suggestive of shallow burials. Following low surface resistivity at 16 m, there is a higher region from 18 to 20 m, then further high surface resistivity at 21, 23, 28 and 30 m, although the general surface resistivity appears to be higher at the northern end of the profile, from 26 m onwards. The low surface resistivity from 14 to 16 m is reflected in the twin-probe resistance plot, figure 4.2.

There also appears to be a cut and back-fill from 22 to 30 m north, suggesting another deep-cut grave, presumably filled with human remains, as well as the very shallow disturbances. This does also show on the resistance plot (figure 4.2) as a lower resistance area.

One further south-north profile was done and this was further to the west. This was q7, which was 39 m east. However, this started at 20 m north of the baseline. This profile is shown below in Figure 4-8.

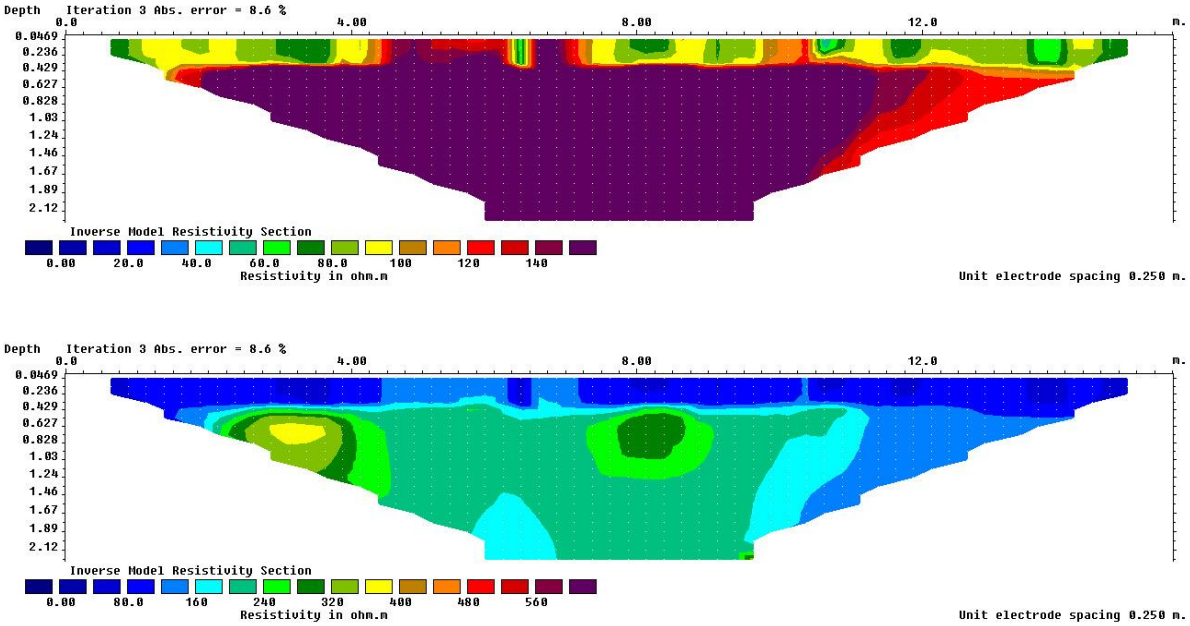


Figure 4-8: Profile q7. Top: 10 Ωm scale; bottom: 40 Ωm scale

The slight dip in the bedrock at the start of the profile may be a function of the boundary conditions. The large dip from 12 m at the northern end appears to be a real dip. Time did not permit a further profile to extend this line north. Note that this plot is 8 m further north than q5 and q6910 and is further west, so it would not be expected to align with the other plots.

Note the rises in shallow resistivity at 2, 5, 7 and 10 m, which may indicate more shallow burials.

4.3.3 Diagonal Profile

Profile q8 was designed as a control to observe what would be seen from a formal grave, the only one in the burial ground. As this grave sits at the junction of the east-west and north-south paths, any orthogonal profile would lie along one of the paths so could provide no evidence of further unmarked graves. For this reason, the profile was put in diagonally, starting at 50 m east on the 20 m line and passing through 60 m east 10 m to the north. That would give a length of 14.14 m, so the profile continued a little further north-east at a full 15.5 m. The grave, assumed to be marked by the stones and the small fir tree, was then centred about 7 m along this line. The plot is shown in Figure 4-9.

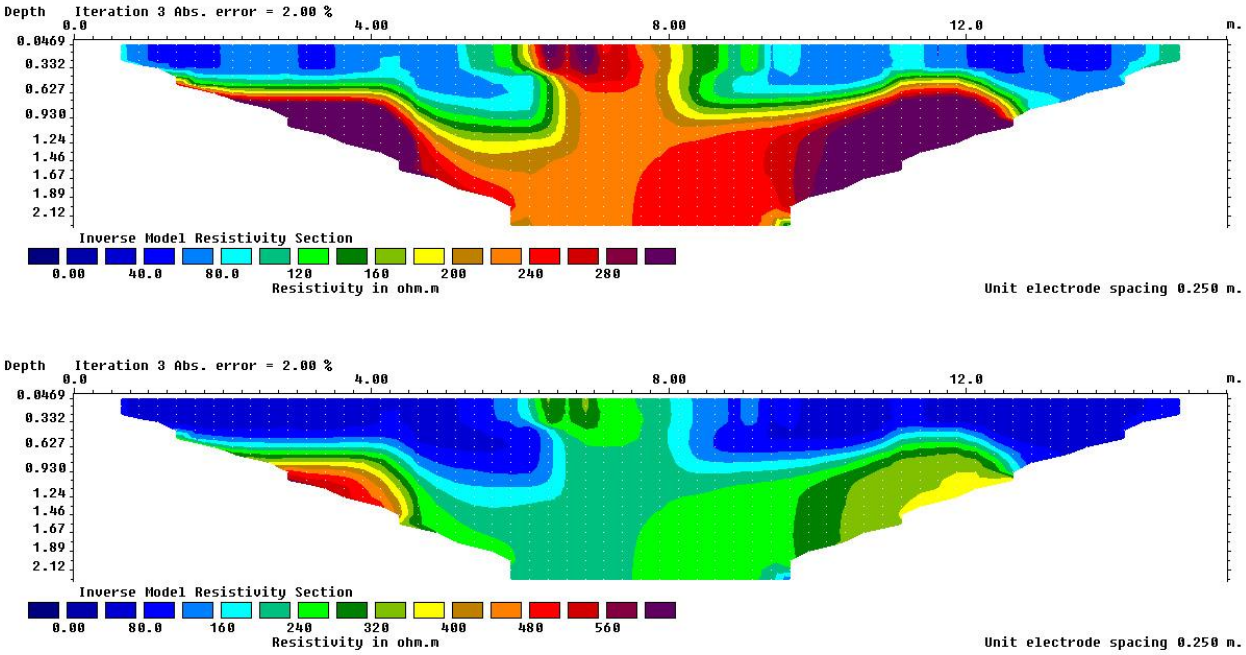


Figure 4-9: Diagonal profile q8, through the formal grave of Revd Scott. Top: 20 Ωm scale; bottom: 40 Ωm scale

The profile suggests a deep grave cut straight down through the bedrock. Note that this is expected to be diagonally through the grave, so distance along the profile does not accurately reflect the length of the grave cut. It would appear from this that the grave was backfilled with stone rubble rather than earth.

At first sight, the ground levels other than in the grave appear to have low resistivity, but this is partially because of a higher resistivity scale being used to provide best definition. Using the 10Ωm scale, a similar surface configuration is seen, with higher values possibly representing shallow burials at 2m, 4m and 11 m.

5. Discussion

We know that there were a large number of burials and they were at high density. It is a case of interpreting the data to get our best understanding of how the burials were made.

Any magnetometry data was overwritten by large spikes, even patches, of ferrous interference. This would suggest that there are a large number of iron nails beneath the surface, which in turn suggests large numbers of nailed coffins.

We did not use ground-penetrating radar, but it is likely that any radar data generated would also be severely degraded by metallic returns.

Earth resistance techniques were generally successful. These consisted of a twin-probe resistance plot of the full area and resistivity profiles across selected parts of that plot, and these methods provided complementary information.

The area covered by the plot was 4800 m^2. This was slightly offset to the north of the cemetery, but covered the northern bound and was within five metres of the southern wall. The western portion, about 10 m in width, was excluded, but was under tree canopy, and this would have added significant problems to surveying.

The plan that twin-probe resistance generated showed areas of higher and lower resistance in the top most portion of the ground, and also showed very many small patches of disturbance spread across the whole area.

The profiles showed that bedrock was generally about 0.5 m below the surface, so its effect would be just within range of the twin-probe device, so variations in bedrock composition or disturbance may be reflected in the lightness or darkness of the plot at any point.

Depending on the scale chosen, the profiles could show bedrock either as solid (with a few exceptions) or cut away square down to the 2 m depth of the plot. Even in these cuts, the back fill appeared to be very rubbly, suggesting that extra material could have been thrown in as the graves settled. The density of human interment to backfill cannot be estimated, but it is assumed that bodies were buried in several layers to make best use of these deep pits. Cutting down through the rock would have been very hard work, and it is assumed it would have been a task for workhouse inmates.

The surface disturbances cause other problems of interpretation. These can occur either over the top of the cuts discussed above or over the solid rock. If they were burials, they would be very shallow indeed. Earth would have to be mounded above them. The field is very flat now but it may have been graded after it ceased being used. However, the topsoil was and is still thin. There are some very slight ridges at the northern end of the ground, but these may well post-date the use as cemetery.

It had been hoped also to do an earthwork survey of the shallow ridges which run south-west – north-east across the site. However, the EDM (electronic distance meter) failed on the second day of use and left a very incomplete set of data, which could not be used to add details of these

ridges to the magnetometer and resistance plots. The ridges do show up in a hill-shaded image generated from LiDAR data (see Figure 5-1).

These ridges are curious. They appear undisturbed, but that would not accord with all the diggings which occur all over the field. This could suggest that they post-date the use of the site as burial ground. Perhaps they had a drainage function, although they did not show any obvious presence in the twin-probe resistance plot. Alternatively, if they are contemporaneous with the use as a burial ground, then they could indicate the boundaries of areas where pits were dug, in strips up to 5 metres wide, aligned with the short axis.

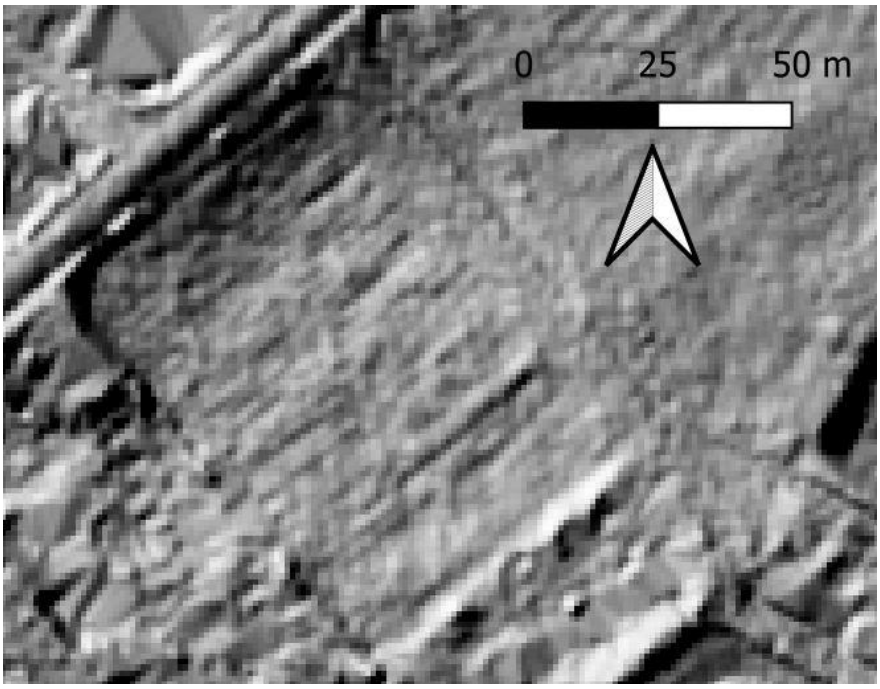


Figure 5-1: Hill-shaded image generated from LiDAR data: azimuth 315°, altitude 25°, Z-factor 10

Our best interpretation then of the data collected is that multiple interments were made generally in deep pits, but it is likely that there are also very shallow interments across the burial ground. Cheap, nailed coffins were used for burial. In the first instance, the lighter portions of the resistance plot (figure 4.2) indicate the likely location of these deep pits. In theory, more data could be obtained by greater use of resistivity profiles, but data collection for these profiles is a slow process using BACAS' kit. Multiple profiles can be obtained much more quickly, but that involves the use of expensive, sophisticated equipment beyond BACAS' reach. Use of deeper-looking twin probe resistance, involving more widely separated probes may possibly provide extra information. Magnetic and radar based surveys are likely to be thwarted by the widespread scatter of iron nails.

Before this burial ground was opened, there was a small cemetery immediately next to the chapel at the workhouse. Although consideration was given to investigating this plot, it was considered too small to allow any useful form of geophysical survey.

6. Comment and conclusions

We set out with the objective of identifying whether we could detect any burial plots or pits. The resistance profiles have enabled us to show there are a number of places where there appear to be cuts into the bedrock consistent with the existence of burial pits. However, the ground is very disturbed and we have not been able to pinpoint the exact outline of any particular pit.

Digging holes in the burial ground would have been back-breaking work. There is limestone not far below the surface, which could have had to be cut out to some depth. It is an area rich in stone quarries, and efforts would have been made to extract the stone in such a way that it had commercial value. It seems likely that when preparing the ground for burial a large pit would be dug in one operation and then used for interments until it was full. The next pit would then be dug. A total of 3192 burials between 1858 and 1899 equates to roughly one burial every five days. It would not take more than a few weeks to fill a pit.

The ridges that run parallel to the short axis of the site are, on average, 5 metres apart. It may be that the ridges are on the undisturbed ground between lines of pits. If the pits were 4 metres wide, then two coffins could be fitted end to end across the width.

It was common practice for the dead paupers to be buried in cheap coffins, and the magnetometry data does show ferrous interference which could be due to the presence of iron nails.

Refusing to mark a pauper's grave was intended to be punitive (Strange 2003). It was considered the poor needed to be deterred from being so irresponsible and feckless as to die in poverty. Being buried in a pauper's grave was feared and caused distress to the surviving relatives. Although the workhouse authorities were adamant that no pauper's grave should be marked, it is noteworthy that there was a formal layout of paths in the burial ground, certainly from 1884 onwards (as marked on the OS map, and confirmed by our surveys). The burial ground would have resembled a 'normal' cemetery, having paths, trees, a boundary wall and an impressive entrance from the road, but without any grave markers.

The only grave marker that existed was a simple one to the Reverend John Scott ("In the centre, however, there is one stone, lichened and rough, on which can just be traced the name of "Scott" and the date 1865", *Bath Chronicle 1947*). The logical place for this stone is at the intersection of the two crossing paths (Figure 2-6). There are a small number of stones there, and we did search for an engraved worked stone without success. It would be good to find it but it may have been removed.

7. Bibliography

Bath Chronicle. 1892. "Workhouse." *Bath Chronicle* (12 May 1892).

Bath Chronicle. 1947. "Worked for St Martin's: Stories of Two Men." *Bath Chronicle* (20 September 1947).

Boulnois, H. Percy. 1883. *The Municipal and Sanitary Engineer's Handbook.* London: E & F N Spon.

Chislett, W.H.A. 2007. "Bath Union Workhouse, The Chapel, John Plass, and St. Martin's Hospital." *The Survey of Bath and District* 22: 22-31. https://historyofbath.org/images/documents/cd2141f8-3a21-4668-8865-138137e863f5.pdf.

Higginbotham, Peter. 2012. The Workhouse Encyclopedia. The History Press.

Hurren, Elizabeth, and Steve King. 2005. "'Begging for a burial': form, function and conflict in nineteenth-century pauper burial." *Social History* 30 (3): 321-341. https://doi.org/10.1080/03071020500185448.

Local Government Board. 1882. Eleventh Annual Report, 1881-82. London: HMSO.

Payne, John. 2020. *Workhouse to Hospital: A brief account of the Odd Down site of Bath Workhouse.* Bath. https://www.bathscape.co.uk/wp-content/uploads/2020/10/Workhouse-to-Hospital.pdf.

Senior, Nassau, and Edwin Chadwick. 1834. *Poor Law Commissioners' Report of 1834*, London: HMSO.

Strange, Julie-Marie. 2003. "Only a Pauper Whom Nobody Owns: Reassessing the Pauper Grave c. 1880-1914." *Past & Present* (178): 148-175.

Wooster, Phillip. 1978. "The Stone Industry at Bath." *Bristol Industrial Archaeological Society J* 11: 5-13.

Appendix A: Details of gridding

A1 Gridding

The grid was started at the corner with the gate to Lympsham Green. Two of the large green metal posts in the fence were used, A and B, as shown in the figure and photographs, and the peg placed at 5.9m from A and 2.87m from B. This was designated as (1000, 1000) for the purposes of the (unsuccessful) earthwork survey. The grid baseline was set along the grass, parallel to the path. At 60m, the baseline was 0.85m from the path edge.

This did mean that the grid north bore little relation to true north, being about 120 W of true north.

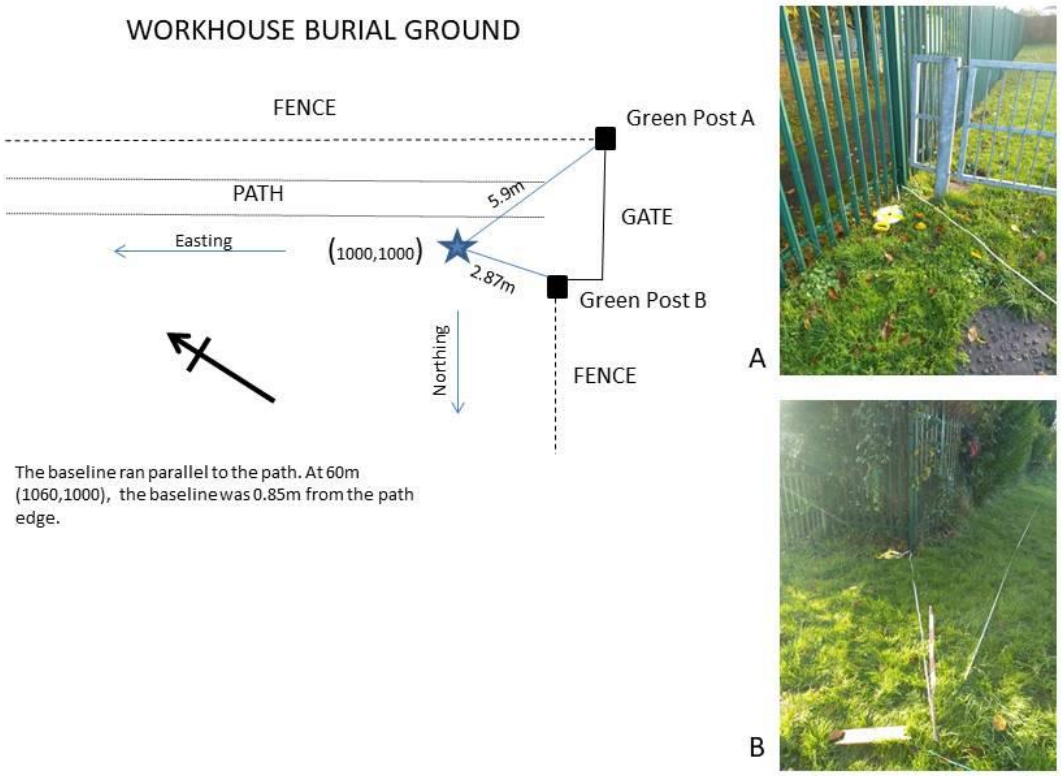


Figure A-1: Setting up the grid

A2 Magnetometry

The survey used a Bartington 601-2 gradiometer taking readings at 0.25 m intervals along lines 1 m apart, giving 1600 readings per full grid square. The data logger automatically sorted the data to parallel lines. The grid pattern walked is shown in Figure A-2 below.

Note that there was an iron fence about 5 m north of the top grid squares, and also close to the eastern squares (2, 4, 6). The south-east corner of grid 6 was also masked off by an iron safety fence.

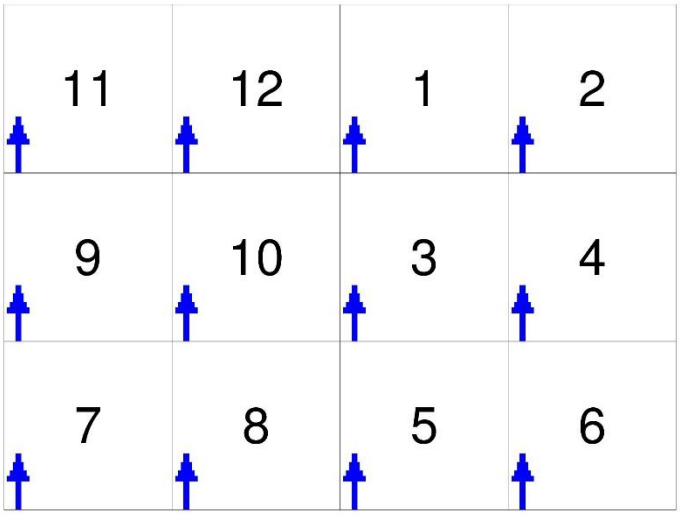


Figure A-2: Magnetometry. Grid pattern walked. Top of plot is next to footpath.

A3 Twin-probe resistance

The resistance work was done using a Frobisher TAR3 meter, kindly supplied by Bathscape. This took readings at 0.5 m intervals along lines 1 m apart, giving 800 readings per full grid square. The data were abstracted from the text file as a single line of readings following the zig-zag pattern walked. The order of grids reflected the need to keep well away from the magnetometer on day 1. The grid pattern is shown in Figure A-3 below.

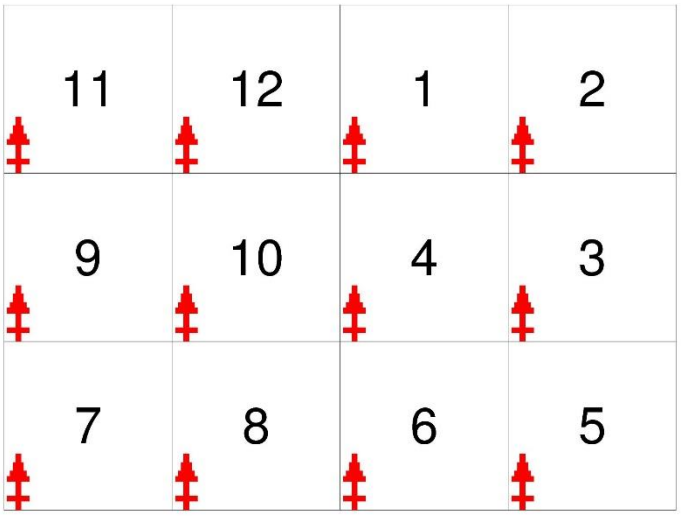


Figure A-3: Twin-probe resistance grid patter walked. Footpath is just beyond top.

Note that grid 10 was repeated as grid 21, but starting in the south-east corner heading west rather than the normal south-west corner heading north. This was to check that the data were ground data not influenced by the data logger. This is shown in Figure A-4.

Figure A-4: Starting points of grid 10 and grid 21 indicated by arrow position, with arrow direction showing direction of first line.

A4 Resistivity profiles.

Twelve profiles were taken, although no. q4 was discarded because of the high concentration of faulty readings. All profiles were set up using 32 probes at 0.5 m spacing, although profile no. q2 only used 28 probes because of problems in the electronic set-up.

In all cases, 8 rows of data were taken, to give coverage down to 2 m depth.

Where profiles were concatenated, probe 20 on the first line became probe 0 on the line to be joined. This gave adequate overlap down to row 6 of the data with a little interpolation down to row 8. Lines q1 and q2 were concatenated, as were lines q6, q9 and q10. It had been intended to concatenate lines q4 and q3 but not once line q4 was discarded.

The locations are given in Section 3.4 and Figure 3-5.

Appendix B: Poor data collection in Profile q4

Below is the initial print-outs from Profile q4, using our normal Geotomo Res2Dinv software 3.117 with dongle to provide full analysis. The bottom picture is the full inversion and in itself looks plausible, but the top picture shows the initial data. The dark hexagons are anomalously high readings. These are very concentrated, particularly in the readings of low-number probes. Possibly a connector was not fully home, but there was no obvious problem with the readings as they were taken. The middle plot is the data used for the inversion process. Software within the program has interpolated values to replace the anomalous readings to produce a useable data set. This is normal, and is usually acceptable, as there might typically be only one or two anomalies in any data set. The problem here is that there are so many anomalies so close together that the interpolations cannot be reliable, so the final profile cannot be reliable.

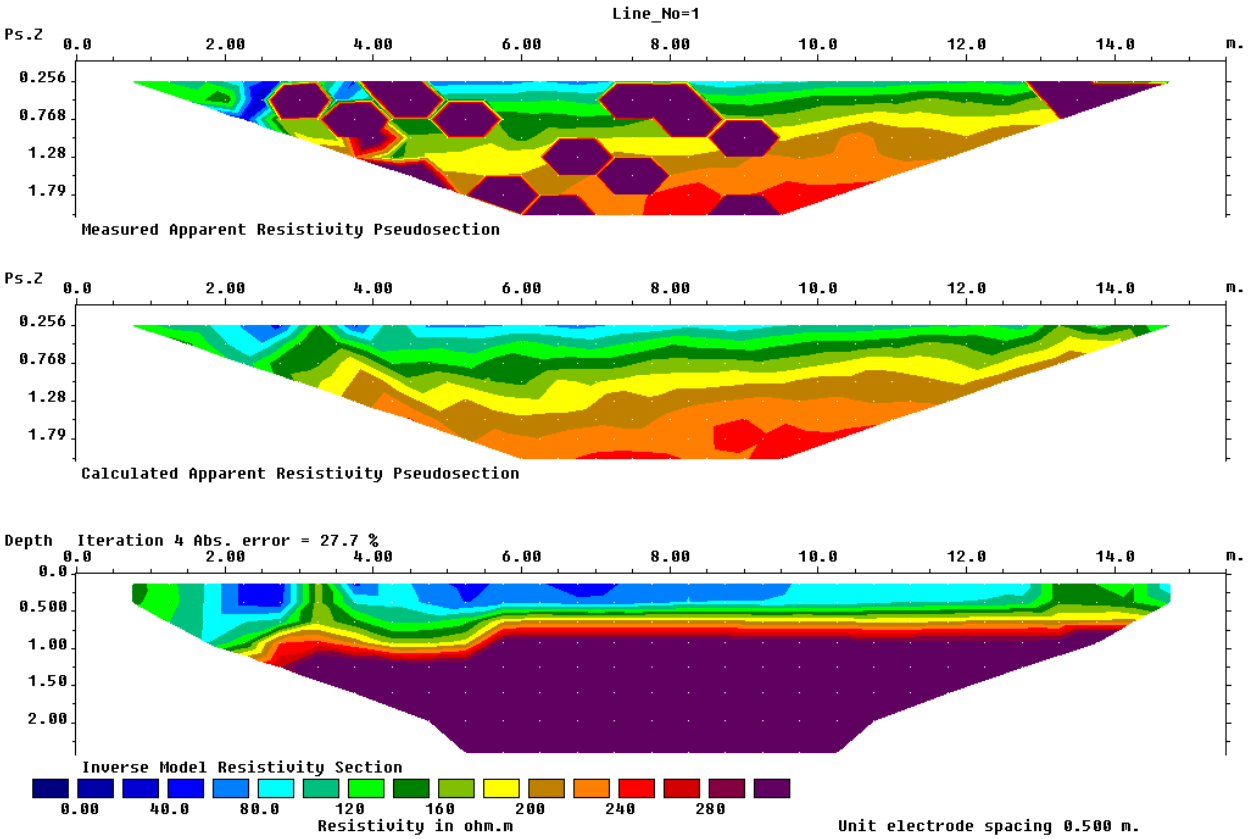


Figure B-1: Profile q4, showing in the top plot the poor data points, followed by the software replacement of those poor points, and then the resulting resistivity profile.