YCCCART 2014/Y19
North Somerset HER 2014/048

Cadbury Congresbury Hill Fort: Use of an electronic, hydrostatic level as an aid to manual surveying.

YATTON, CONGRESBURY, CLAVERHAM AND CLEEVE ARCHAEOLOGICAL RESEARCH TEAM (YCCCART)

General Editor: Vince Russett

Team YCCCART on the west end of Cadbury-Congresbury Hill Fort

Congresbury and Yatton-FRED-Cadbury Hill-2014-Y19-ver.2

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Abstract

During 2010 – 14, Yatton, Congresbury, Claverham and Cleeve Archaeological Research Team (YCCCART) carried out surveys using an electronic, hydrostatic level (NIVCOMP) on Cadbury Congresbury Hill Fort. Initially, a linear profile of a section of the east end of the rampart, and a survey of a circular platform were carried out (Corney, 2004,[YCCCART 2011/Y6]; YCCCART 2012/ Y2). Subsequently, other features, (Corney, 2004), were surveyed, along with an area of the hill fort which had not been surveyed previously. The data collected during these surveys were processed using the Golden Software "Surfer" program, to produce three-dimensional and contour images.

Acknowledgements

The authors are most grateful for the assistance of members of YCCCART in the completion of these surveys.

They could not have been carried out without the willing permission of Yatton and Congresbury Parish Councils and English Heritage. A Heritage Lottery Grant allowed YCCCART to acquire a Nivcomp, electronic, hydrostatic level which provided the data for the "Surfer10" software program, kindly donated by Golden Software Ltd.

YCCCART are also most grateful to Vince Russett for editing this report.

Introduction

YCCCART is one of a number of Community Archaeology Teams across North Somerset, supported by the North Somerset Council Development Management Team.

The objective of the Community Archaeology Teams is to carry out archaeological fieldwork, for the purpose of recording, better understanding and management of the heritage of North Somerset.

Site Location

Figure 1: Site Location. The arrow points to the 'centre' of the hill fort.

Cadbury Hill is part of the Cadbury Hill Local Nature Reserve, situated on the parish boundary between Yatton and Congresbury parishes, in North Somerset, the centre of the site being at ST441650. The site is the westernmost point of Broadfield Down, the largely limestone down which occupies much of the central area of North Somerset.

The site can be accessed from the north by Henley Lane, off Frost Hill in Yatton parish, which leads to a small public car park: there is also access by Blind Lane, off the A370 at Rhodyate Hill in Congresbury parish

Land use and geology

Cadbury Hill is a public area owned by Congresbury and Yatton Parish Councils and North Somerset Council, and enjoyed by walkers (particularly dog walkers). The main ramparts are thickly covered with trees, while the interior is used as rough grazing, and has recently been mainly cleared of scrub.

The hill fort is situated on a small outcrop of Oxwich Head limestone which overlies the Clifton Down limestone formation. The junction of these two formations appears to result in a steeper slope in some places, and at Cadbury Hill this steep slope has been utilised as part of the outer defences.

Historical & archaeological context

See YCCCART Report, 2011 / Y20, Geophysical surveys at Cadbury Hill, Congresbury.

Objectives

To use a Nivcomp, electronic, hydrostatic level, and process the data using the Surfer 10 programme (Golden Software, USA) to:

1. Enhance, by illustrating the contour and 3-dimensional appearance, previously recognised archaeological features; a 'D' – shaped enclosure; features adjacent to the 'citadel'; an embanked circular enclosure (Corney, 2004), and a more detailed description of a circular platform (Corney, 2004, YCCCART 2012/Y2).

2. Survey an area of the previously unrecorded west end of the hill fort, noted in Corney's survey, (2004).

Methodology

The sites to be surveyed were selected from the manual (YCCCART 2012/Y2), and Corney, (2004) *[YCCCART 2011/Y6]*, surveys (appendix 1a and b). The relationship between sites 2, 3, and 4 (see below) are shown in appendix 1c. In order to show the three-dimensional appearance of the selected features, grid surveys using an electronic, hydrostatic level (Nivcomp), were performed (appendix 2). Tapes were laid, relative to baselines established for either the manual, (YCCCART 2012/Y2), or RM15 (YCCCART 2011/Y20) surveys, to determine the features to be investigated. For each feature, a zero point for the electronic hydrostatic level was established, and height readings in millimetres above or below the zero point were recorded in a table. An appropriate interval of recording (for example, 0.5, 1 or 2 metres [m]) was selected, specific for each feature, which was considered to provide the best representation. Where a larger interval, for example, 2m, was chosen initially, further, targeted areas could be surveyed, using smaller interval readings, for example, 0.5m and 1m, to give a more detailed image. The data were entered into an Excel file (Microsoft) and processed using the "Surfer" software programme (kindly donated by Golden Software, USA), (appendix2). Paper and electronic copies of the raw data are preserved in the archives.

Results

1. *A 'D-shaped' enclosure on the eastern ramparts*

Two 'D'–shaped enclosures (Fig 2) were shown on the Corney 2004 survey (YCCCART, 2011/Y6, YCCCART 2012/Y2) (Appendix 3), and form terminals of the inner rampart on either side of the presumed north-east entrance (discussed by Corney, 2004, p14, item 4.2.3). These D-shaped enclosures, when added to a pre-existing earthwork, are thought by Dark (2001) to be a good indicator of post-Roman re-occupation. The slightly smaller, more northerly, of the two features was chosen (YCCCART 2012/Y2).

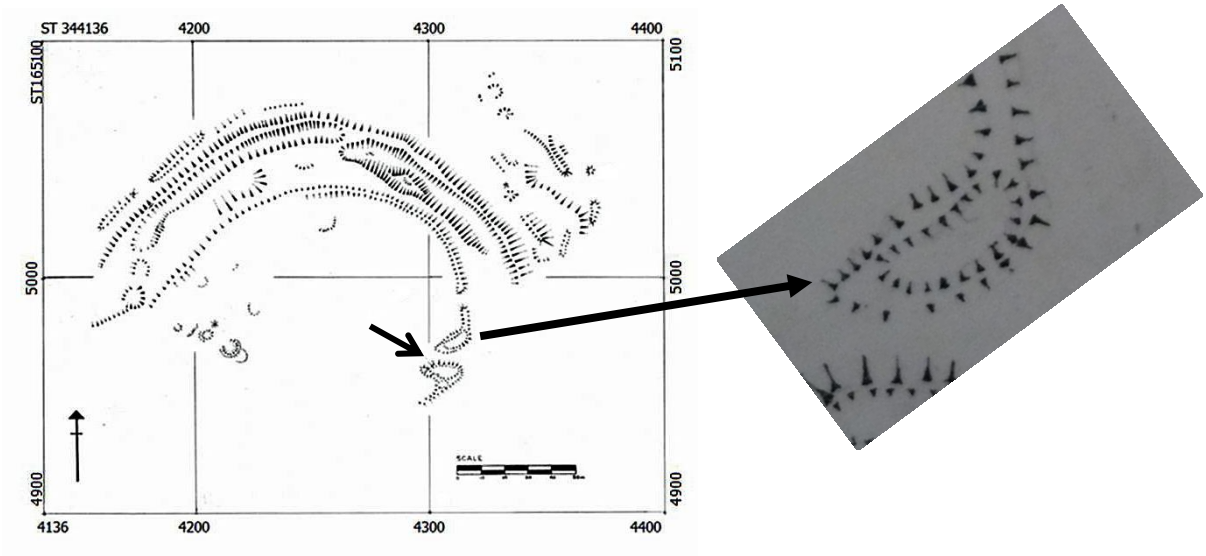


Figure 2. Extract from Manual survey (YCCCART 2012/Y2). 'D'-shaped enclosures at eastern end of northern ramparts (small arrow). Surveyed, northerly enclosure shown on enlarged area.

It was, however, only faintly discernible (Fig 3), and was considered a suitable subject to attempt to demonstrate its shape in 3 dimensions.

A tape grid, 22 x 17m, was laid out using the manual survey baseline (appendix 3) with the X axis, westerly at 1 m intervals (23 columns), and the Y axis northerly at 0.5 m intervals (35 columns). The Z axis was the height above, (+), or below, (-), the zero point, within the feature, in mm. These values were measured and recorded on paper. Maximum heights above or below the zero point were 642 to -1583 mm respectively. The raw data were processed electronically as described previously, and a contoured, 3-dimensional image, (Fig 4), was prepared. The final result confirmed the slightly oval shape of the feature, and corresponded well with the manual drawing.

Figure 3. A. The outline of the 'D'- shaped feature is faintly discernible among the vegetation. Base of the hydrosatatic level device, centre. B. The tape grid is laid over the feature.

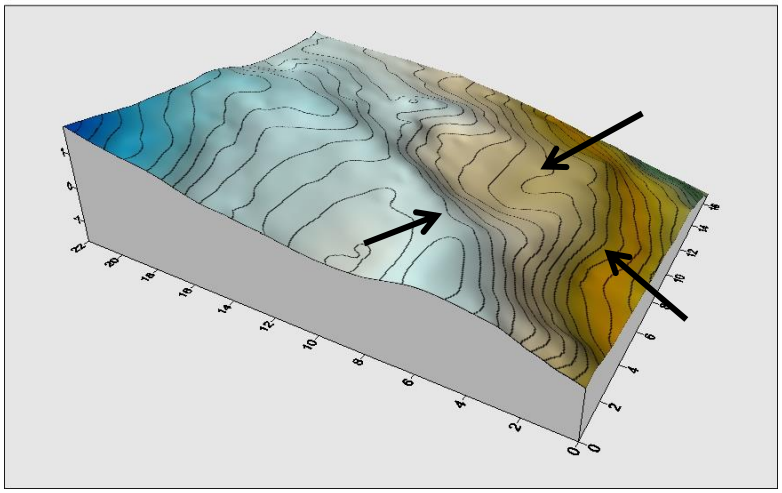


Figure 4. The 'D'- shaped feature (arrows) is represented by the contoured, 3-dimensional figure.

2. *Features adjacent to a roughly circular, walled enclosure* (*the 'citadel')*

At the eastern edge of the roughly circular, walled enclosure, (Corney, 2004), believed to have been created in the Victorian era (Fig 5), two features in a linear, north-south orientation, close to the wall of the enclosure, with the ground falling away on a fairly steep slope at the eastern edge (Fig 6), were surveyed.

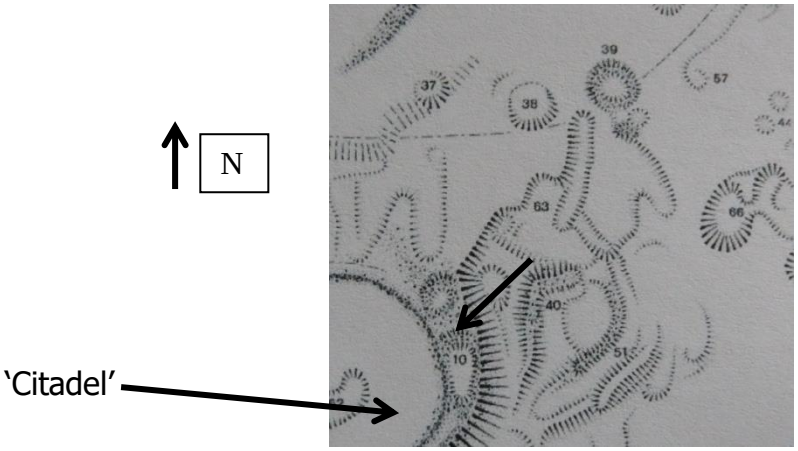


Figure 5. Extract from Corney's 2004 survey (appendix 1). Features (arrow) at eastern edge of the roughly circular, walled enclosure ('citadel').

Figure 6. A. The features looking south, 'citadel' to the right. B, the features looking north.

A tape grid, 10 x 27m, was laid out using the manual survey baseline (appendix 4). The zero point was set within the feature. Heights were measured at 1 x 1m intervals, with the X axis, southerly (11 columns), and the Y axis northerly (28 columns). The Z axis was the height above, (+), or below, (-), the zero point in mm., and the results were recorded on paper. Maximum heights above or below the zero point were 43 to -1921mm, respectively. The raw data were processed electronically as described previously, and a contoured, 3-dimensional image (Fig 7), was prepared. This corresponded well with the manual survey, showing circular and oval platforms.

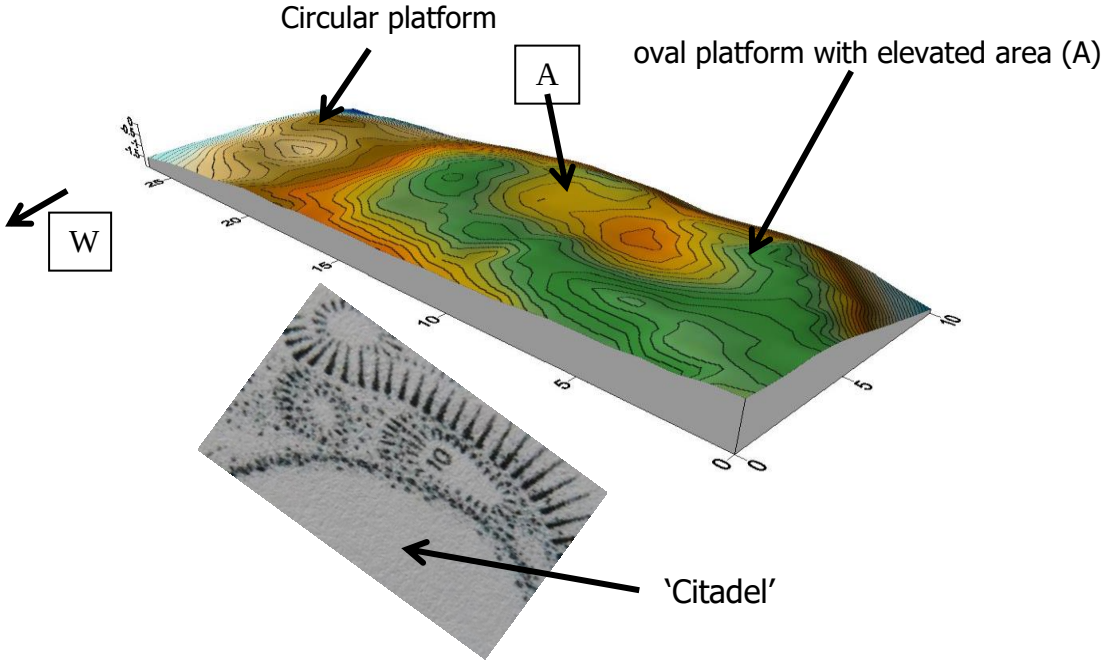


Figure 7. 3-dimensional image above, corresponding to the circular platform and oval feature (10), from Corney's, 2004 survey, below. A, elevated area; W, west.

The small circular platform at the northern end of the two features was confirmed. The oval feature, however, may represent a similar platform enclosing an elevated area.

3 *An embanked circular structure*

This feature is situated at the northern edge of the hill fort (Fig 8), and slightly easterly [see Corney's survey, (2004, feature 39)]. A tape grid, 9 x 9m, was laid out over the feature, related to the RM 15 grids (appendix 5). Heights were measured at 1 x 1m intervals; X axis, northerly (10 columns), and the Y axis westerly (10 columns). The zero point was set in the centre of the feature. The Z axis was the height above, (+), or below, (-), the zero point in mm. The results were recorded on paper. Maximum heights above or below the zero point were 600 to -626 mm respectively. The raw data were processed electronically as described previously, and a 3-dimensional image produced (Fig 9). This corresponded well to the manual survey.

Figure 8. A, the embanked circular structure with the base of the hydrosatatic level (arrow) at the centre, looking west. B, the embanked circular structure, looking south. Base of the hydrosatatic level at the centre (arrow); tapes at northern edge of the feature.

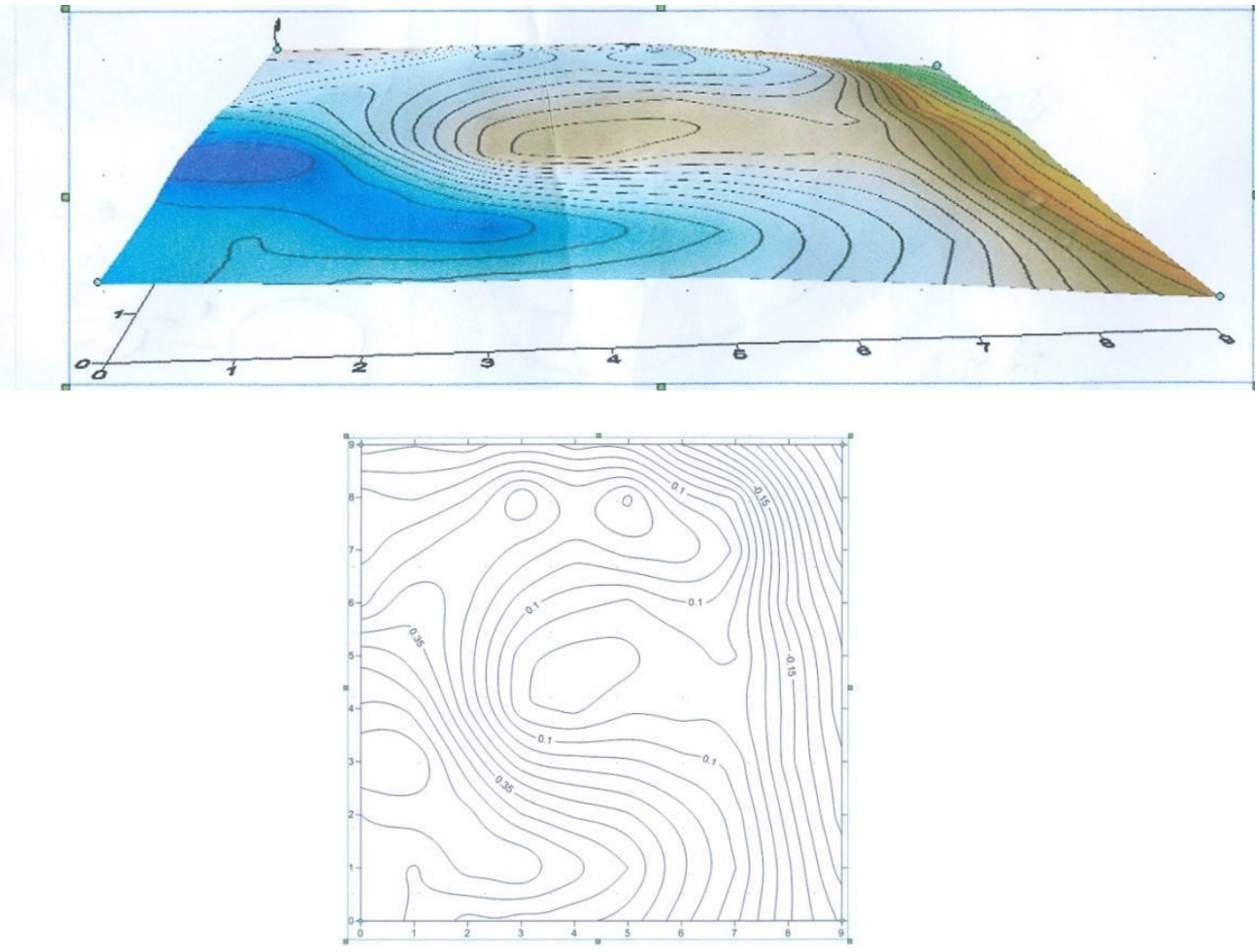


Figure 9. 3-dimensional (above), and contour, (below), images of the embanked circular structure.

The survey was repeated two years later (2014), following concerns over possible damage to the surface (appendix 6). The image obtained was similar to the earlier one, varying slightly because of the difficulty of placing the tapes exactly as previously,

(appendix 5). Nevertheless, it was sufficiently similar, to conclude that the original structure was unchanged.

4 *A circular platform*

See Cadbury manual report*, (YCCCART 2012/Y2).* This feature (Fig 10) is situated at the northern edge of the hill fort and slightly easterly, (appendix 7). It was identified on a northerly facing slope just below the embanked circular structure (3), (above).

Figure 10. A, The electronic hydrostatic level is shown in the centre of the feature. B, using the level to measure heights above and below the zero point.

A tape grid, 8 x 16m, was laid out using the manual survey baseline (appendix 7). Heights were measured at 1m intervals along the X axis, northerly (9 columns), and 0.5 m intervals along the Y axis westerly (17 columns). The zero point was set in the centre of the feature. The Z axis was the height above, (+), or below, (-), the zero point in mm. The results were recorded on paper. Maximum heights above or below the zero point were 684 to -357 mm. The raw data were processed electronically as described previously, and 3-dimensional and plain contoured images were produced (Fig 11). This corresponded well to the manual survey.

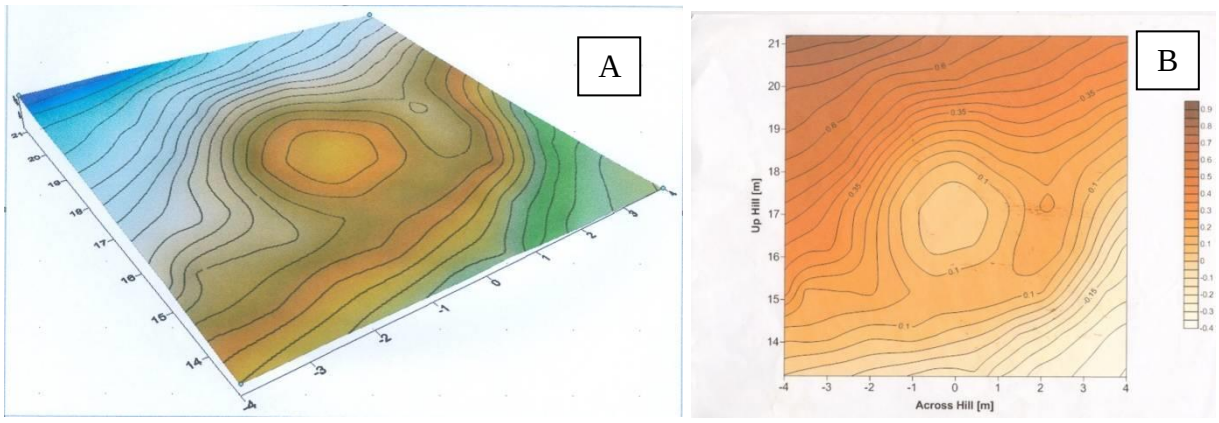


Figure 11. 3-dimensional (A), and contour (B), images of the circular platform. [Fig B appeared in the Cadbury Manual report - YCCCART 2012/ Y2]

5 *Survey of a previously unrecorded area of the west end of the hill fort*

The west end of the hill fort, covered previously with low scrub/brambles, was cleared by YCCCART members, in the spring of 2012. This enabled an area, related to the RM 15 grids, to be surveyed (Fig 12).

Figure 12. Surveying the west end, Grid 1. A, looking west; B, looking north east.

The area covered 40m (east – west) x 30m (north – south) and was surveyed in two parts, as Grids 1 (20 x 30 m) and 2 (20 x 30m) (appendices 8 and 9). For each grid, heights were measured at 2m intervals along both the X (east – west) and Y (north – south) axes. The zero point was established within each grid, and the difference in height between the 2 zero points was recorded. The Z axis was the height above, (+), or below, (-), the zero point in mm. Maximum heights above or below the zero point were 1041 to – 1479 mm For grid 1, and 711 to -1359 mm for grid 2. The results were recorded on paper, and the raw data were processed electronically as described previously. Individual grids were plotted, and contour images were produced for grid 1 (Fig 13), and 2 (Fig 14).

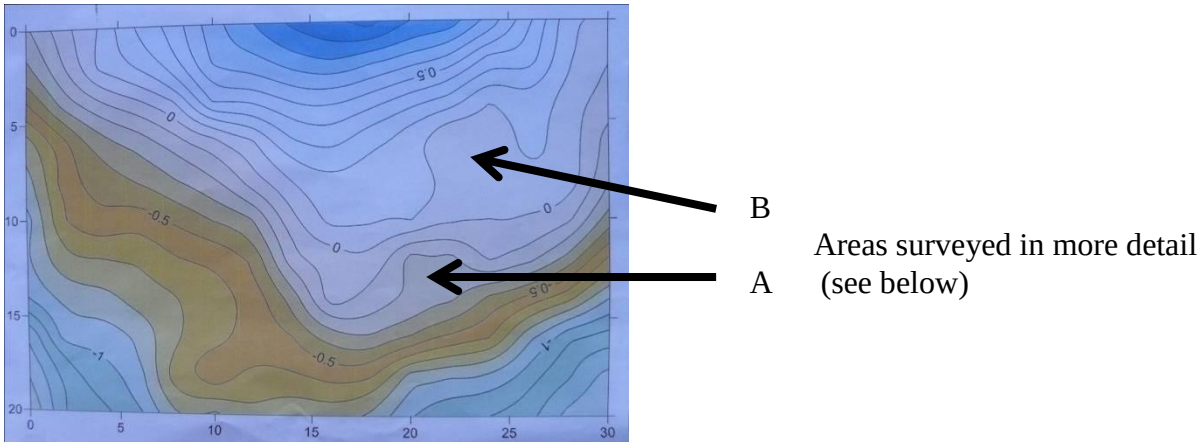


Figure 13. General survey, Grid 1. Contour plan. (Arrows indicate features of interest)

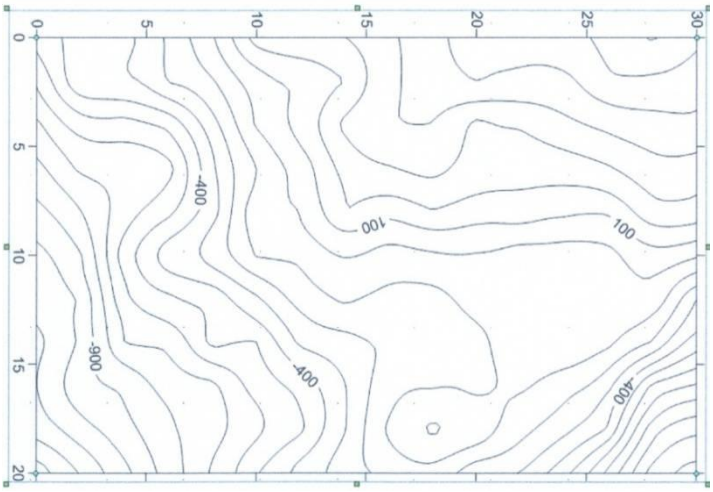


Figure 14. General survey, Grid 2. Contour plan.

In grid 1, two areas were identified (Fig 13, A and B, arrowed), in which prominent interruption of the contours was seen. One of these, (A), corresponded with a slightly depressed, faintly circular area (Fig 15); and (B) corresponded with a more regular, 'square' shape (Fig 16). These features were targeted for a more detailed investigation.

Figure 15. Indented contour area in grid 1, identified on the ground. (Looking west).

Figure 16. 'Square' shaped area in grid 1, identified on the ground. (Looking west).

For feature A, a 7 x 6 m grid, was chosen, centred on the designated area (appendix 10). At intervals of 0.5m westerly, and 1m southerly, heights above, (+), and below,

(-), the zero point (within the feature), were 423 to -167mm respectively. For feature B (appendix 11), a 9 x 9 m grid at intervals of 1 m westerly and 1 m southerly, again centred on the area, was chosen. The zero point was established at the north-west corner. The Z axis was the height above, (+), or below, (-), the zero point in mm and the maximum readings above and below were 927 to -165mm. The results were recorded on paper. The raw data were processed electronically as described previously, and 3-dimensional images produced (Figs.17 and 18).

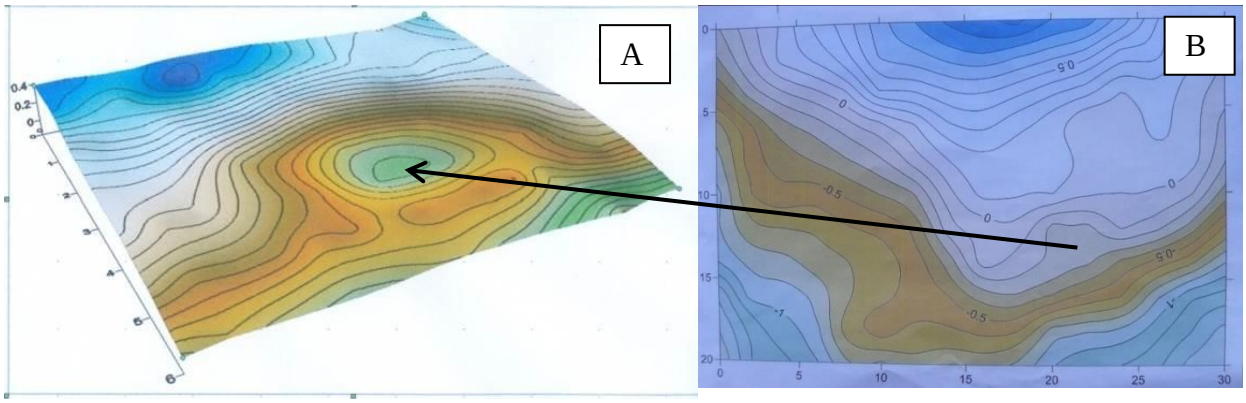


Figure 17 A. Grid 1, feature A. B, Figure 13, repeated for comparison.

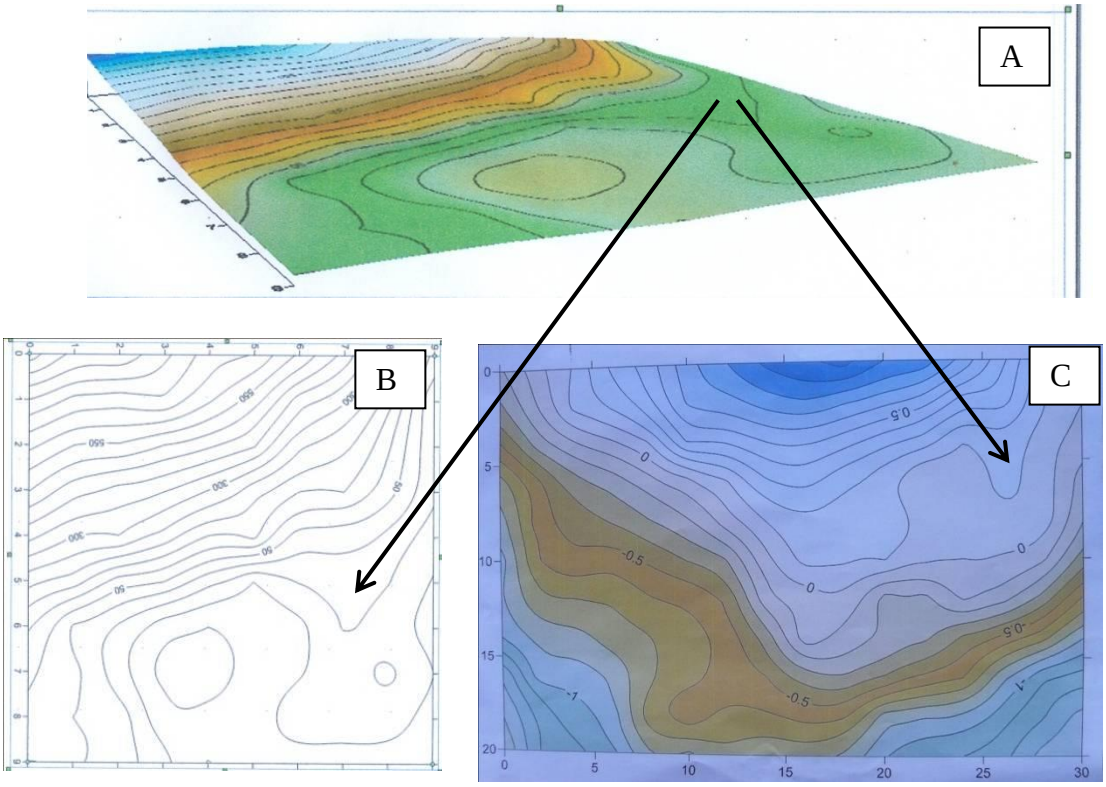


Fig 18. Grid 1, feature B. A, 3 dimensional representation; B, contour plan; C, Figure 13, repeated for comparison.

Thus, feature A was shown to have an approximately circular, low profile, when surveyed in more detail, and these findings may be consistent with the base of a circular platform. The detail was less clear in feature B, which had a 'square' profile.

Nevertheless, a hint at a circular profile was seen, and this may also, cautiously, represent a circular platform.

Comments

This report describes in detail the use of an electronic, hydrostatic level (Nivcomp), to survey, manually, archaeological surface features, and the use of computer software (Surfer 10 programme, kindly provided by Golden software, USA). It has been used in 2 ways: firstly, to examine features identified previously by manual survey, and represent them by contour and 3- dimensional images; and secondly, survey an area of the hill fort, not subjected previously to a manual survey.

For the first objective, several features were defined by this novel method, namely a 'D'-shaped feature (site 1), circular platforms (sites 2, 4, and 5A), and an embanked circular enclosure (site 3).

In Corney's 2004 survey he described a site (numbered 10) which corresponds to site 2 of the present study. He considered that, 'in form, this feature was similar to the 'D' shaped enclosures or chambers flanking the eastern entrance of the hillfort'. The current survey suggests that the smaller of the two features represents a circular platform, adjacent to an oval structure. Using the electronic, hydrostatic level, this latter feature was further shown to have a 'circular' profile enclosing a more level area. This had not been observed on the earlier survey (Corney, 2004). Furthermore, taken together, the two features at site 2 do not resemble the 'D' shaped enclosure, shown for site 1.

Three of these features, (sites 3, 4 and 5A) appeared to be 'cut' into the contours of the ground, making it less likely that they were natural features. Corney, (2004), describes 'terracing' into the hillside for some of these features, and his observation compares well with the current contour findings using the electronic, hydrostatic level. A fourth feature, (site 5B), was less obvious. Nevertheless, it was selected from a more general survey (site 5), and had some features suggestive of a potential circular structure, which were not immediately obvious on the ground. It is possible that this represents a similar structure to sites 2, 4, and 5A, but has been more severely eroded. Furthermore, since the technique can be modified to suit the feature being surveyed, a more detailed survey of this latter feature, perhaps at 0.5m intervals might clarify the above findings.

It was of interest that on retrospective examination of the embanked circular enclosure and circular platforms described above, they all appeared to have a small break in the contours at one point. It is tempting to speculate that these may represent possible 'entrances.' However, these 'entrances' faced in different directions, and since the features are frequently 'terraced' into the contours of the hillside, this may reflect the natural slope, rather than an 'entrance'. Further work, on future similar features, may help to clarify this.

Two of these features (sites 5A and B) were only suspected following a more general survey, indicating that under certain circumstances, where a larger area has

not been surveyed previously, some features can be identified and then investigated in more detail. Thus, for the first time, a feature, (site 5A), not easily recognised on the ground, was identified by a general survey, and clearly defined by a more detailed, targeted investigation.

The surveying technique using an electronic, hydrostatic level and computer software to produce 3-D images, also affords the potential to monitor surface features over a period of time. For example, there was concern that the embanked circular enclosure (site 2), may have been potentially damaged, subsequent to the initial survey. However, re-surveying the feature two years later (appendix 6), clearly indicated that there had been no change, since the 2 images, were almost identical (the axis of the second survey varied slightly from the earlier one).

In conclusion, this novel use, to the authors' knowledge, of an electronic, hydrostatic level, has potential as an aid to manual surveying on 'archaeological' sites.

Recommendations

Continue using the electronic, hydrostatic level, described in this report, on other sites to further appraise its use.

References

Corney, M, 2004. *Cadbury Hill Fort: an Analytical Survey*. YCCCART Report 2011/Y6 (www.YCCCART.co.uk)

Dark, K. 2001. *Britain and the end of the Roman Empire. Tempus*

YCCCART Report, 2011 / Y20. *Geophysical surveys at Cadbury Hill, Congresbury.*

YCCCART Report, 2012 / Y2. *Manual survey of north east ramparts of Cadbury Congresbury Hill Fort, 2008-2011*

Appendix 1

a) - Survey of Cadbury - Congresbury Hill Fort, 2004. (Mark Corney)

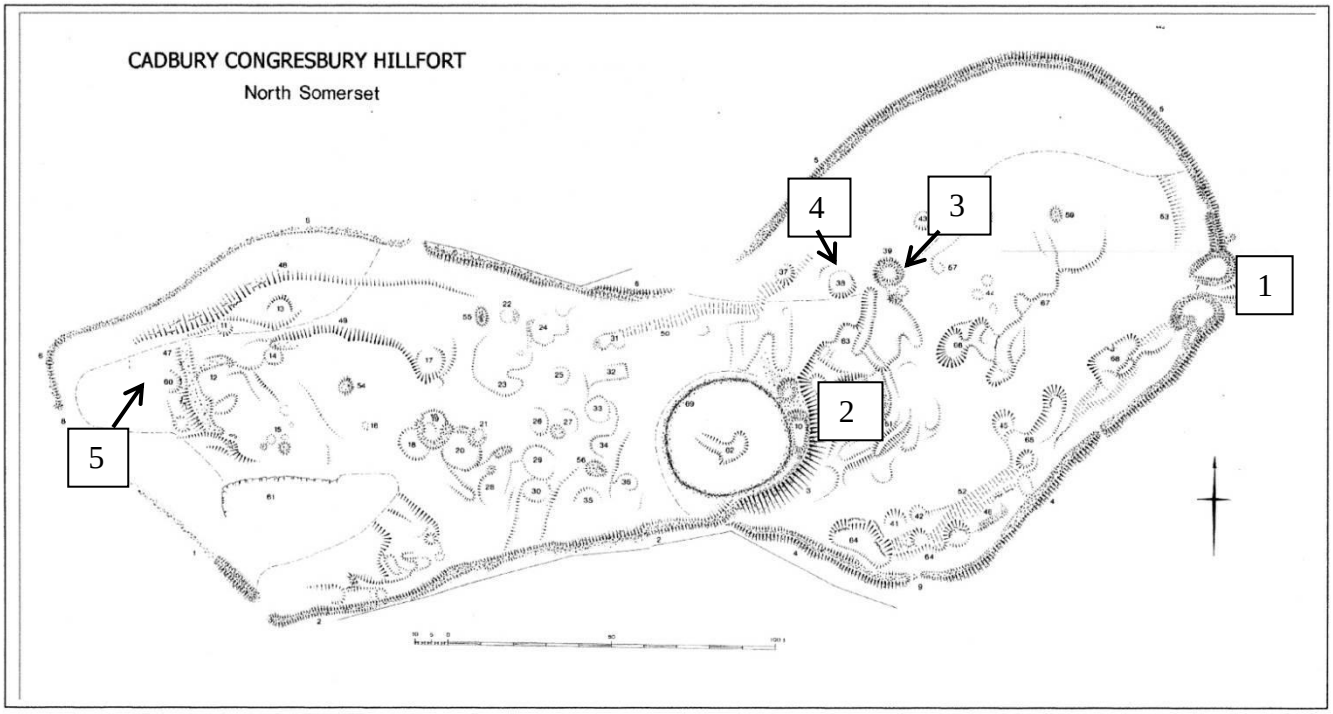
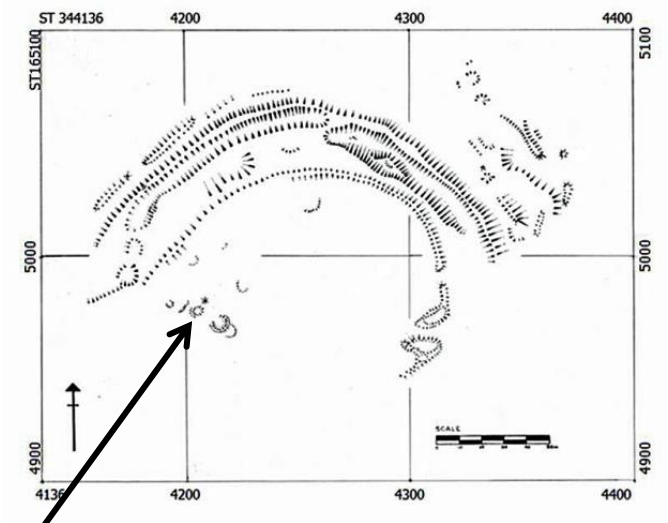


Fig 3: Main survey drawing

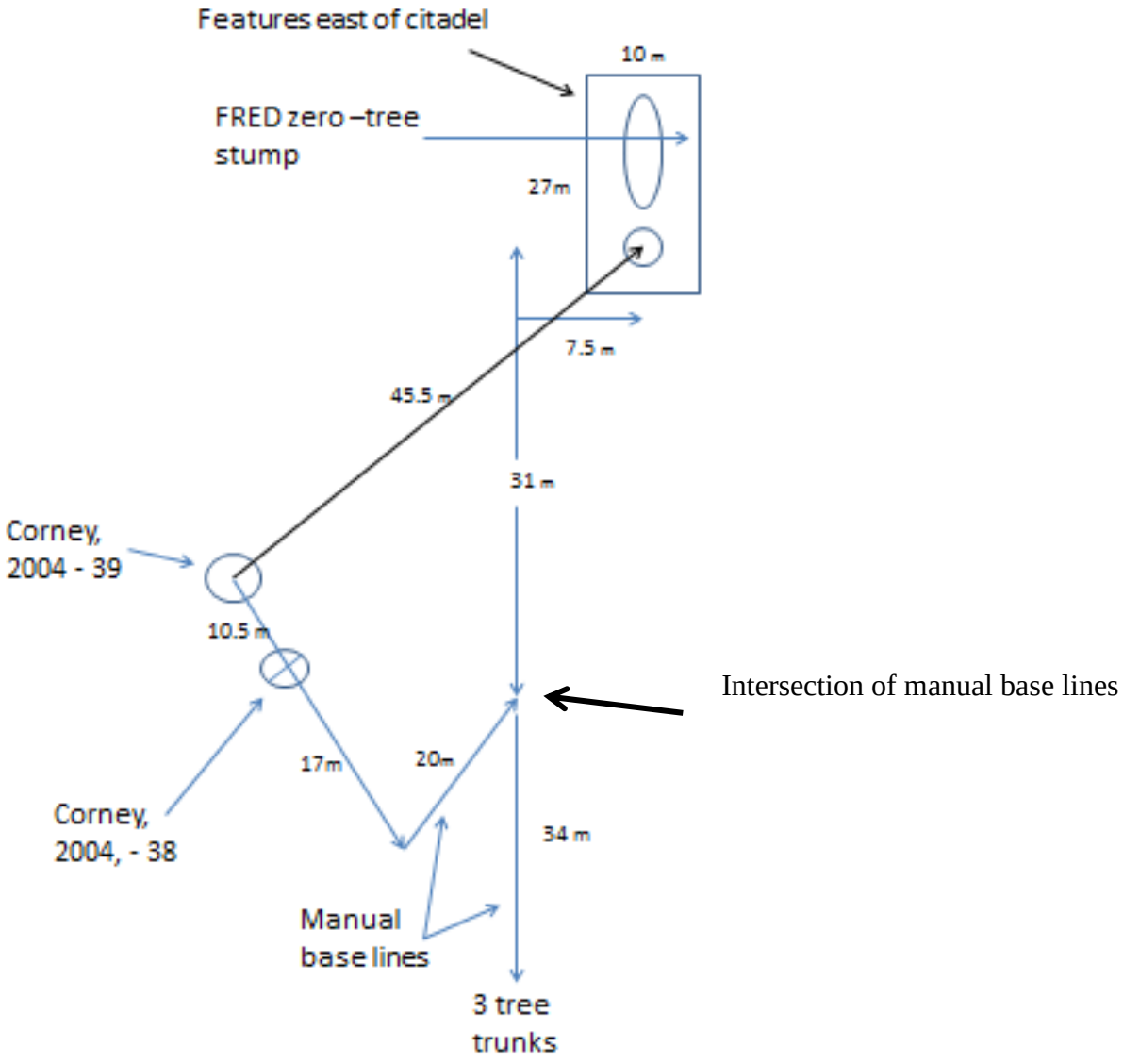
1, 'D' enclosure; 2, Features east of the 'citadel'; 3, embanked circular enclosure; 4, circular platform; 5, West end survey, and targeted features (5A and 5B).

b) Manual survey of northern ramparts (YCCCART 2012/Y2)



4, circular platform, reported in YCCCCART 2012/Y2.

c) Relationship between the features east of the 'citadel' (No.10, Corney, 2004), an embanked circular enclosure (No.39, Corney, 2004; *YCCCART 2012/Y2*), and a circular platform (No.38, Corney, 2004; *YCCCART 2012/Y2*).



Appendix 2

The use of the NIVCOMP electronic, hydrostatic level; data recording, and use of 'Surfer'.

Equipment: Nivcomp, electronic, hydrostatic level

Manufacturer / Supplier:
Dietzsch and Rothe MSR-Technik OHG
Olzmannstrasse 47/ D-08060 Zwickau
Germany
Website: www.dirotec.com

Setting up a grid, and using the electronic, hydrostatic level

Table for entering readings

Entries = Z axis

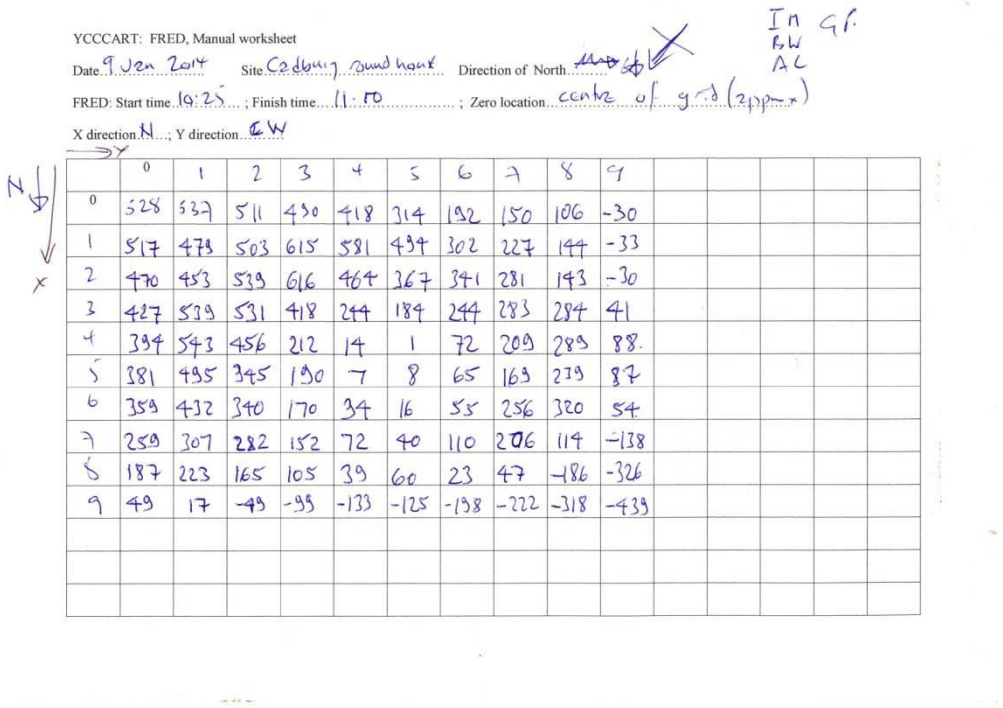
N ↑

Y axis →

X axis ↓

	0	1	2	3	4	5
0						
1						
2						
3						
4						
5						

Table showing readings (raw data);



YCCCART: FRED, Manual worksheet

Date 9 Jan 2014 Site Cadbury Quad bank Direction of North

FRED: Start time 10:25 ; Finish time 11:50 ; Zero location centre of grid (approx)

X direction N ; Y direction E W

In GF
BW
AL

	0	1	2	3	4	5	6	7	8	9
0	528	537	511	430	418	314	192	150	106	-30
1	517	479	503	615	581	494	302	227	144	-33
2	470	453	539	616	464	367	341	281	143	-30
3	427	539	531	418	244	184	244	283	284	41
4	394	543	456	212	14	1	72	209	289	88
5	381	495	345	190	-7	8	65	169	279	87
6	359	432	340	170	34	16	55	256	320	54
7	259	307	282	152	72	40	110	206	114	-138
8	187	223	165	105	39	60	23	47	-186	-326
9	49	17	-49	-99	-133	-125	-198	-222	-318	-439

Excel file entry from above table;

Xm	Ym	Zmm
0	0	528
0	1	537
0	2	511
0	3	430
0	4	418
0	5	314
0	6	192
0	7	150
0	8	106
0	9	-30
1	0	517
1	1	479
1	2	503
1	3	615
1	4	581
1	5	494
1	6	302
1	7	227
1	8	144
1	9	-33

Entry shown is X axis from 0 to 1m, Y axis 0 to 9m, as part of the 9 x 9 m grid.

Computer screen shot of Surfer programme.