NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION

ARCHAEOLOGY IN NEW ZEALAND

PINPOINTING A BURIED FORT ON POINT RESOLUTION, AUCKLAND

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INTRODUCTION

Point Resolution is the northeastern tip of the Parnell ridge, separating Hobson Bay from Judges Bay on the south shore of the Waitemata harbour (Fig. 1). It was one of three shoreline forts built for Auckland's defence in the 19th century, the New Zealand government having perceived threats from Russian naval forces in 1855 and 1877 (Fraser 1986: 47, 294). The other two were North Head and Bastion Point.

The Point is composed of Waitemata sandstones and Parnell grit sediments with a mixture of rubble and soil on top (Ballance 1979) and it has almost vertical sides to east and west. There is a small park on the point, with a footpath on the eastern margin which connects St Stephen's Avenue to a staircase descending the point to a footbridge over a channel at the foot (Fig. 2). The bridge leads to a causeway carrying the railway and a road. On the construction of the causeway in 1926 the tip of the point was removed (Johnson 1988: 123, 128). A channel was cleared inland of the railway embankment to provide tidal flushing between Judges and Hobson bays.

On the west side of the park there is a 3 m bank covered in trees and scrub, running southeast to northwest. Between this bank and the cliff edge is a large hotel. The clear level ground of the park is approximately 1125 sq m. There are also trees on the eastern cliff edge, and to the north and south.

The research reported here was carried out as coursework towards a Masters degree at the University of Auckland. The intention of the research was to apply the resistivity survey technique to the problem of accurately locating the buried 19th century remains of the last phase of the fortress on the point. Fig. 3 is a sketch plan of the fort in September 1891, in its final configuration (Mitchell 1991).

The shape of the point has since changed (compare Figs. 2 and 3). The park was thought to cover more than half the area inside which most of the fort probably lay. It was considered undesirable to undertake extensive exploratory excavations to establish its location. However, if some identifiable features could be found through survey and limited excavation, the position of the defences could be extrapolated.

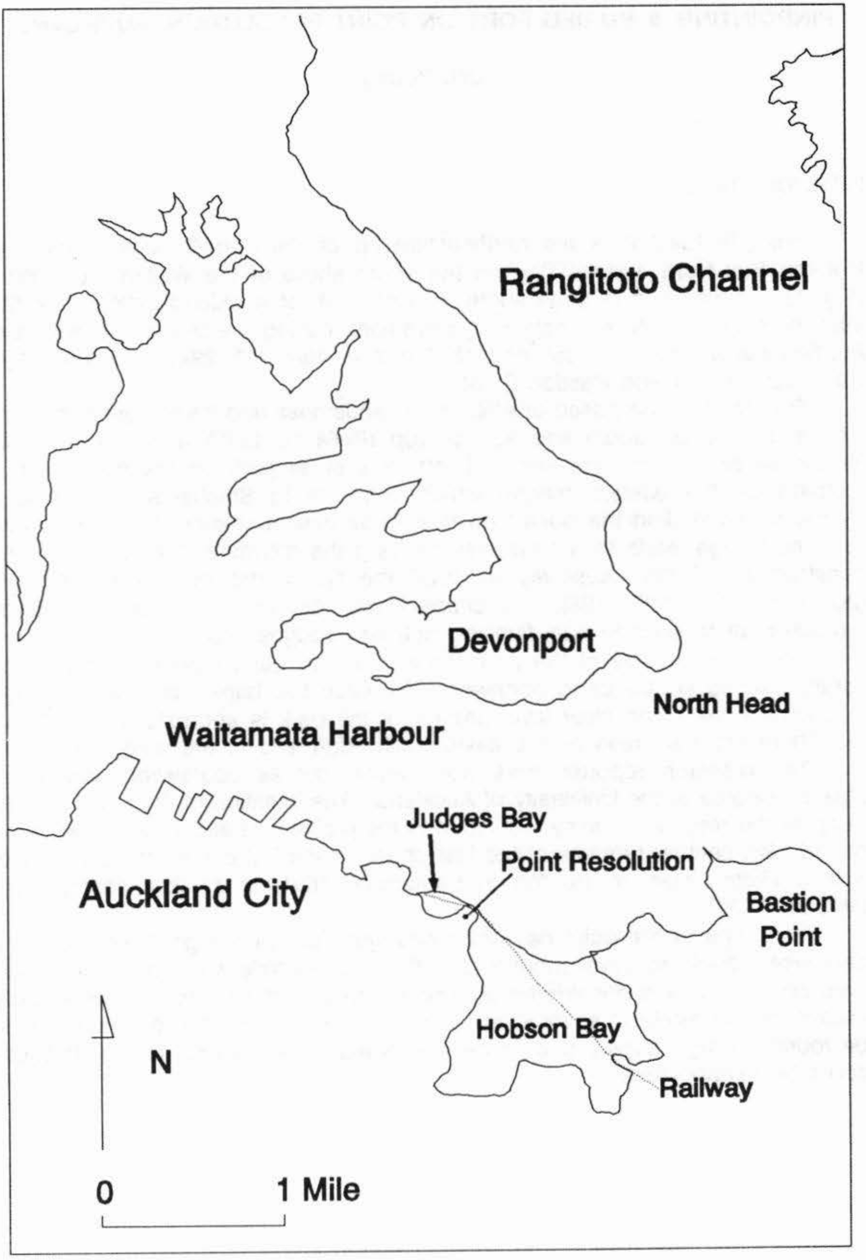

Fig. 1. Location map

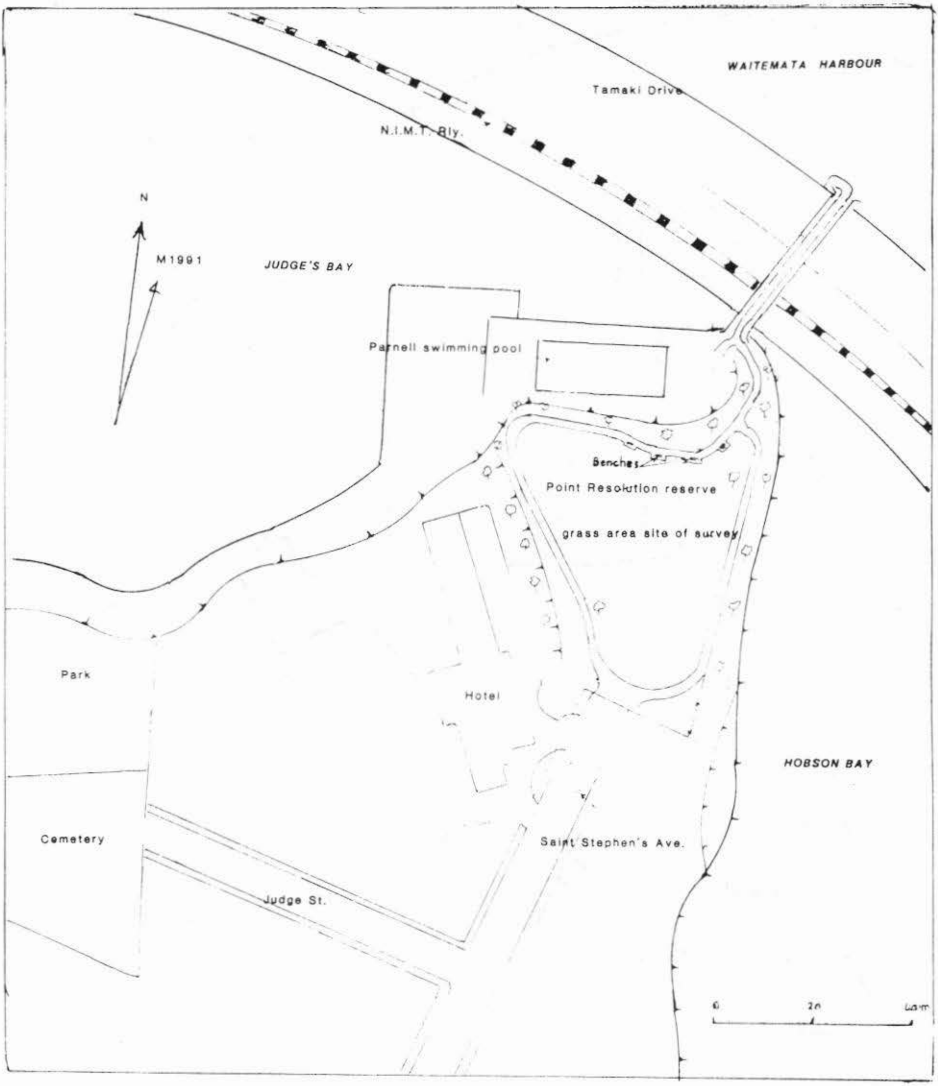

Fig. 2. Location of Point Resolution Reserve.

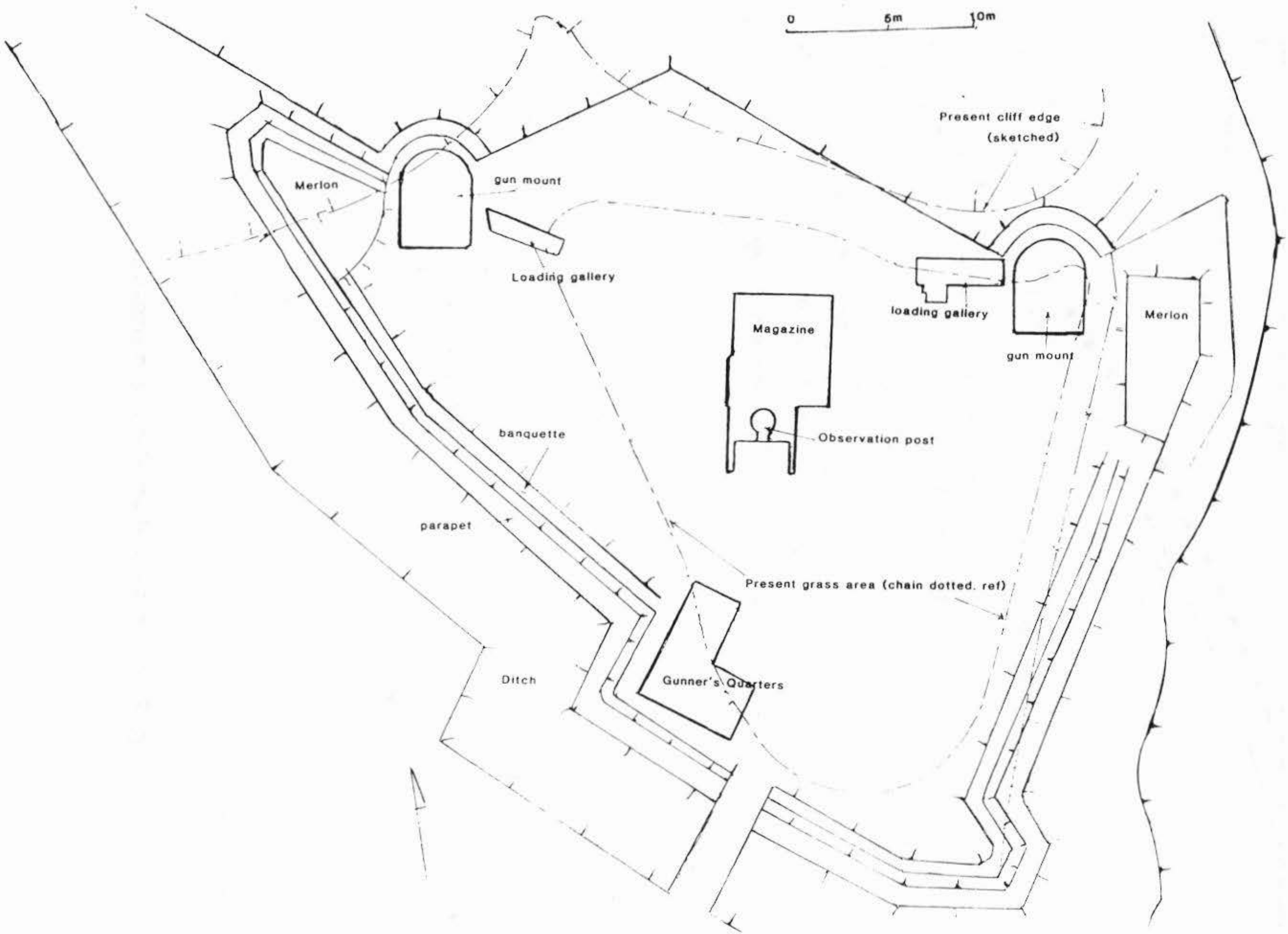

Fig. 3. Fort Resolution after September 1891 (Mitchell 1991).

METHODOLOGY

According to Clark (1969: 701) and Carr (1982: 60), a critical factor in resistivity surveying is the weather, and one is advised that a long dry spell before the survey will usually give the best results (Weymouth 1986: 321). Point Resolution is a fairly well-drained area. Three days without rain constitutes a reasonably long dry spell in Auckland, and the survey was carried out at the end of such a period. The equipment used was a resistivity surveying kit made by the University of Surrey, a prismatic compass, and 50 m tapes.

Resistivity surveying consists principally of ascertaining the characteristics of groundwater between two probes. All groundwater contains dissolved minerals or salts and is therefore a good conductor of electricity. (Pure water is not.) The groundwater situation may vary between that of a totally saturated loose organic fill in, say, a well, and a perfectly dry open air space. The former would present little resistance to an electric current, the latter a great resistance. There are many possible variations between these two extremes, depending on the porosity of the ground, and it is possible to deduce the presence of masonry, compacted roadworks, filled ditches, holes, trenches and the like according to differences in resistence across an area. The weather is an important factor (Carr 1982: 48), since the resistivity readings vary according to weather conditions, for both the soakage of rainwater by different substances and the rate of transpiration and evaporation vary.

Resistivity is defined as resistance per unit area of section of a conductor, and thus for a fixed cross-sectional area resistivity may be considered an indicator of the kind of material through which a current is flowing, depending on the amount and distribution of water in the material.

The process consists of running a small direct current from a dry-cell battery between two earth probes. The size of the current is known to the instrument at the time of measurement. Another pair of probes in a separate circuit, a measured distance apart, detect the electric potential between each other due to the field set up by the first pair and read this with a voltmeter. This voltage, together with the known current, gives the resistance between the second pair of probes (Ohm's Law). Because the cross-sectional area between the second pair of probes is fixed, the resistivity of the material is a function of that resistance. Because the water in the pores of the material will be of fine cross-section its ionisation by the current flow would rapidly change, and the voltage and current readings change also. Therefore an inverting device in the current circuit converts the current to alternating current. Ionisation of the water thus also alternates rapidly and, in effect, remains constant. The alternating current also cancels out the influence of other earth currents present, such as galvanic action between different minerals (Leute 1987: 13).

The meter has five probes, all being of equal length, and connected by flexible wires to a five-way rotary switch. Any position of the switch will ensure that one probe, identified by a colour code on the probe and on the switch, will be inactive, and the other four will be activated in an array in which, in a line of four, the two outer probes will provide the current, and the two inner probes will provide a resistance reading on a gauge. With this arrangement a grid line can be traversed rapidly by using the 'spare' probe to leapfrog the others, each probe in turn becoming the spare. The in-line array is known as the *Wenner* array, and is convenient and fast, though it has the slight disadvantage that a single object such as a wall crossed at right angles may show itself as a double peak reading (Leute 1987: 13).

THE SURVEY

A tape was used as a base line, running for 40 m on a heading of 260 degrees magnetic at the north end of the area. It started at zero metres at the eastern fence and ran straight and tangential to the rear faces of the concrete bases of two public benches on the northern fringe of the park (see Fig. 2).

The resistivity readings were taken along tapes running at headings of 170 degrees magnetic, spaced at 2 m intervals along the base tape. The first tape was roughly parallel to the eastern margin of the park. Readings were taken at 1 m intervals along these lines using the *Wenner* array of probes and readings were recorded as they were taken, on a graph-paper chart matching the ground grid.

The probes were about 18 cm long and rarely struck hard material, which could always be avoided by moving the probe a centimetre or two (Clark 1969: 704). The lines ended at the footpath that surrounds the park, and were of varying length, the longest being 46 m. The survey took two–four people about four hours.

The resistivity readings were entered from the chart into a computer program (SDR 3.1 (Datacom)), which converted them into a contour map (See Fig. 4). Each entry has three components: the resistivity reading (in ohms per square metre) and the X (northing) and Y (easting) co-ordinates. Contour lines are lines joining points of equal resistance and must have some coherent regular interval, for example, lines may be required at readings of 50 ohms, 75 ohms, 100 ohms and so on. But the actual readings are not so regular. If the program is plotting, say, a 100 ohm contour it may be contemplating a point in a square between readings of, say, 98 ohms, 104 ohms, 97 ohms, 105 ohms. Its points are very close together to form in effect a line, and it does the interpolation of the points by triangulating from neighbouring readings, attempting to keep the triangles as near to equilateral as possible. It produces these joined points at great speed, and the resulting contour map can be edited, for example, the frame size changed, the contour interval altered if the lines are too close, and so on.

Fig. 4. Computer-drawn 'contour' map of survey results.

RESULTS

This map was then compared with the 19th century plan (Fig. 3) of the fort's last configuration. The most conspicuous feature of the contour map is the large rectangular indication in the northwest corner. Its similarity with the magazine shown on Fig. 3 is noticeable, in size, shape and in its distance from the eastern cliff edge. This alone could not prove its identity, but the contour map also shows an anomaly at the southern end. Again, high resistivity readings suggest the possibility of a heap of rubble, masonry, brickwork or comparatively solid material compatible with the gunner's quarters shown in a similar position on Fig. 3. There is a further anomaly at the northeast corner of the contour map which could be associated with the eastern gun platform shown on Fig. 3 or its associated loading gallery. The western gun emplacement position is not clearly indicated.

It was decided that a trench could usefully be dug to expose the south edge of the large rectangular anomaly in the hope that this would positively identify it. An excavation was therefore carried out under permit (no. 1991/21) from the Historic Places Trust.

EXCAVATION

Excavation was carried out during 19-23 August 1991. The following is a brief description of the results. The resistivity plot was used to select an area on the ground for excavation. The base line of the plot was set up again and the position of the large rectangular anomaly recalculated. A point near the centre of the southern edge was selected and a trench dug north-south across this area (Area A, Fig. 5).

This revealed concrete at a depth of 19 cm, which was exposed to show a concrete slab 80 cm wide running southeast to northwest ending in a flattened rough concrete dome. Below this dome, at a depth of about 27 cm, was the top of a double brick (cavity) wall running south-north. At this depth the brown topsoil, laced with broken bricks and cement tiles, interfaced with a yellow clay (Fig. 5).

The brick wall appeared to have a buttress, bricks being visible protruding from the east side, almost under the concrete slab. South of the concrete slab, a recent plank was uncovered, protecting a polythene pipe. Below it the wall continued to the south. There was now no cavity in the wall; the east face was smooth brickwork, the top eroded, covered to the west by rough cement.

The early construction materials used and the location of the wall in the position predicted by the resistivity plot and identified on the 1891 plan as the site of the magazine gave reasonable indication that the survey had accurately located the west wall of the magazine. Further investigation was undertaken to confirm this, however.

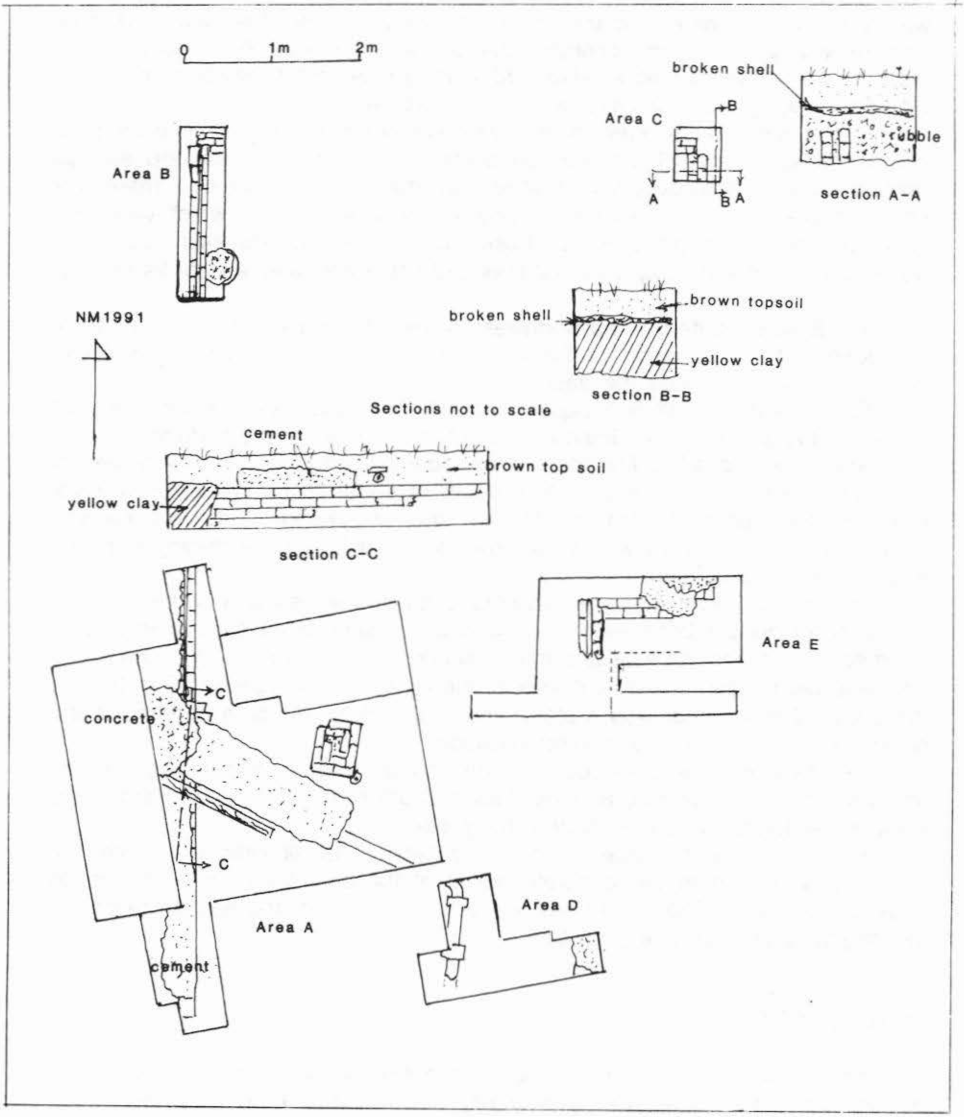

Fig. 5. Excavated areas: plans and cross-sections.

The wall was followed for 1 m south, at which point it took a steep slope downwards, and was assumed to be the entrance portal of the magazine. It was about 0.5 m thick. To the north the cavity between the inner and outer courses was probed and confirmed that the wall was over 0.5 m deep. The outer wall, though of bricks, also had a rough cement reinforcement on the outside, bringing the thickness up to about 0.5 m.

In the area to the east of the concrete dome the top of a brick pillar approximately 40 by 46 cm was encountered – 5 cm from the top an iron bracket carrying a hinge pin protruded from the southeast corner. There was also a rebate down the diagonally opposite corner of the pillar, which was seen to match the inner angle of the protrusion of brickwork on the east side of the wall opposite. Presumably these rebates had accommodated a door frame (Fig. 5).

Area B was located at the northwest corner of the anomaly, 10 m north of the portal. A continuation of the brick wall was found at the same depth, making a corner towards the east (Fig. 5).

Six m east of Area B a square (Area C) was excavated at the northeast corner of the anomaly, disclosing the northeast corner of the building.

Area D was sited to find the eastern portico, part of which was located at the extreme east of the trench. At a depth of about 20 cm, a cast iron water pipe about 6 inches (15 cm) in diameter was uncovered. This was followed north and found to curve westwards towards a similar pipe emerging from the end of the concrete slab in Area A.

Area E was excavated in an attempt to locate the east wall of the building. A crumbling double brick wall was found at a depth of 40 cm running north. It turned a corner to the east and then a second corner, continuing to the north. This was clearly the southeast corner of the building (compare with Fig. 3). To the south of this corner was a stone and rubble filled tunnel, a remnant of the earlier phase of the fort, a loading passage.

On the west wall, 2 m south of the northern corner, a testpit to find the magazine floor was begun, and reached a depth of 0.8 m through rubble and shingle. A shortage of time halted this probe.

The site was surveyed with plane table and alidade to locate the excavations relative to the concrete bases of the park benches on the north edge of the park. The datum was a point 14.4 m from the eastern fence on the original plot base line (Fig. 6).

CONCLUSIONS

The computerised contour map of the site showed an anomaly whose position coincided reasonably closely with the magazine ruins excavated. The resistivity of the anomaly, compared with the surrounding terrain, was what would be expected from the nature of the ruins. However, the resistivity survey gave no noticeable indication of the presence of a cast iron water main crossing the south end of the building at a shallow depth, which one might have expected, nor its concrete capping. Radar would probably disclose such a

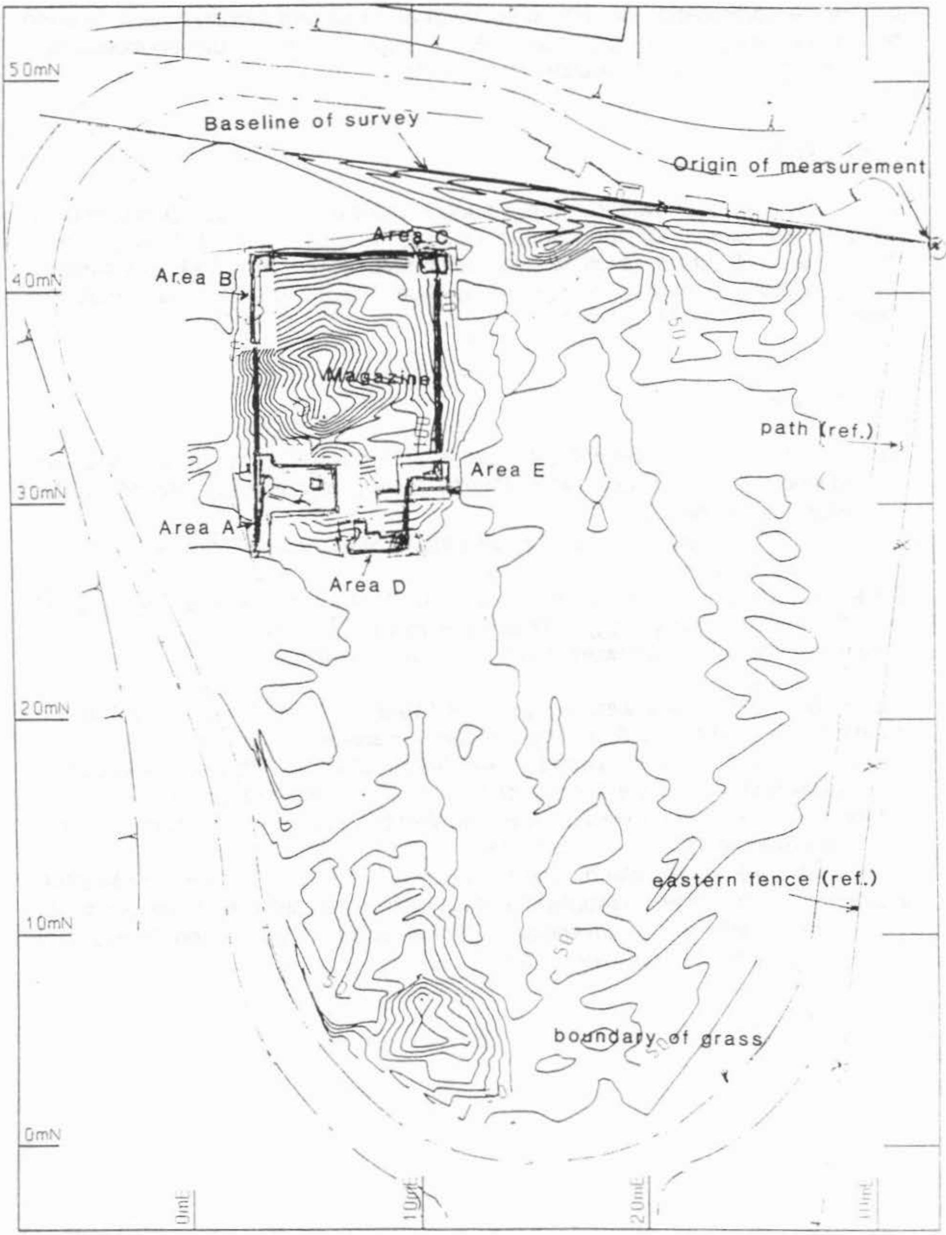

Fig. 6. 1891 magazine and excavation areas superimposed on Fig. 4.

feature. A combination of techniques such as radar plus resistivity is suggested by, for example, Weymouth (1986: 388). Magnetometry would doubtless also show supplementary information of this kind.

ACKNOWLEDGMENTS

I wish to acknowledge the valuable assistance in this undertaking of, among many others: Dr Doug Sutton, Dr Peter Sheppard, John Mitchell, Dominic Wilson, Stuart Bedford, Geoff Mosen, Helen McCracken, Annette Hugill, Amanda Young, Victoria Grouden, Wynne Spring-Rice, Wayne England, Tony Hall, Kim Tatton and Sheena McLachlan.

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