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**A64 YORK BYPASS TO MALTON  
BYPASS DUALLING  
GEOPHYSICAL SURVEY**

A PROGRAMME OF RESEARCH CARRIED OUT  
ON BEHALF OF

THE DEPARTMENT OF TRANSPORT

By

GeoQuest Associates

Department of Transport

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## SUMMARY

This report describes the results of geophysical surveys of nine areas adjacent to the A64 road between York and Malton. The aim of the surveys was to characterise archaeological and other features detected by earlier desk top and walkover studies. Geomagnetic measurements were made at 10x0.5m intervals using a fluxgate gradiometer and results presented as greyscale images on digitised Ordnance Survey basemaps with geophysical and archaeological interpretations. Data quality was generally good, although contamination by surface ferrous objects prevented detection of archaeological features in some areas (RPS147, RPS135). The major archaeological features located include extensive ditch systems in RPS164 and RPS100 (Whitwell-on-the-Hill), part of a rectangular enclosure in RPS116 (Fourth Milestone Farm) and a number of ring ditches of probable prehistoric date. Several archaeological features detected by air photographic survey were confirmed by the geophysical mapping.

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## INTRODUCTION

This report presents the results of geophysical surveys in nine areas adjacent to the A64 between York and Malton Bullen and Partners are the Consulting Engineers and RPS Clouston are their archaeological sub-consultants on the A64 York Bypass to Malton Bypass Dualling scheme promoted by the Department of Transport GeoQuest were commissioned to carry out the geophysical survey

The desk top studies and walkover surveys had identified a number of sites where geophysical survey was necessary to test for archaeological potential These formed the basis of the contract documents and one extra site was identified as requiring geophysical survey during the contract period

This report first presents the criteria by which sites were selected for survey and then describes the methods used for obtaining and processing the geophysical data The archaeological significance of our findings are then discussed in the light of the earlier desk and field work studies Appendices at the rear of the report provide technical descriptions of the geophysical and graphical methods employed

## SITE SELECTION

The table below lists the geophysical study sites (from south to north) and the reasons for their investigation

SITE	National Gnd Reference	AREA ha	LOCATION	AIMS OF SURVEY
116	SE652571	0.4	Fourth Milestone Fm	To characterise rectangular cropmark enclosure east of present road with west arm under road
147	SE662578	3.5	Stockton Common	Check for existence of features related to crop mark suggesting northern ditch in this area
100	SE725663	1.5	Whitwell on the Hill	Verify existence of enclosure with associated trackways and field boundaries
164	SE727666	3.0	Whitwell on the Hill	Roman kiln marked on OS 1:10000. Hence locate any other evidence of contemporary kiln industry
127	SE730670	2.5	Crambeck	Area of prehistoric landscape hence locate any further subsoil prehistoric features
135	SE734673	2.0	Crambeck	A broad semi circular cropmark is seen near road. Test for continuation of pottery manufacturing complex
132	SE737677	1.5	Crambeck	A half rectangular enclosure exists, part under A64. Locate enclosure precisely and internal features
163	SE750685	1.5	High Hutton	Ridge and furrow and suggestion of possible deserted medieval village site in vicinity
101	SE766700	1.5	Huttons Ambo	Define area of archaeological activity evidenced by extensive ditches in air photos east of A64

The solid geology comprises Bunter and Keuper Sandstones in the south west, overlain by Keuper Marl and Lower Lias with Oolitic Limestone in the Malton area. The drift cover is variable, including lacustrine clays, sands and gravels and boulder clay. Most of the sites were under arable cultivation and had been harvested of cereal or potato crops immediately prior to the surveys. The topography is gently undulating with elevations of between 19m and 97m above Ordnance Datum. The Whitwell to Malton Section is higher and hillier than that between York and Whitwell.

## **THE GEOPHYSICAL SURVEYS**

### **Introduction**

Geophysical surveying provides a rapid method for the detection of subsoil features within archaeological landscapes. Two methods are most frequently used. Geomagnetic surveying employs a portable magnetometer to detect small perturbations in the Earth's magnetic field caused by changes in soil magnetic susceptibility or permanent magnetisation. The resistivity method, on the other hand, maps differences in soil electrical resistance which mainly reflect variations in water content. For rapid reconnaissance in the areas involved it was decided that geomagnetic surveying would satisfy the project aims stated above.

### **Field Methods**

At each site, areas to be surveyed were established and fixed with respect to mapped features using an Electronic Distance Meter or tapes and an optical square. Measurements of vertical geomagnetic field gradient were then made at 1.0x0.5m intervals in gridded units of 20x20m. This measurement scheme will detect geophysical anomalies on a scale of 1.0-2.0m and this approximately equates to the archaeological resolution. Survey blocks were offset from existing A64 fencelines by 2-5m to avoid strong, associated field gradients and no survey was earned out on the carriageway. The instrument used was a Geoscan FM36 fluxgate gradiometer with ST4 sample trigger. A zig-zag traverse scheme was employed throughout and data were periodically downloaded in the field to a Sharp PC3000 portable graphics computer for storage and verification. Appendix A provides more information about this method of archaeological geophysical surveying.

### **Data Processing**

The geophysical results were processed into half-tone images, scaled to 32 shades of grey, showing the residual geomagnetic anomalies. These are presented in odd numbered Figures 1-21 on basemaps digitised from 1:2500 plans supplied by Bullen and Partners. The captions to the figures contain the relevant grey-scales from which anomaly magnitudes can be obtained. Appendix B describes the computer processing of the field data in more detail.

## **SURVEY RESULTS**

### **General**

Each of the study sites was found to be characterised by moderate to weak geomagnetic anomalies, (standard deviations  $< 2.5 \text{ nT/m}$ ) Local exceptions occur within small areas of disturbed ground, adjacent to metalled roads containing high magnetic susceptibility materials and near metal fences, buildings, pylons and buried iron pipes. In general the areas investigated were relatively free from contamination by surface iron objects and only at sites RPS147 (east) and RPS135 have subsoil geomagnetic anomalies been partly obscured by ferrous contamination. The geophysical images for each site have been smoothed by applying a 3x3 box filter to reduce the effects of random soil and instrument noise.

Archaeological interpretations were made of the geophysical data, taking into account the archaeological background provided by the air photographic and field walking studies and summarised in the table above. These interpretations are presented in even numbered Figures 2-22 using the symbols defined in the key to each diagram.

### **Site RPS116, Fourth Milestone Farm (Figures 1 & 2)**

A weak and diffuse rectangular, positive magnetic anomaly has been detected in the central part of the surveyed area confirming the existence of the rectangular enclosure located by air photography. This feature is approximately 33m in diameter, with rounded corners and there is some geophysical evidence for a rectangular internal structure or further enclosure. Additional ditches may be present immediately SW of the main feature.

### **Site RPS147, Stockton Common (Figures 3-6)**

Results from this site are shown separately for the areas east and west of the A64. Figure 3 shows that much of the eastern area near Hazelbush Farm is extensively contaminated with surface iron objects or the brick rubble of made up ground and this has obscured weaker anomalies of possible archaeological interest. Nevertheless, it has been possible to detect a major N-S oriented ditch, immediately south of Hazelbush Farm which may relate to a similar cropmark feature seen in air photographs. A diffuse, curving, positive anomaly near the SE limit of this surveyed area may reflect a second ditch or is possibly of geological origin. No further evidence for archaeological structures was found in the area east of the A64.

Data obtained in the survey block west of the A64 were of reduced quality because of exceptionally uneven terrain following the harvest of parsnips and cereal crops. The geophysical data provide evidence, in the form of chains of small magnetic dipoles, for several pipes traversing this field. A large ditch with a diameter of 18m has possibly

been located in the centre of this survey block with associated concentric outer ditch on the SE sector

### **Site RPS100, Whitwell-on-the-Hill (Figures 7 & 8)**

Here geophysical survey has confirmed the existence of a rectangular ditched enclosure in the field south of Tout Hill. Further ditches have been detected south and north of this feature, the latter being partly obscured by a manure heap present at the time of survey. Ridge and furrow cultivation is seen in the southern part of this survey area in the form of a regular set of parallel geomagnetic lineations.

### **Site RPS164 South, Whitwell-on-the-Hill (Figures 7-10)**

This section of the evaluation comprised survey of areas between Shepherdfields Lane and the A64, and that between Tout Hill and the A64. A metal pipeline and area of burning are the main geophysical features detected in these areas. However, there is also evidence for a ring ditch and adjoining linear ditches of archaeological interest in the southern quarter of the block between the A64 and Shepherdfields Lane (Figures 9 & 10). The ring ditch has an approximate diameter of 12m.

### **Site RPS164 North, Whitwell-on-the-Hill (Figures 11 & 12)**

Geophysical survey of this area has revealed a remarkable landscape of geophysical anomalies which provide convincing evidence for an extensive set of ditched enclosures and possible field boundaries of uncertain date (Figure 12). The presence of several compact areas of low susceptibility suggests that stone structures may be present within several of the smaller enclosures. No strong dipolar magnetic anomalies have been detected suggesting an absence of any major kiln sites. Two pylons have created large circular magnetic anomalies which have obscured more subtle anomalies within part of the area investigated.

A linear texture in the geophysical data is seen in the northernmost field surveyed. This may be due to relict ridge and furrow or tile field drains, as noted in Figure 12.

### **Site RPS127, Crambeck (Figures 13 & 14)**

The dominant geophysical feature within this area is a series of parallel linear, positive magnetic anomalies oriented NW-SE which probably represent a network of tile field drains with an average spacing of ~10m. A strong positive magnetic anomaly arising from a row of garages has partly obscured subsoil features in a small zone west of Holmes Crescent.

An extended, diffuse positive magnetic anomaly has been detected adjacent to the A64 and almost certainly reflects a headland composed of contrasting soil material. There is some evidence however, for a pair of ditches near the SW limit of the headland which may have greater archaeological significance. A second possible minor ditch (or buried pipe) has been located 20m SW of Holmes Crescent. No further evidence for the postulated prehistoric landscape is apparent in geophysical data from this site.

### **Site RPS135, Crambeck (Figures 15-16)**

Dense ferrous contamination has obscured subsoil geophysical features along the northern 80m of this survey transect. Within the remaining area geophysical mapping provides good evidence for several extensive ditches, one 140m long, and a set of parallel field drains oriented NW-SE. The ditches may represent field boundaries or possible prehistoric enclosures. No evidence has been found, in the form of zones of intense magnetisation, for kilns or areas of dense pottery scatter. There appear to be no stone structures in this survey block.

### **Site RPS132, Crambeck (Figures 17 & 18)**

Here the major geophysical feature is a linear zone, ~10m wide, oriented NE-SW which traverses the northern third of the surveyed area. This feature marks the trace of a road which was destroyed in 1934 (farmer, pers. comm.). A pair of sinuous, positive magnetic anomalies probably represent the remains of ditched field boundaries or other forms of enclosure of uncertain date.

No geophysical evidence was found for the postulated half rectangular enclosure.

### **Site RPS163, High Hutton (Figures 19 & 20)**

A distinctive feature of this area was the well preserved medieval ridge and furrow field system. This structure is manifest in the geophysical data as parallel sets of curving, positive and negative magnetic lineations marking the troughs and crests of successive rigs. Although these ridges share the same orientation, it is interesting to note that the spacing of strips changes from about 5m to about 10m north of a line extending west from the Lodge House.

No evidence is seen in the geophysical data for buildings or other structural remains of medieval settlement.

## **Site RPS101, Huttons Ambo (Figures 21 & 22)**

Subsoil anomalies in the northern part of this site have been saturated by the influence of a metal pylon. However, in the remaining area, a network of intersecting, linear, positive anomalies have been detected which almost certainly represent tile field drains.

With the exception of the possible pits or ditch segments shown in Figure 22, no other features of archaeological interest have been located.

