Archaeological Services
University of Durham

A64 Rillington Bypass, North Yorkshire

geophysical surveys

on behalf of
Atkins Heritage
WS Atkins Consultants Ltd

for
Highways Agency

ASUD Report 1030
October 2003

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Contents

1. Summary

The project

1.1 This report presents the results of geophysical surveys conducted along part of the preferred route option for the A64 Rillington Bypass in North Yorkshire.

1.2 The works were commissioned by Gareth Talbot of Atkins Heritage for WS Atkins Consultants Ltd, acting on behalf of the Highways Agency, and conducted by Archaeological Services University of Durham (ASUD).

Results

1.3 Gradiometer scanning of three fields indicated the presence of a considerable number of very weak magnetic anomalies, which were subsequently covered by detailed gradiometer survey. Topsoil magnetic susceptibility surveys did not indicate areas of potential archaeological interest.

1.4 With the exception of probable ridge and furrow remains the gradiometer surveys detected few features of possible archaeological origin. In particular, the surveys have not identified features which may have been part of the known barrow cemetery to the north.

2. Project background

Location (Figure 1)

2.1 The study area comprises three arable fields to the south of Rillington village, 6km northeast of Malton, North Yorkshire, centred on NGR: SE 860 740. The village is situated at the southern edge of the Vale of Pickering and at the northern edge of the Yorkshire Wolds.

Development proposal

2.2 It is proposed that the A64 will bypass the village of Rillington. The preferred route for the bypass (the 'Blue Route') lies to the south of the village.

Objective

2.3 The general objective of the surveys was to assess the nature, extent and potential significance of any surviving archaeological features within and adjacent to the proposed development corridor, so that an informed decision may be made regarding the nature, and scope of, any further scheme of archaeological works that may be required in advance of development. A specific aim of the surveys in Areas 1 and 2 was to determine whether or not a Scheduled Ancient Monument (Iron Age square barrow cemetery NY1117) extends into the preferred route corridor for the bypass.

Specification summary

2.4 Three types of geophysical survey were required for Areas 1 and 2: scanning with a fluxgate gradiometer; magnetic susceptibility survey and detailed fluxgate gradiometery. Following gradiometer scanning and magnetic susceptibility surveys of Area 3 it was agreed that this area should also be covered by detailed gradiometer survey.

2.5 Since a Scheduled Ancient Monument (NY1117) lies immediately north of and partly within the study area, a Section 42 licence was granted by English Heritage under the 1979 Ancient Monuments and Archaeological Areas Act (as amended by the National Heritage Act 1983) prior to the commencement of fieldwork.

2.6 Following discussions with Atkins Heritage, the works were undertaken in accordance with a methods statement prepared by Archaeological Services, and in accordance with English Heritage (1995) Research and Professional Services Guideline No.1, *Geophysical survey in archaeological field evaluation*; the Institute of Field Archaeologists (2002) Paper No.6, *The use of geophysical techniques in archaeological evaluations*; and the Archaeology Data Service (2001) *Geophysical Data in Archaeology: A Guide to Good Practice*.

Dates

2.7 The surveys were undertaken between 18th September and 6th October 2003. This report was prepared between 7th and 22nd October 2003.

Personnel

2.8 The surveys were conducted by Janice Adams, Will Davies, Mark Douglas, Michael Douglas and Duncan Hale. This report was prepared by Duncan Hale (the Project Manager) with illustrations by Linda Bosveld.

Acknowledgements

2.9 Archaeological Services is grateful for the assistance of the farmer, Mr Allanby, and Atkins Consultants in facilitating this work.

Archive

2.10 The paper and data archive is currently held at Archaeological Services, University of Durham. It is anticipated that the data archive will be transferred to the Archaeology Data Service in due course.

3. Archaeological and historical background

3.1 A Stage 2 Cultural Heritage Assessment was undertaken by Atkins Heritage (2000). The following summary of the known archaeological resource is based on their report.

Prehistoric period

3.2 The study area lies in a very rich archaeological landscape, which appears to have been intensively settled since the early post-glacial period. The earliest evidence for occupation in the surrounding area is from Star Carr, a well-known Mesolithic site on the edge of the Vale of Pickering near Scarborough, although no evidence for such early occupation has been found at Rillington. The Neolithic occupation of the Rillington area is attested to by a possible long barrow and several finds of flint artefacts of the period. Numerous Bronze Age round barrows or ring-ditches and evidence for enclosures indicate a considerable level of activity here during the Bronze Age. A cluster of such ring-ditches lies in the southern part of Scampston Park, just to the north-east of the present study area. Additional round barrows occur in both East Field and West Field, north and west of the study area. The Iron Age at Rillington is similarly well represented, with barrow cemeteries, enclosures and land boundaries. An extensive Iron Age cemetery containing 23 square barrows, possible burial pits, boundary ditches and ditched enclosures, as well as round barrows, lies at East Field, immediately north of the present study area. This complex of features is a Scheduled Ancient Monument (NY1117), although the extent of the site has not been established and it was considered likely that it may extend into the study area.

Historic period

3.3 The Romans maintained a significant presence in the area, with a fort at Malton to the west (*Derventio*). Although it is likely that there was settlement around Rillington during the period, the evidence so far comprises 3rd and 4th century pottery, a burial on High Street and a brooch. Apart from an Anglo-Saxon burial at East Field little is known of Saxon activity in the immediate

area, however, a significant settlement and burial site at West Heslerton has been the subject of a substantial archaeological project over the last two decades. The medieval village of Rillington was centred around the church, which includes a 12th century chancel. The village expanded during the 17th and 18th centuries and a number of the buildings from that period are now listed.

4. Landuse, topography and geology

4.1 At the time of fieldwork the three survey areas comprised fields on the fertile valley floor. Areas 1 and 2 carried oilseed rape stubble, while Area 3 was fallow.

4.2 The land was predominantly level with a mean elevation of *c.*20m AOD.

4.3 The underlying solid geology of the area comprises Ampthill Clay and Kimmeridge Clay, which is overlain by alluvial floodplain deposits of sand and gravel.

5. Geophysical survey

Technique selection

5.1 Geophysical surveying enables the relatively rapid and non-invasive identification of potential archaeological features within landscapes and can involve a variety of complementary techniques such as magnetometry, electrical resistivity, ground-penetrating radar and electromagnetic survey. Some techniques are more suitable than others in particular situations, depending on a variety of site-specific factors including the nature of likely targets; depth of likely targets; ground conditions; proximity of buildings, fences or services and the local geology and drift.

5.2 In this instance, based on aerial photographic cropmark evidence, it was likely that cut features, such as ditches, would be present on the site, and that other types of feature such as trackways, wall foundations and fired structures (for example kilns and hearths) might also be present. Given the anticipated shallowness of the targets (<1.5m in depth) and the non-igneous geological environment of the study area the following techniques were considered appropriate: topsoil magnetic susceptibility survey; geomagnetic scanning; and detailed fluxgate gradiometer survey.

5.3 The topsoil magnetic susceptibility survey technique is designed for rapid assessment of the concentration of ferrimagnetic minerals in the top *c.*60mm of soil. When used for gridded surveys it can help to identify areas of archaeological potential such as former occupation sites, since human habitation leads to an irreversible magnetic enhancement of the soil, mainly as a result of burning.

5.4 The geomagnetic scanning and detailed geomagnetic surveys both use a fluxgate gradiometer (magnetometer) to detect anomalies in the vertical component (i.e. gradient) of the Earth's magnetic field caused by variations in soil magnetic susceptibility or permanent magnetisation. Such anomalies often reflect archaeological features. The scanning method is particularly rapid but should be used with caution since it can be very difficult even for experienced operators to detect areas of interest, let alone individual anomalies (see IFA Paper No.6, 2002 and English Heritage Research and Professional Services Guideline No.1, 1995). Detailed area survey is the preferred technique, by which high-resolution geomagnetic data are recorded on a grid system for subsequent processing and interpretation.

Field methods

5.5 A 20m grid was established across each survey area and tied-in to known, mapped Ordnance Survey points using a Leica TCR307 total station survey instrument with datalogger. This grid was used as the basis for each of the following surveys.

Topsoil magnetic susceptibility

5.6 This survey was undertaken using a Bartington Instruments MS2 meter and field loop sensor. The instrument sensitivity was set to 1SI, and data logged on a 10m grid. Data were processed and displayed in a manner similar to that described below for the detailed gradiometer data, but were interpolated to form an array of regularly-spaced data at 5 x 5m intervals.

Geomagnetic scanning

5.7 The scanning was undertaken using a Geoscan FM36 fluxgate gradiometer in Analogue Display mode. The 5nT range was selected as the soils were found to be magnetically quiet. The study areas were traversed at 25m intervals and the frequency of anomalies noted for each field. The occurrence of geomagnetic anomalies detected was graded as either high, moderate or low.

Detailed geomagnetic survey

5.8 Measurements of vertical geomagnetic field gradient were determined using a Geoscan FM36 fluxgate gradiometer fitted with an ST1 sample trigger to enable automatic logging of the data. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was set to 0.1nT, the sample interval to 0.25m and the traverse interval to 1.0m, thus providing 1600 sample measurements per 20m grid unit.

5.9 Data were downloaded on-site into a Samsung P25 laptop computer for initial processing and storage and subsequently transferred to a desktop computer for processing, interpretation and archiving.

Data processing

5.10 Geoplot 3.00(K) software was used to process the geophysical data and to produce continuous tone greyscale images of the raw data. The detailed gradiometer survey results are shown at 1:1250 in Figures 2, 6 & 10 and the

magnetic susceptibility results in Figures 3, 7 & 11. The greyscale images have been imported directly into a digital plan supplied by Atkins Consultants, which incorporates ASUD total station survey data. In the gradiometer data images, positive magnetic anomalies are displayed as dark grey and negative magnetic anomalies as light grey. Palette bars relate the greyscale intensities to anomaly values in nanoTesla. The magnetic susceptibility images are similar, with the highest values being displayed as the darkest greys. Similarly, palette bars relate the greyscale intensities to SI units.

5.11 The following basic processing functions have been applied to the gradiometer datasets:

Clip – is used to clip, or limit, data to specified maximum or minimum values; for limiting large noise spikes; also generally makes statistical calculations more realistic (Areas 1, 2 & 3).

Zero mean grid – sets the background mean of each grid to zero; for removing grid edge discontinuities (Areas 1 & 2).

Destagger – to correct for displacement of anomalies caused by alternate zig-zag traverses (Areas 1, 2 & 3).

Zero mean traverse – sets the background mean of each traverse within a grid to zero; for removing striping effects in the traverse direction and removing grid edge discontinuities (Areas 1, 2 & 3).

Despike – to locate and suppress random iron spikes in gradiometer data (Areas 1, 2 & 3).

Low pass filter – to suppress high frequency, small-scale spatial detail; for smoothing data or for the enhancement of larger, weak features (Areas 1, 2 & 3).

Interpolate – to increase the number of data points in a survey; to match sample and traverse intervals and so create a smoother appearance to the data. In this instance the gradiometer data have been interpolated from 1.0 x 0.25m intervals to 0.25 x 0.25m intervals. The magnetic susceptibility data have been interpolated from 10 x 10m intervals to 5 x 5m intervals.

Interpretation: anomaly types

5.12 Colour-coded geophysical interpretation plans are provided in Figures 4, 8 & 12. Three types of geomagnetic anomaly have been distinguished in the data:

positive magnetic	regions of anomalously high or positive magnetic field gradient, which may be associated with high magnetic susceptibility soil-filled structures such as pits and ditches.
negative magnetic	regions of anomalously low or negative magnetic field gradient, which may correspond to features of low magnetic susceptibility, such as wall footings and other

concentrations of sedimentary rock, voids and field drains.

dipolar magnetic — paired positive-negative magnetic anomalies, which typically reflect ferrous or fired debris and/or fired structures such as kilns or hearths.

Interpretation: features

5.13 Colour-coded archaeological interpretation plans are provided in Figures 5, 9 & 13.

Area 1

5.14 Geomagnetic scanning of this area indicated a high frequency of very weak magnetic anomalies, typically in the range ± 3nT. It was considered likely that anomalies of this magnitude could reflect archaeological features. Subsequent detailed gradiometer data indicate that these anomalies were almost certainly due to the east-west features described below.

5.15 The magnetic susceptibility data are relatively smooth with the exception of an area along the northern side of the field. Values in this part of the field are generally higher than elsewhere. This was noted during the fieldwork and found to broadly correspond with the nature of the existing ground surface, which had been turned over here and consequently provided more complete field loop sensor contact with exposed soil as opposed to a thin layer of vegetation across the rest of the field.

5.16 The gradiometer data are characterised by an east-west 'texture' of parallel, alternate, weak positive and negative magnetic anomalies. As in Area 3 (below) the orientation of the anomalies turns slightly southwards towards the western end of the field. This could reflect a recent plough regime but may also reflect underlying remains of ridge and furrow cultivation. In this instance the ridges have been levelled by later activities and so the positive anomalies are likely to reflect the displaced topsoil that has accumulated in the furrows. The anomalies occur at a frequency of *c.*4m, a typical interval for relatively narrow ridge and furrow. The length of the ridges here (surviving to at least 300m), and elsewhere in Yorkshire up to 1000m, is quite unusual compared with much of the rest of England and is considered to be a regional variation (Hall 1998), perhaps due to the excellent natural drainage afforded here by the gravel subsoil, and similarly by the chalk subsoil of the Wolds.

5.17 Additional positive magnetic anomalies have been detected in this area near the eastern and western ends of the field. Those at the eastern end correspond to the locations of deep wheel ruts evident on the ground, while the linear anomaly near the western end reflects relatively high magnetic susceptibility materials, almost certainly a soil-filled ditch which is likely to be a former field boundary.

5.18 The survey of this field has also detected a scatter of intense dipolar magnetic anomalies. These anomalies almost certainly reflect items of near-surface

ferrous debris, such as horseshoes, chain links and fragments of agricultural machinery. A proportion of these anomalies is indicated on the geophysical interpretation drawing.

Area 2

5.19 Geomagnetic scanning of this area also indicated a high frequency of very weak magnetic anomalies, typically in the range ± 3nT. It was again considered likely that anomalies of this magnitude could reflect archaeological soil-filled features. Subsequent detailed gradiometer data indicate that these anomalies were almost certainly due to the east-west features described below.

5.20 The magnetic susceptibility data are relatively smooth with a slight increase in values from east to west. This slight enhancement could be anthropogenic but also recent.

5.21 The south-east corner of the field was not surveyed due to the presence of a steel-capped geotechnical borehole. The gradiometer data are again characterised by an east-west texture of parallel, alternate, very weak positive and negative magnetic anomalies. This could reflect a recent plough regime but may also reflect underlying remains of ridge and furrow cultivation. Particularly in the eastern part of the survey the data appear more likely to reflect ridge and furrow remains. The anomalies here are less evenly spaced, varying between 5-10m intervals.

5.22 A scatter of intense dipolar magnetic anomalies has been detected across the survey area. These anomalies almost certainly reflect items of near-surface ferrous debris.

Area 3

5.23 Geomagnetic scanning of this area indicated a high frequency of weak magnetic anomalies, typically in the range ± 5nT. It was again considered likely that anomalies of this magnitude could reflect archaeological soil-filled features.

5.24 The magnetic susceptibility data are relatively smooth with a zone of slightly enhanced values in the north-eastern corner of the field.

5.25 The gradiometer data are again characterised by an east-west texture of parallel, alternate, very weak positive and negative magnetic anomalies. The anomalies turn slightly southward in the western part of the field. This may reflect a recent plough regime but may also reflect underlying remains of ridge and furrow cultivation. The anomalies in the western part of this field in particular appear to reflect ridge and furrow remains, evenly spaced at *c.*7m intervals.

5.26 A number of other very weak positive magnetic lineations have been detected in this area. Each reflects slightly enhanced magnetic susceptibility materials, possibly the remains of a soil-filled gullies. Some of these share a north-west/south-east orientation and appear to be associated with one another.

Others have different orientations but also appear to reflect the scant remains of soil-filled features of unknown function or date.

5.27 A negative magnetic anomaly along the eastern edge of the field corresponds to a modern wheel rut.

5.28 A scatter of intense dipolar magnetic anomalies has been detected across the survey area. These anomalies almost certainly reflect items of near-surface ferrous debris.

6. Conclusions

6.1 Fluxgate gradiometer and topsoil magnetic susceptibility surveys have been undertaken along part of the preferred route for the proposed A64 Rillington Bypass near Malton in North Yorkshire. The study area lay to the south of a scheduled Iron Age barrow cemetery (SAM NY1117).

6.2 Gradiometer scanning of the three fields indicated the presence of a considerable number of very weak magnetic anomalies, which were subsequently covered by detailed gradiometer survey. Topsoil magnetic susceptibility surveys did not indicate areas of potential archaeological interest.

6.3 With the exception of probable ridge and furrow remains the gradiometer surveys detected few features of possible archaeological origin. In particular, the surveys have not identified features which may have been part of the known barrow cemetery to the north.

6.4 The planning authority may require further investigation of some of these features prior to the proposed development of the site.

7. References

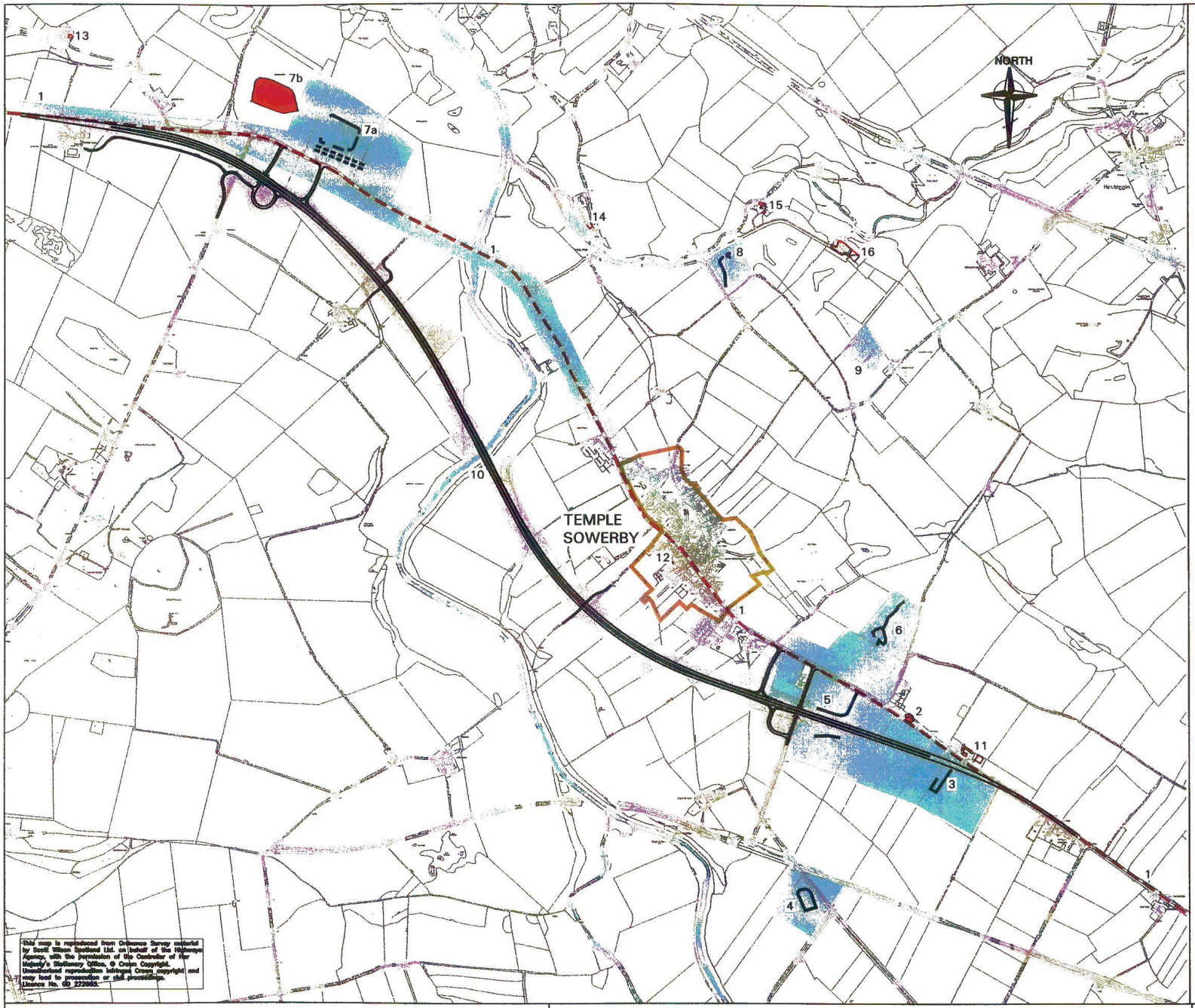
Archaeology Data Service (2001) *Geophysical Data in Archaeology: A Guide to Good Practice*. Arts and Humanities Data Service.

Atkins Heritage (2000) Archaeology and Cultural Heritage, in *A64 Improvements: Rillington Bypass - Stage 2 Scheme Assessment Report: Volume 1*. WS Consultants Ltd.

English Heritage (1995) Research and Professional Services Guideline No.1, *Geophysical survey in archaeological field evaluation*. London.

Hall, D (1998) Medieval fields in their many forms. *British Archaeology* 33. Council for British Archaeology internet journal.

Institute of Field Archaeologists (2002) *The use of geophysical techniques in archaeological evaluations*. Paper No.6, Institute of Field Archaeologists, Birmingham.



LEGEND

- Proposed Route
- Conservation area boundary
- 7b Scheduled monument
- 16 Listed building
- Projected course of Roman road
- Cropmarks
- Area of known archaeological sensitivity

NOTES

1. For a description of numbers used on plan refer to text of report.

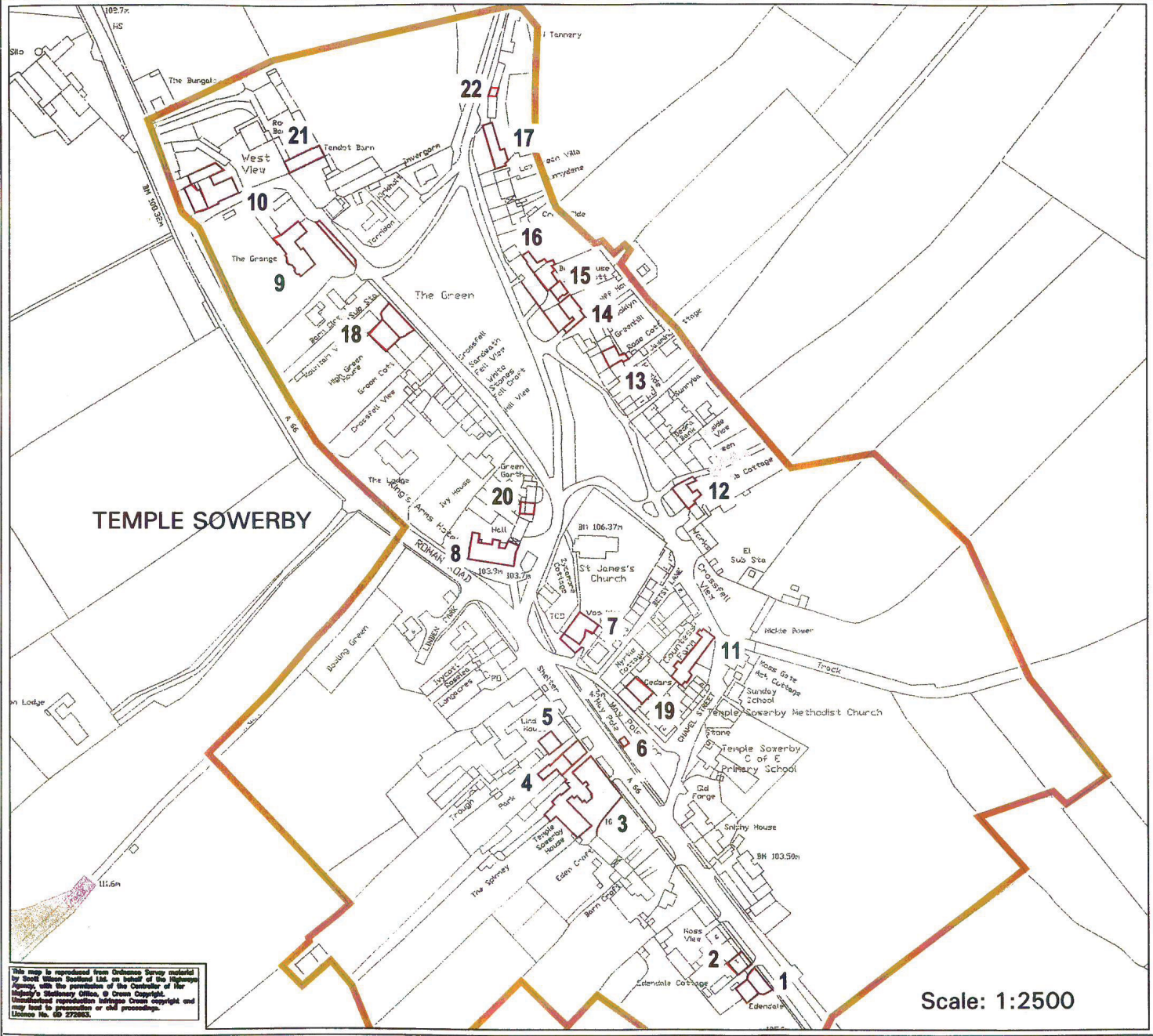
Scale: NTS

A66 TEMPLE SOWERBY BYPASS AND IMPROVEMENTS AT WINDERWATH

LISTED BUILDINGS AND ARCHAEOLOGICAL RESOURCES OUTSIDE THE TEMPLE SOWERBY CONSERVATION AREA

HIGHWAYS AGENCY

Figure 7.1



LEGEND

Conservation Area Boundary

Listed Building

Ref.	Listed Building No. Description
L1	Edendale House, late C18th/early C19th; also low wall & piers to front of Edendale House.
L2	Edendale Cottage, railings and central gate, late C18th
L3	Temple Sowerby House, now hotel, early C18th; front and return walls & gatepiers of Temple Sowerby House
L4	Park House, late C18th/early C19th; front and return walls, railings & gatepiers of Park House
L5	Linden House, late C18th/early C19th
L6	Maypole, possibly on site of earlier cross, mentioned in 1817 enclosure awards
L7	Woodbine House & warehouse to rear, late C18th/early C19th; front and walls, central gate & railings to Woodbine House
L8	King's Arms Hotel, formerly Inn and attached house, C18th
L9	The Grange, house and domestic wing - 1817; walls, gatepiers, gates, low walls and railings
L10	West View farmhouse with adjoining cottage & byre - 1801; front and return walls & gates
L11	Countess farmhouse & barn, C18th
L12	Swan House & Swan Cottage (formerly the Black Swan Inn) - 1616
L13	Rose Cottage, early C18th
L14	Sheriff House, late C18th
L15	Beech Cottage, mid C18th
L16	Beech House and stables, late C18th
L16	Low walls, gatepiers, railings to front of Beech Cottage and House
L17	Threshing barn & byre, south of Tannery's dovecote, late C18th/early C19th
L18	Mountain View, late C18th/early C19th; front & return walls, gatepiers to Mountain View
L19	The Cedars, late C18th/early C19th; low walls, piers & railings to front of The Cedars
L20	Antique Shop, former cottage, C17th
L21	Free-standing barn, late C18th/early C19th
L22	Dovecote, late C18th/early C19th

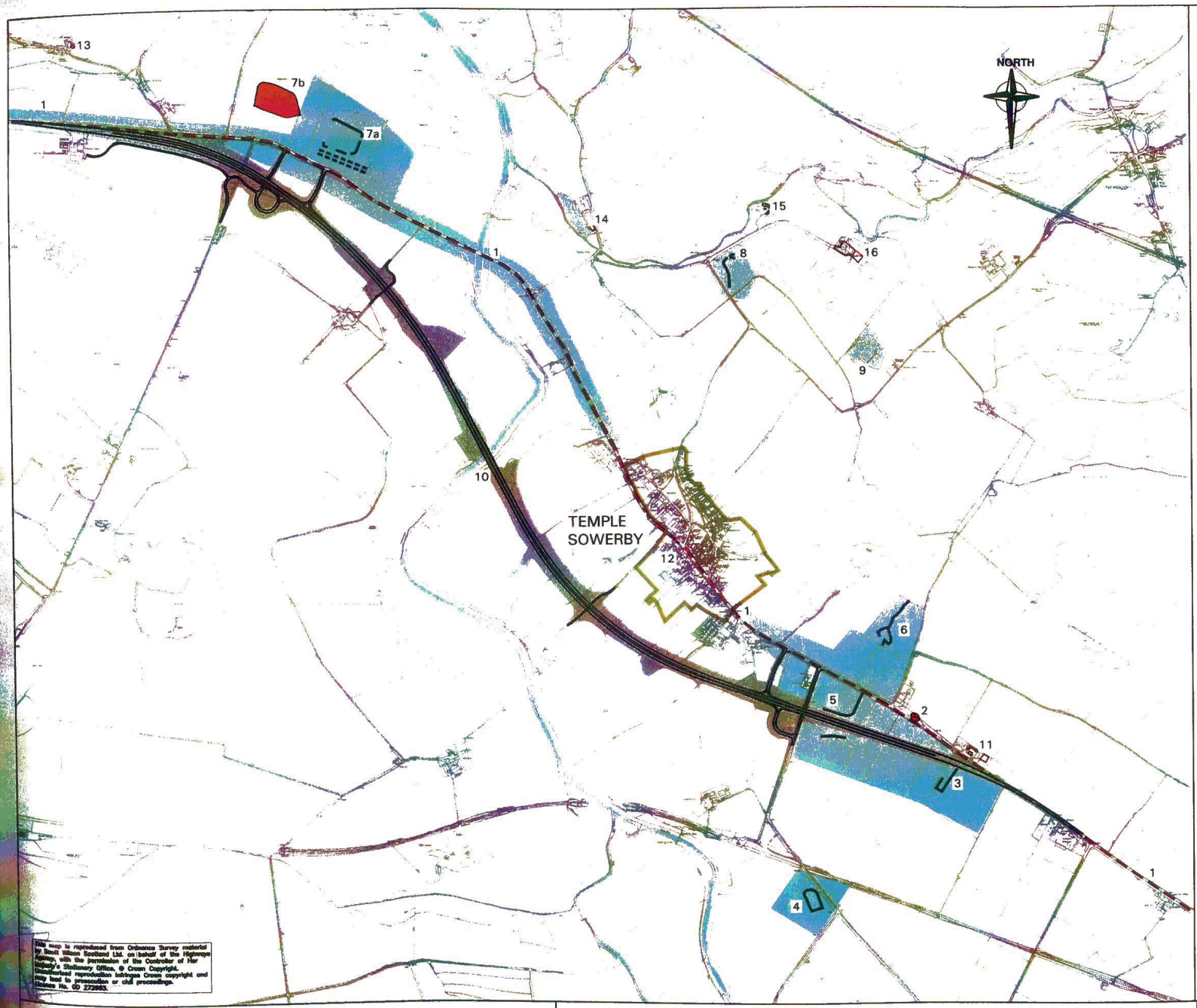
Note: All buildings are Grade II listed.

A66 TEMPLE SOWERBY BYPASS AND IMPROVEMENTS AT WINDERWATH

LISTED BUILDINGS & CONSERVATION AREA BOUNDARIES

HIGHWAYS AGENCY

Figure 7.2



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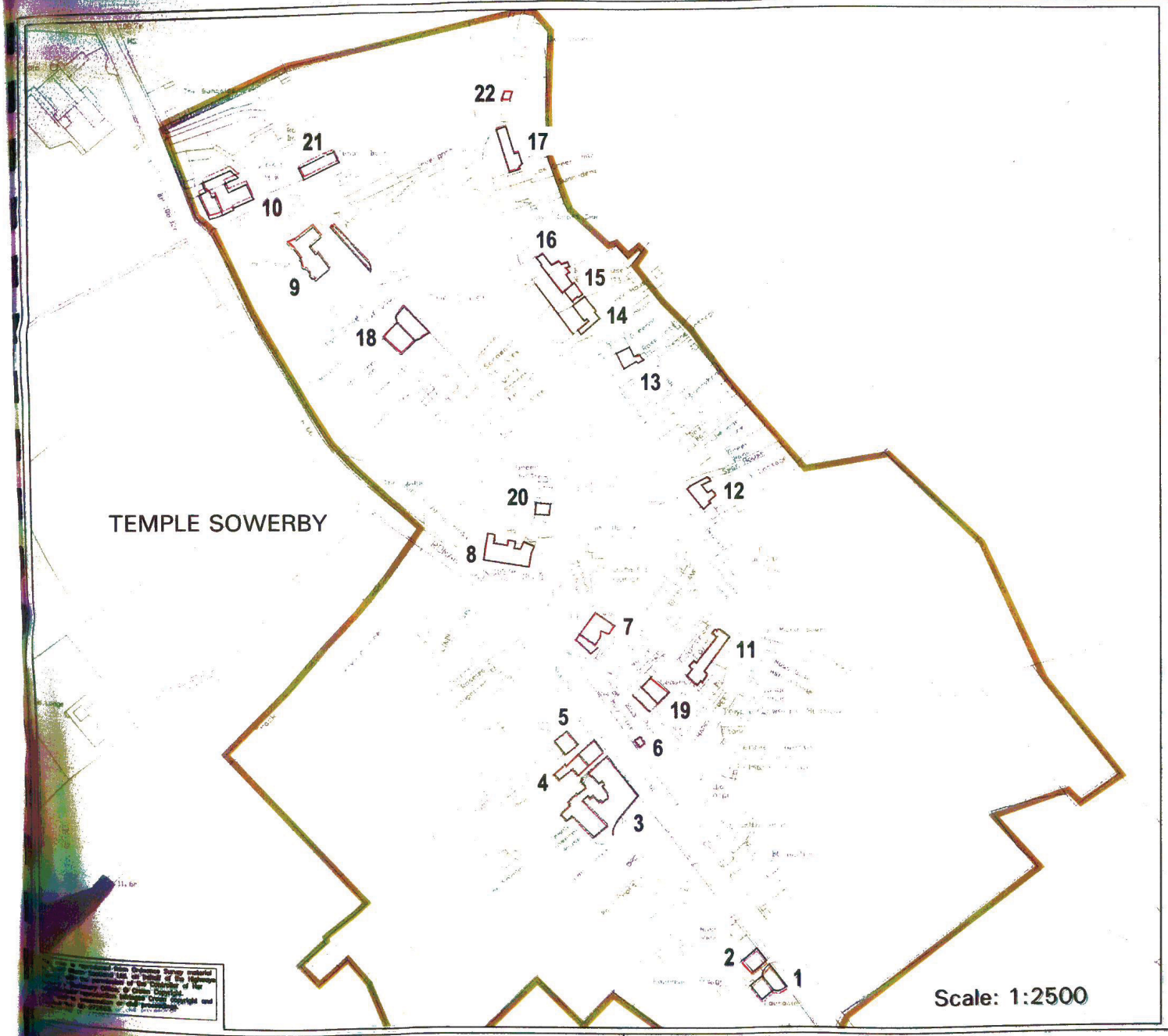

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LISTED BUILDINGS & CONSERVATION AREA BOUNDARIES

HIGHWAYS AGENCY

Figure 7.2