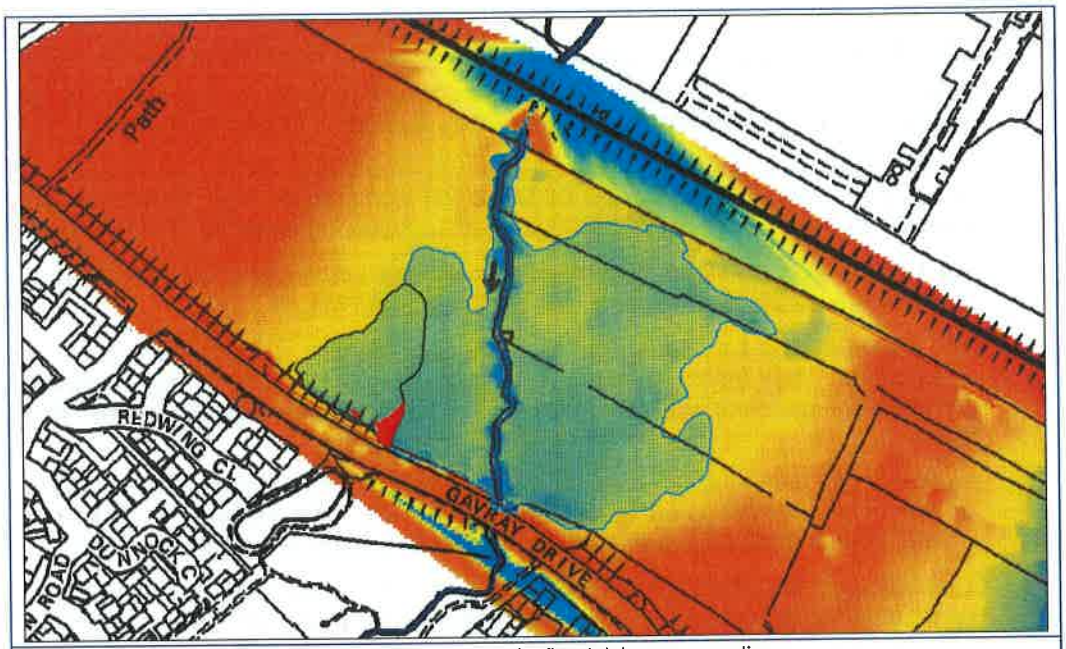
Figure 5-2 Depths of Flooding



Black outline – Area to be filled and will therefore require floodplain compensation
Red areas within the site – areas where depths are greater than 300mm

The volume was derived by using the cell size of the grid of 2.5m. The total volume within the area to be developed was calculated to be 673.40m³, for the derived flood outline.

It was considered feasible to use only 0.4 hectares (hatched area on Figure 5-1) of the available land for compensation, the area immediately adjacent to the Langford Brook. Using the methodology outlined above, grounds levels within this compensation area were extracted. To provide sufficient compensation it is considered necessary to lower the ground levels to a constant level of 66.6m AOD.

By lowering the area to a level of 66.6m AOD this will provide a storage capacity of 742.2m³, which is sufficient to compensate for the area being raised and will slightly increase the floodplain volume.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

JBA were appointed by Gallagher Estates in June 2004, to undertake a Flood Risk Assessment for a proposed site at Gavray Drive, Bicester. The existing site is open fields.

The study has considered flooding from the Langford Brook, which flows through the centre of the site. This Flood Risk Assessment and this report follow the relevant sections of the guidelines in Appendix F of PPG25 – Planning Guidance Development and Flood Risk.

The Environment Agency's 2004 Flood Zone Maps which were obtained from the local council were initially used to determine the flood risk to the site.

JBA commissioned K.V. Surveys of Malvern to undertake a topographical survey of the watercourse. This survey provided information on the shape of the channel and the dimension of any structures found along the watercourse, and was undertaken in June 2004.

Flows for input in the model were obtained using the FEH Rainfall-Runoff methodology. The 1% AEP flow was estimated to be 7.5m³/s, and the +20% increase in flow, to take into account the possible effects of climate change, was taken to be 9.0m³/s.

A steady state HEC-RAS model was developed using the new topographic survey, with the cross sections adjacent to the site being extended across the floodplain using the land survey provided to JBA by the Client.

A DTM of the site was created using the land survey, from which the 1% AEP (1 in 100-year) flood extent was derived. Following discussions with the Environment Agency it was considered appropriate to derive the flood outline using the water levels when the model was ran with a 20% increase in Manning's 'n' values. This would to take into account any intolerance in the survey data and sensitivity of the model runs. The model results indicated that an area of the site would be at risk from flooding with all but a small area of the site experiencing depths of flooding less than 300mm.

The proposed site at Gavray Drive, Bicester lies within PPG25 flood risk zones 2 and 3 – medium to high risk. The area of the site which lies outside of the 1% AEP (1 in 100-year) flood extent is considered to be suitable for most development.

The Environment Agency states that during times of flooding in a 1% AEP (1 in 100-year) flood event, a dry means of access must be available to the site. A dry means of access would be available to the site from all main access roads, particularly the A4421.

6.2 Recommendations

The Environment Agency recommends that floor levels of all new developments be set a minimum of 600 mm above the 1 in 100-year flood levels. The estimated 1 in 100-year water level in the vicinity of the site was 66.74 m AOD. Floor levels of the proposed development should therefore be constructed at a minimum elevation of 67.34 m AOD.

Floodplain rationalisation has been considered and it is proposed to rationalise the floodplain on the site rather than have a layout that fits around the existing floodplain outline.

APPENDICES

Appendix 2: Flood Compensation

1 FLOODPLAIN COMPENSATION

1.1 Background

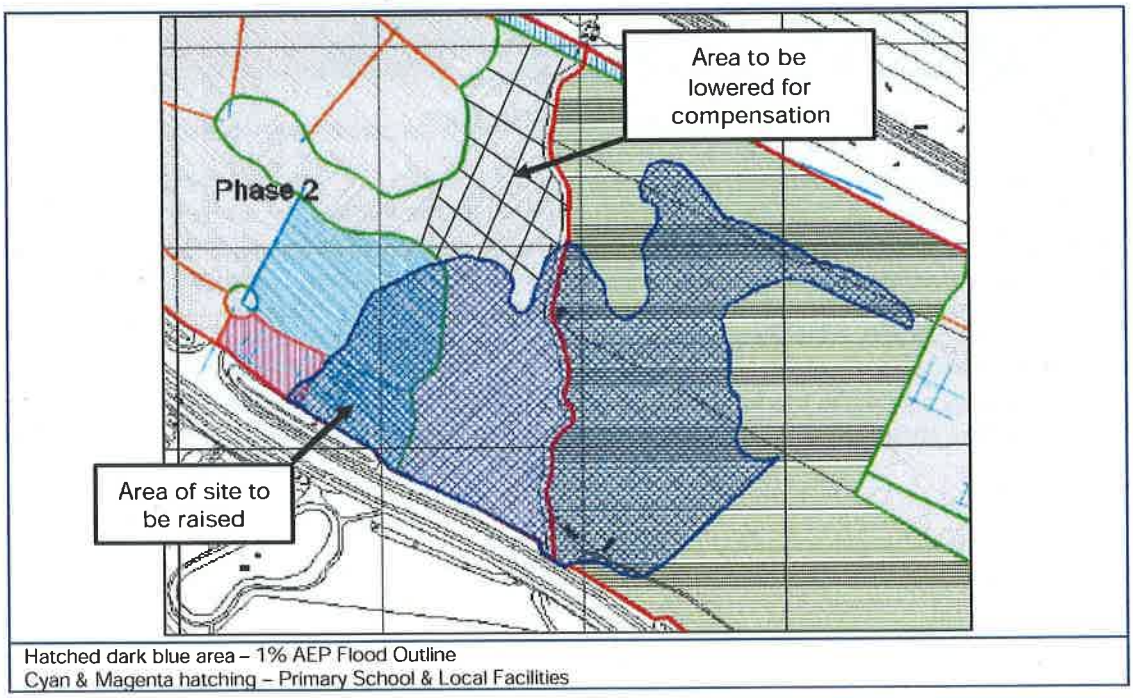
Gallagher Estates Ltd (GE) is proposing to develop the site at Gavray Drive, Bicester. The site is currently a greenfield site, and the Langford Brook flows in a southerly direction through the centre of the site. Development proposals for the site include residential areas and a primary school. Part of the site has been shown to lie within the 1% AEP (1 in 100-year) floodplain.

1.2 Previous Studies

In January 2004, JBA Consulting was commissioned by JJ Gallagher's Ltd to undertake a Flood Risk Assessment (FRA) of the site at Bicester. The study incorporated new hydrological analysis and the construction of a new hydraulic model. The 1% AEP (1 in 100-year) flood outline across the site was derived. The results of the FRA were presented in a report dated July 2004[1]. In summary, it is proposed to rationalise the floodplain on the site rather than have a layout that fits around the existing floodplain outline. In order to undertake this, floodplain compensation calculations have been carried out to ensure that the new development does not reduce the floodplain capacity.

An extract of the proposed development plans are illustrated in Figure 1-1, with the full plan being attached to this document. The area of land to be raised is 0.4 hectares and the land available for compensation is 0.9 hectares.

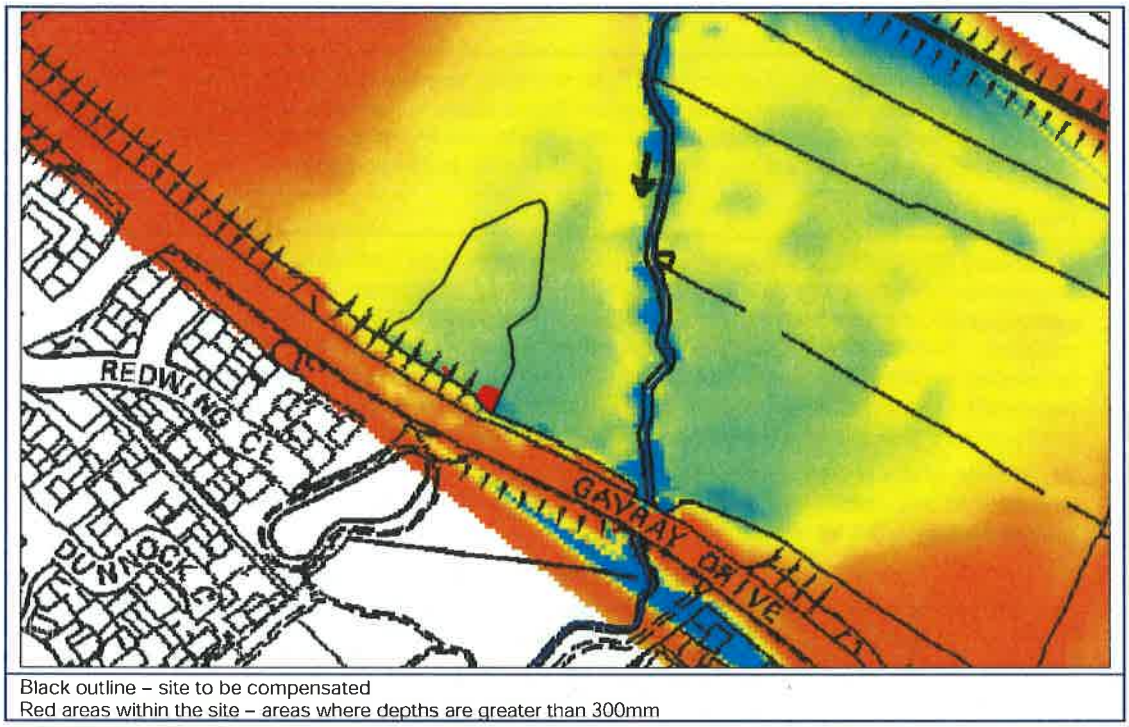
Figure 1-1 Site Development Proposals



[1] Flood Risk Assessment - Gavray Drive Bicester, Final Report, JBA July 2004

The floodplain compensation calculations have been undertaken by spreadsheet calculations. Using Vertical Mapper (VM), the ground levels within the area to be raised were extracted to determine the depths of flooding. All depths within the area, apart from two small areas illustrated in Figure 1-2, were lower than 300mm and therefore it was considered necessary to compensate in one band only.

Figure 1-2 Depths of Flooding



Black outline – site to be compensated
Red areas within the site – areas where depths are greater than 300mm

The volume was derived by using the cell size of the grid of 2.5m. The total volume within the area was calculated to be 158.17m^3, for a 1% AEP (1 in 100-year) flood event.

It was considered feasible to use only 0.5 hectares (hatched area on Figure 1-1) of the available land for compensation, the area immediately adjacent to the Langford Brook. Using the methodology outlined above, grounds levels within this compensation area were extracted. To provide sufficient compensation it is considered necessary to lower the ground levels to that of the average of the existing ground levels of the area to be raised, which has been calculated to be 66.64m AOD.

By lowering the area to a level of 66.64m AOD this will provide a storage capacity of 210.49m^3, which is sufficient to compensate for the area being raised and will slightly increase the floodplain volume.

Appendix 1: Air Quality Assessment Technical Report

JJ Gallagher Ltd

Gavray Drive, Bicester

Air Quality Assessment
Technical Report

JJ Gallagher Ltd

Gavray Drive, Bicester

Air Quality Assessment Technical Report

December 2004

Ove Arup & Partners Ltd
The Arup Campus, Blythe Gate, Blythe Valley Park, Solihull, West Midlands. B90 8AE
Tel +44 (0)121 213 3000 Fax +44 (0)121 213 3001
www.arup.com

Job number 116095-00

ARUP

Document Verification

Job title	Gavray Drive, Bicester	Job number	116095-00
Document title	Air Quality Assessment Technical Report	File reference	
Document ref			

Revision	Date				
Draft 1	18/06/04	Filename	Air Quality Report DRAFT 180604.doc		
		Description	First draft		
			Prepared by	Checked by	Approved by
		Name	Nicole Rogers	Michael Bull	Peter Braithwaite
		Signature			
Issue	08/07/04	Filename	Air Quality Report FINAL 080704.doc		
		Description	Final report		
			Prepared by	Checked by	Approved by
		Name	Nicole Rogers	Michael Bull	Peter Braithwaite
		Signature			
Issue 2	26/08/04	Filename	Air Quality Report FINAL REVISED 040804.doc		
		Description			
			Prepared by	Checked by	Approved by
		Name	Nicole Rogers	Michael Bull	Peter Braithwaite
		Signature			
Issue 3	06/12/04	Filename	Air Quality Report FINAL REVISED 2 061204.doc		
		Description	Revised to include updated traffic data for 500 unit Do Something scenario.		
			Prepared by	Checked by	Approved by
		Name			
		Signature			

Issue Document Verification with Document ☑

CONTENTS

		Page
1.	**INTRODUCTION**	**1**
1.1	Air Quality Objectives and Limit Values	1
2.	**ASSESSMENT METHOD**	**2**
2.1	Receptors	3
2.2	Traffic Data	3
2.3	Background Pollutant Concentrations	4
3.	**RESULTS OF DMRB SCREENING ASSESSMENT**	**5**
4.	**MITIGATION MEASURES**	**7**
4.1	Proposed Construction Mitigation Measures	7
4.2	Proposed Operational Mitigation Measures	8
5.	**CONCLUSION**	**8**

APPENDICES

APPENDIX A
Traffic Data

1. INTRODUCTION

In recent years, air quality has become of increasing importance in national and European Union environmental legislation, reflected in policies involving the management of local air quality to reduce human health risks, improve quality of life and minimise harm to the surrounding natural environment. The proposed development of the Gavray Drive site in Bicester, Oxfordshire has the potential to affect local air quality. An air quality assessment, therefore, needs to be undertaken in order to taken into account the likely effects of the proposed development.

This chapter summarises the most recent national and European air quality standards, explains the methodology employed in assessing potential impacts occurring due to the proposed development, examines the existing (baseline) air quality conditions surrounding Bicester and illustrates the magnitude of any likely impacts to local air quality following the methodology in the *Design Manual for Roads and Bridges (DMRB)* "screening" method. The potential air quality impacts have then been compared to national and European air quality standards and objectives to establish their importance. The significance of the impacts have been determined by the proximity and number of residential properties and people affected, the duration of effects and likelihood of occurrence.

1.1 Air Quality Objectives and Limit Values

Air quality objectives and limit values are the standards against which potential changes in local air quality as a result of the proposed development are assessed. They are standards, which are set in place to protect the most vulnerable groups in society in terms of human health (i.e. the very young, the elderly and the infirm) and also for the protection of vegetation and ecosystems.

European Union (EU) air quality policy provides the basis for UK national air quality policy. The EU Air Quality Framework Directive on Ambient Air Quality Assessment and Management came into force in September 1996, with subsequent daughter directives setting Europe-wide standards for air quality. Within the UK, the Environment Act (1995) brought about the instigation of the National Air Quality Strategy (1997) (NAQS), forming air quality standards and objectives for specific pollutants and highlighting measures for local authorities under Local Air Quality Management (*'LAQM'*) to work towards meeting these standards and objectives. The NAQS was revised in 2000 as the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (DETR, 2000a) and an addendum published in 2002 (DEFRA, 2003a). The objectives relevant to local air quality management have been set in the Air Quality Regulations (England) (2000 and 2002).

Each of the priority pollutants set down in the National Air Quality Strategy has a set target level to be achieved by specific years. Some pollutants have standards expressed as long-term averages (i.e. annual means), due to chronic health effects occurring after a prolonged exposure to elevated concentrations. Other pollutants have short-term averages (i.e. either 24 hour, 15 minute or 1 hour means) due to acute health effects arising after short-periods of elevated exposure. For short-term standards, an allowable number of exceedances of the standard are often incorporated, usually expressed as a number of hours or days per year for which the standard may be exceeded or as its percentile equivalent. The pollutants relevant to this assessment are shown below in Table 1.

The achievement or likely achievement of an air quality objective is determined by reference to the quality of air at locations –

(a) which are situated outside of buildings or other natural or man-made structures above or below grounds; and
(b) where members of the public are regularly present.

The Government provides guidance on locations where the objectives should and should not apply.

Table 1: UK Air Quality Objectives

Pollutant	Averaging Period	UK Objectives/ Limit Values	Year for Compliance	EU Limit Values	Year for Compliance
Benzene	Running annual mean	16.25 $\mu g/m^3$	31 Dec 2003	5 $\mu g/m^3$	1st Jan 2010
	Annual mean (Eng & Wales)	5 $\mu g/m^3$	31 Dec 2010		
1,3-butadiene	Running annual mean	2.25 $\mu g/m^3$	31 Dec 2003	N/A	N/A
Carbon monoxide	Maximum daily running 8 hour mean	10.0 mg/m^3	31 Dec 2003	10.0 mg/m^3	2005
Nitrogen dioxide	1 hour mean	200 $\mu g/m^3$ (not to be exceeded more than 18 times per year)	31 Dec 2005	200 $\mu g/m^3$ (not to be exceeded more than 18 times per year)	2010
	Annual mean	40$\mu g/m^3$	31 Dec 2005	40$\mu g/m^3$	2005
PM_{10} (gravimetric)	24 hour mean	50 $\mu g/m^3$ (not to be exceeded more than 35 times per year)	31 Dec 2004	50 $\mu g/m^3$ (not to be exceeded more than 35 times per year)	2005
	Annual mean	40 $\mu g/m^3$	31 Dec 2004	40 $\mu g/m^3$	2005

2. ASSESSMENT METHOD

The screening method outlined in *Version 1.02 (Environmental Assessment)* of the *Design Manual for Roads and Bridges (DMRB) (Highways Agency, November 2003)* was used to assess the changes in local air quality as a result of changes in traffic flows associated with the proposed development. Given the relatively small scale of the development, its residential nature as opposed to industrial or commercial and the existing forecast that air quality standards and objectives will be met by the relevant dates, it was considered that this was an appropriate approach to be taken for the assessment.

The DMRB screening method recommends the examination of five key pollutants: carbon monoxide, benzene, 1,3-butadiene, nitrogen dioxide (NO_2) and particulate matter (PM_{10}). The method outlined in the DMRB is designed to estimate concentrations of these five key pollutants at discrete receptors in order to highlight any locations where there may potentially be an air quality problem. The screening methodology takes into account changes in traffic

flows and speeds and changes in the number of heavy duty vehicles (HDVs) on the local road network. This purpose of the methodology is not, however, for use as an indicator of exact pollutant concentrations, but identifies where further, more detailed assessment could be necessary. It also provides a useful tool to make a comparison between various scenarios, as it does in this assessment, to compare the existing 2004 scenario, and the future (2006, 2010 and 2016) scenarios with and without the development in place.

2.1 Receptors

In assessing pollutant concentrations surrounding the Gavray Drive site, receptors in close proximity to the site and that are representative of other properties in the immediate vicinity were chosen. Pollutant concentrations decrease significantly with distance from a road source and, provided there are no other major sources nearby, would be lower at properties located further from roads than the receptors chosen for this assessment.

Four receptors were chosen around the vicinity of the site in order to assess impacts on local air quality as a result of the proposed development. Two further proposed residential properties were also chosen as receptors with the development in place and have only been considered in the assessment for the "do something" scenarios (i.e. with the proposed development in place). The most sensitive receptors are residential properties and therefore these are the receptors that have been selected in this case.

The receptors used in the DMRB assessment are:

1. Residential property with rear façade backing centre of Gavray Drive (7 Heron Court);
2. Residential property at the corner of Gavray Drive and the Eastern Distributor Road (Rear façade of property backing onto Shearwater Drive);
3. Residential property between Peregrine Way entrance and exit (rear façade of property on Ravenscroft backing onto Eastern Distributor Road);
4. Residential property on Peregrine Way (property on the northern 'exit' portion of the road);
5. Proposed residential property on-site, property at the corner of Gavray Drive turning north onto the Eastern Distributor Road;
6. Proposed residential property on-site, property at the northern most limit of the eastern portion of the site (adjacent to railway line).

It should be noted that the receptors have been assumed to be at ground floor level since the DMRB method does not provide a means to differentiate receptor heights. This approach should therefore be interpreted as a worst-case scenario, since receptors at a higher vertical level will generally be exposed to reduced concentrations compared with those at ground level.

2.2 Traffic Data

Existing (2004) and predicted future traffic flows for 2006, 2010 and 2016 with and without the proposed developments in place for roads surrounding the site were calculated and provided by Colin Buchanan and Partners. Traffic data provided were in the form of AADT (Annual Average Daily Traffic) flows calculated from AM peak and AADT flows calculated from PM peak and an average was taken from the two figures to provide the data used in the assessment (Appendix A)

All calculated traffic flows for the present and estimated traffic flows used in the air quality assessment are shown in Table 2.

Table 2: Traffic Data for Gavray Drive site

Road Link	Average AADT Flows							Speed Limit (kph) (same for each scenario)
	2004 (Existing)	2006 DM	2006 DS	2010 DM	2010 DS	2016 DM	2016 DS	
Gavray Drive	1263	1667	5820	1771	5924	1938	6091	32
% HGVs	2	2	3	2	3	2	3	-
Eastern Dist Rd (betw Gavray Drive & Peregrine Way)	9358	12922	14709	13722	15509	10024	16810	64
% HGVs	10	9	8	9	8	3	8	-
Eastern Dist Rd (south of Peregrine Way)	11630	12015	15610	12759	16354	13968	17564	64
% HGVs	11	11	11	11	11	11	11	-
Peregrine Way	4913	5075	5092	5390	5406	5901	5307	32
% HGVs	2	2	2	2	2	2	2	-
Eastern Distributor Road (north of Gavray Drive)	14171	13378	13646	14206	14474	15553	15821	64
% HGVs	9	8	8	8	8	8	8	-

* DM = Do Minimum (i.e. without development), DS = Do something (i.e. with development)

2.3 Background Pollutant Concentrations

The screening method requires annual mean background concentrations for each pollutant assessed. The background concentrations for all pollutants were taken from the background pollution tables for Cherwell District Council available in the Government's National Air Quality Archive (http://www.airquality.co.uk/archive/laqm/tools.php?tool=background) at National Grid Reference 462500, 224500. These were obtained for the present scenario of 2004 and for 2006, 2010 and 2020 using the procedures detailed on the National Air Quality Archive website.

Background concentrations used in the DMRB screening assessment are shown below in Table 3.

Table 3: Annual Average Background Pollutant Concentrations

Pollutant	Annual Average Concentration (μgm^{-3})			
	2004	2006	2010	2016
CO	0.19	0.16	0.12	0.11
Benzene	0.21	0.19	0.18	0.17
1,3-butadiene	0.09	0.07	0.06	0.06
NO_2	19.37	17.72	15.4	13.97
PM_{10}	17.8	17.58	16.4	16.4

There are no Air Quality Management Areas (AQMAs) declared in Cherwell District, for any of the seven key pollutants outlined in the UK air quality objectives. There are no pre-existing problems, therefore, in terms of air quality.

3. RESULTS OF DMRB SCREENING ASSESSMENT

The baseline pollutant conditions surrounding the site are detailed below in Table 4. It can be seen that currently pollutant concentrations in the vicinity of the proposed site are well within the UK and European objectives. The pollutant concentrations predicted by the graphical screening method for all future scenarios are also presented in Table 4.

Referring back to the national air quality standards and objectives (see Table 1) it can be seen that all pollutants are well within all relevant standards and objectives for all pollutants assessed. Pollutant concentrations also decrease or remain at the same level over time from the 2006 scenarios to the 2016 scenarios as they do from the Do Minimum to Do Something scenarios. This is a result of improving vehicle technologies and removal of older cars from the national vehicle fleet over time. Any increases are negligible, however, and all remain well within the respective standards and objectives.

In comparison with the 2004 pollutant concentrations, the predicted concentrations for the greater majority of the future scenarios, both with and without the proposed development in place, show slight decreases.

Table 4: Pollutant concentrations for the existing scenario (2004) and all future scenarios (2006, 2010 and 2020) with and without development from the DMRB Screening Assessment

Pollutant	Carbon Monoxide (CO)	Benzene	1,3-butadiene	Nitrogen Dioxide (NO_2)	Fine Particulate Matter (PM_{10})	
Averaging Period	Annual mean (mg/m^3)	Annual mean ($\mu g/m^3$)	Annual mean ($\mu g/m^3$)	Annual mean ($\mu g/m^3$)	Annual mean ($\mu g/m^3$)	No. of days >50$\mu g/m^3$
Receptor 1 – Centre of Gavray Drive						
2004	*0.20*	*0.22*	*0.1*	*19.68*	*17.96*	*1.37*
2006 DM	0.17	0.2	0.08	18.08	17.51	1.05
2006 DS	0.19	0.22	0.09	19.15	18.01	1.41
2010 DM	0.13	0.19	0.07	15.70	16.53	0.51
2010 DS	0.14	0.21	0.08	16.51	16.87	0.67
2016 DM	0.12	0.18	0.07	14.23	16.45	0.48
2016 DS	0.13	0.20	0.08	14.85	16.70	0.59
Receptor 2 – Corner of Eastern Distributor Road and Gavray Drive						
2004	*0.23*	*0.25*	*0.14*	*23.30*	*19.26*	*2.55*
2006 DM	0.20	0.23	0.12	22.18	18.97	2.26
2006 DS	0.22	0.25	0.14	22.98	19.41	2.71
2010 DM	0.16	0.21	0.10	18.96	17.48	1.03

2010 DS	0.17	0.23	0.12	19.51	17.75	1.22
2016 DM	0.14	0.20	0.10	16.38	16.94	0.71
2016 DS	0.16	0.22	0.11	17.11	17.29	0.91
Receptor 3 - Eastern Distributor Road						
2004	*0.22*	*0.24*	*0.14*	*23.23*	*19.18*	*2.48*
2006 DM	0.19	0.21	0.11	21.32	18.57	1.88
2006 DS	0.19	0.22	0.12	22.18	18.90	2.19
2010 DM	0.14	0.20	0.09	18.18	17.18	0.84
2010 DS	0.15	0.21	0.10	18.81	17.36	0.95
2016 DM	0.13	0.19	0.09	16.18	16.88	0.68
2016 DS	0.14	0.20	0.10	16.48	16.96	0.72
Receptor 4 - Peregrine Way						
2004	*0.23*	*0.25*	*0.12*	*20.70*	*18.48*	*1.80*
2006 DM	0.19	0.22	0.09	18.93	17.93	1.35
2006 DS	0.19	0.22	0.09	18.93	17.93	1.35
2010 DM	0.14	0.21	0.08	16.39	16.84	0.66
2010 DS	0.14	0.21	0.08	16.39	16.84	0.66
2016 DM	0.13	0.20	0.08	14.83	16.71	0.60
2016 DS	0.13	0.20	0.08	14.74	16.68	0.58
Receptor 5 - On-site, Corner Eastern Distributor Road/ Gavray Drive						
2004	*0.27*	*0.29*	*0.19*	*24.86*	*20.39*	*3.89*
2006 DM	n/a	n/a	n/a	n/a	n/a	n/a
2006 DS	0.22	0.25	0.14	22.73	19.37	2.67
2010 DM	n/a	n/a	n/a	n/a	n/a	n/a
2101 DS	0.17	0.23	0.12	19.39	17.76	1.22
2016 DM	n/a	n/a	n/a	n/a	n/a	n/a
2016 DS	0.16	0.23	0.11	17.08	17.32	0.93
Receptor 6 - On-site, northeastern corner						
2004	*0.24*	*0.26*	*0.17*	*25.01*	*19.94*	*3.33*
2006 DM	n/a	n/a	n/a	n/a	n/a	n/a
2006 DS	0.20	0.23	0.13	22.32	19.01	2.29
2010 DM	n/a	n/a	n/a	n/a	n/a	n/a
2010 DS	0.16	0.21	0.11	19.06	17.50	1.04
2016 DM	n/a	n/a	n/a	n/a	n/a	n/a

2016 DS	0.14	0.21	0.10	16.80	17.10	0.80

In addition to emissions from road traffic, there are two railway lines passing to the north and to the west of the site, both of which have the potential to effect local air quality in bringing electric and diesel powered trains in close proximity to the site. Such locomotives emit nitrogen oxides, sulphur dioxide, and PM_{10}. Moving locomotives to not, however, make a significant contribution to short-term pollutant concentrations and there is no evidence to suggest that there is a risk of the 1 hour NO_2, 24 hour PM_{10} and 24 hour and 1 hour SO_2 mean objectives being exceeded in the vicinity of railway lines[1]. Exposure to stationary locomotives may be more significant, but only if locomotives are regularly stationary for periods of 15-minutes or more (potentially causing a risk of exceeding the SO_2 15-minute objective) and if there is regular outdoor exposure within 15m of the stationary locomotives[1]. The nearest stations to the Gavray Drive site are of a great enough distance for emissions from there to be considered insignificant.

4. MITIGATION MEASURES

4.1 Proposed Construction Mitigation Measures

Prior to commencement of construction activities, a Code of Construction Practice (CoCP) will be agreed with the local council to ensure the potential for adverse environmental effects on local receptors will be avoided. The Code is expected to contain the following air quality mitigation measures:

- Wheel washing facilities to prevent mud from construction operations being transported on to adjacent public roads;
- Damping down of site haul roads during prolonged dry periods;
- Regular cleaning of hard-surfaced site entrance roads;
- Ensuring that dusty materials are stored and handled appropriately (e.g. wind shielding or complete enclosure, storage is away from site boundaries, drop heights of materials are restricted, watersprays are used where practicable to reduce fugitive dust emissions);
- Ensuring that dusty materials are transported appropriately (e.g. sheeting of vehicles carrying spoil and other dusty materials);
- Confinement of vehicles to designated haul routes within the site;
- Restricting vehicle speeds on haul roads and other unsurfaced areas of the site;
- Hoarding and gates to prevent dust breakout; and
- Appropriate dust site monitoring is included within the site management practices to inform site management of the success of dust control measures used.

Construction activities would hereby be controlled to reduce as far as possible the potential environmental impacts, and therefore limiting residual impacts.

1 Department for Environment, Food and Rural Affairs (2003), Part IV of the Environment Act 1995, Local Air Quality Management, Technical Guidance LAQM.TG(03).

4.2 Proposed Operational Mitigation Measures

In terms of the five key pollutants (carbon monoxide, benzene, 1,3-butadiene, nitrogen dioxide and particulate matter) the proposed development has no negative impact on the local air quality, especially so over time and therefore no mitigation measures are proposed with respect to operational traffic.

5. CONCLUSION

This air quality assessment examines existing air quality, outlines the relevant air quality standards and objectives and assess the potential changes in air quality arising from the development of the Gavray Drive site in Bicester.

A review and assessment of air quality has been undertaken by Cherwell District Council, which concluded that there would be no exceedence of any of the air quality objectives in the relevant years for any of the key pollutants and therefore no Air Quality Management Areas were declared in the district. This was recently confirmed by the Updating and Screening Assessment (*Air Quality Updating and Screening Assessment for Cherwell (Draft), February 2004*), which verified that detailed assessments would not be required for any pollutants.

The construction effects of the proposed development on local air quality will be primarily events where dust causes a nuisance during the limited duration of construction activities. These will be controlled, however, through mitigation measures contained within the Code of Construction Practice, thereby making certain that potentially adverse effects of construction on local air quality are kept to an absolute minimum of completely avoided.

Impacts to local air quality from the proposed residential developments will be from associated road traffic and the pollutants assessed were carbon monoxide, benzene, 1,3-butadiene, nitrogen dioxide and particulate matter. Together with background pollutant concentrations for the site, traffic data with anticipated changes in traffic flows due to the development were used to predict air pollution concentrations for the existing scenario (2004) and in the future years 2006 (opening year), 2010 and 2016, with and without the development in place.

All national air quality objectives are predicted to be met by the relevant years with and without the development in place. The predicted concentrations indicate that the effects of the proposed development on local air quality are negligible.

Appendix 2: Results Table

Results Table for Air Quality

Receptor No.	Receptor Description	Link No.	% HGVs AM	% HGVs PM	% HGVs Average	Existing (2004) AADT AM Peak	Existing (2004) AADT PM Peak	Existing (2004) Average	2006 Do Minimum AADT AM Peak	2006 Do Minimum AADT PM Peak	2006 Do Minimum Average
1	Gavray Drive, Centre	1	0.05	0.1	**0.1**	1803	722.56	**1263**	1863.005	1471.774	**1667**
2	Corner of Eastern Distrib & Gavray Drive	1	0.23	0.11	**0.2**	13290.2	5425	**9358**	13728.79	12115.15	**12922**
		2	0.05	0.1	**0.1**	1803	722.56	**1263**	1863.005	1471.774	**1667**
3	Eastern Distributor Road	1	0.25	0.17	**0.2**	11330.04	11930	**11630**	11704.2	12324.1	**12014**
4	Peregrine Way	1	0.13	0.06	**0.1**	4595.78	5230	**4913**	4747.465	5402.462	**5075**
5	On-site, Corner Eastern Distrib Rd/ Gavray Drive	1	0.23	0.13	**0.2**	14055.69	14286	**14171**	14519.54	12236.01	**13378**
		2	0.05	0.1	**0.1**	1803	722.56	**1263**	1863.005	1471.774	**1667**
6	On-site, northeast corner	1	0.23	0.13	**0.2**	14055.69	14286	**14171**	14519.54	12236.01	**13378**

Receptor No.	Receptor Description	Link No.	2006 Do Something AADT AM Peak	2006 Do Something AADT PM Peak	2006 Do Something Average	2010 Do Minimum AADT AM Peak	2010 Do Minimum AADT PM Peak	2010 Do Minimum Average	2010 Do Something AADT AM Peak	2010 Do Something AADT PM Peak	2010 Do Something Average
1	Gavray Drive, Centre	1	6015	5625	**5820**	1978.582	1562.544	**1771**	6131	5716	**5924**
2	Corner of Eastern Distrib & Gavray Drive	1	15515	13902	**14709**	14579.4	12865.79	**13723**	16366	14652	**15509**
		2	6015	5625	**5820**	1978.582	1562.544	**1771**	6131	5716	**5924**
3	Eastern Distributor Road	1	15299	15920	**15610**	12429.3	13087.7	**12759**	16024	16683	**16354**
4	Peregrine Way	1	4764	5420	**5092**	5041.59	5737.356	**5389**	5058	5753	**5406**
5	On-site, Corner Eastern Distrib Rd/ Gavray Drive	1	14787	12504	**13646**	15419.14	12994.14	**14207**	15687	13261	**14474**
		2	6015	5625	**5820**	1978.582	1562.544	**1771**	6131	5716	**5924**
6	On-site, northeast corner	1	14787	12504	**13646**	15419.14	12994.14	**14207**	15687	13261	**14474**

Receptor No	Receptor Description	Link No.	2016 Do Minimum AADT AM Peak	2016 Do Minimum AADT PM Peak	2016 Do Minimum Average	2016 Do Something AADT AM Peak	2016 Do Something AADT PM Peak	2016 Do Something Average
1	Gavray Drive, Centre	1	2165.647	1711.155	**1938.401**	6318	5864	**6091**
2	Corner of Eastern Distrib & Gavray Drive	1	5961.503	14085.55	**10023.53**	17747	15872	**16809.5**
		2	2165.647	1711.155	**1938.401**	6318	5864	**6091**
3	Eastern Distributor Road	1	13607.6	14329	**13968.3**	17203	17924	**17563.5**
4	Peregrine Way	1	5519.551	6281.659	**5900.605**	5537	5076	**5306.5**
5	On-site, Corner Eastern Distrib Rd/ Gavray Drive	1	16880.86	14226.07	**15553.46**	17147	14494	**15820.5**
		2	2165.647	1711.155	**1938.401**	6318	5864	**6091**
6	On-site, northeast corner	1	16880.86	14226.07	**15553.46**	17147	14494	**15820.5**

		% HGVs Existing 2004			% HGVs Do Minimum 2006			% HGVs Do Something 2006		
Receptor No. Receptor Description	Link No.	AM No.	PM No.	Average No	AM	PM	Average No	AM	PM	Average No
1 Gavray Drive, Centre	1	35.8	14.6512	**25**	37	29.62	**33**	128.3	178.82	**154**
			%	2		%	2		%	3
	1	1593.31	348.31	**971**	1645.92	555.13	**1101**	1645.92	662.35	**1154**
			%	10		%	9		%	8
Corner of Eastern 2 Distrib & Gavray Drive	2	35.8	14.66	**25**	37	29.62	**33**	128.3	178.82	**154**
			%	2		%	2		%	3
Eastern Distributor 3 Road	1	1474.45	986.26	**1230**	1523.12	1018.92	**1271**	1973.08	1324.3	**1649**
			%	11		%	11		%	11
4 Peregrine Way	1	72.58	101.42	**87**	74.96	104.78	**90**	75.3	105.47	**90**
			%	2		%	2		%	2
	1	1593.24	1040.21	**1317**	1645.92	547.27	**1097**	1645.92	547.27	**1097**
			%	9		%	8		%	8
On-site, Corner Eastern Distrib Rd/ 5 Gavray Drive	2	35.8	14.66	**25**	37	29.62	**33**	128.3	178.82	**154**
			%	2		%	2		%	3
On-site, northeast 6 corner	1	1593.24	1040.21	**1317**	1645.92	547.27	**1097**	1645.92	547.27	**1097**
			%	9		%	8		%	8

Receptor No.	Receptor Description	Link No.	% HGVs Do Minimum 2010 AM	PM	Average No	% HGVs Do Something 2010 AM	PM	Average No	% HGVs Do Minimum 2016 AM	PM	Average No
1	Gavray Drive, Centre	1	39.3	31.46	**35**	130.55	180.66	**156**	43	34.48	**39**
				%	2		%	3		%	2
		1	1747.91	589.52	**1169**	1747.91	696.74	**1222**	1913.47	645.47	**1279**
				%	9		%	8		%	13
2	Corner of Eastern Distrib & Gavray Drive	2	39.3	31.46	**35**	130.55	180.66	**156**	43	34.48	**39**
				%	2		%	3		%	2
3	Eastern Distributor Road	1	1617.48	1082	**1350**	2067.44	1387.38	**1727**	1770.9	1184.59	**1478**
				%	11		%	11		%	11
4	Peregrine Way	1	79.62	111.26	**95**	79.94	111.66	**96**	87.16	121.81	**104**
				%	2		%	2		%	2
		1	1747.91	581.18	**1165**	1747.91	581.18	**1165**	1913.47	636.29	**1275**
				%	8		%	8		%	8
5	On-site, Corner Eastern Distrib Rd/ Gavray Drive	2	39.3	31.46	**35**	130.55	180.66	**156**	43	34.48	**39**
				%	2		%	3		%	2
6	On-site, northeast corner	1	1747.91	581.18	**1165**	1747.91	581.18	**1165**	1913.47	636.29	**1275**
				%	8		%	8		%	8

			% HGVs Do Something 2016		
Receptor No.	Receptor Description	Link No.	AM	PM	Average No
1	Gavray Drive, Centre	1	134.3	183.62	**159**
				%	3
		1	1913.47	752.63	**1333**
				%	8
2	Corner of Eastern Distrib & Gavray Drive	2	134.3	183.62	**159**
				%	3
3	Eastern Distributor Road	1	2220.86	1489.97	**1855**
				%	11
4	Peregrine Way	1	87.5	97.79	**93**
				%	2
5	On-site, Corner Eastern Distrib Rd/ Gavray Drive	1	1913.47	636.29	**1275**
				%	8
		2	134.3	183.62	**159**
				%	3
6	On-site, northeast corner	1	1913.47	636.29	**1275**
				%	8

Appendix 1: Noise Assessment

ArupAcoustics

Gallagher Estates

Gavray Drive

Noise Assessment

Report ref
AAc/116095-00/R01

ArupAcoustics

Gallagher Estates

Gavray Drive

Noise Assessment

November 2004

Arup Acoustics
Parkin House, 8 St Thomas Street, Winchester, Hampshire S023 9HE, UK
Tel +44 (0)1962 829900 Fax +44 (0)1962 867270
www.arup.com/acoustics

Job number 116095-00

Job title	Gavray Drive		Job number 116095-00
Document title	Noise Assessment		File reference
Document ref	AAc/116095-00/R01		

Revision	Date				
Issue	18/11/04	Filename	R001- JxW-issue.doc		
		Description			
			Prepared by	Checked by	Approved by
		Name	Jamie Walker BSc(hons)	Colin Waters BSc(Eng) MSc CEng MRAeS FIOA	Colin Waters BSc(Eng) MSc CEng MRAeS FIOA
		Signature			
Rev A	18/11/04	Filename	R001- JxW-issue rev A.doc		
		Description	Oct Development Plan		
			Prepared by	Checked by	Approved by
		Name	Jamie Walker BSc(hons)	Colin Waters BSc(Eng) MSc CEng	Colin Waters BSc(Eng) MSc CEng
		Signature			
Rev B	22/11/04	Filename	R001- JxW-issue rev B.doc		
		Description	Following internal review		
			Prepared by	Checked by	Approved by
		Name	Jamie Walker BSc(hons)	Colin Waters BSc(Eng) MSc CEng	Colin Waters BSc(Eng) MSc CEng
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			

CONTENTS

		Page
EXECUTIVE SUMMARY		**1**
1.	**INTRODUCTION**	**2**
1.1	Site Description	2
1.2	Proposed Development	2
2.	**NOISE CRITERIA**	**3**
3.	**NOISE ASSESSMENT METHODOLOGY**	**4**
3.1	Measurement Survey	4
3.2	Measurement Procedure	4
4.	**MEASUREMENT LOCATION DESCRIPTIONS**	**5**
5.	**ASSESSMENT IN ACCORDENCE WITH PPG24**	**7**
6.	**RAILWAY NOISE**	**7**
7.	**RECOMMENDATIONS**	**8**
7.1	Site Layout	8
7.2	Screening	8
7.3	Property Orientation	8
7.4	Building Design	8
7.5	School	9
8.	**ASSESSMENT OF SITE SUITABILITY**	**9**
9.	**CONSIDERATION OF POTENTIAL NOISE IMPACT OF SITE ON THE LOCAL AREA**	**9**
10.	**CONSTRUCTION NOISE**	**10**
10.1	Control of Construction Noise	10
11.	**TRAFFIC NOISE IMPACT**	**10**
11.1	Calculation of Road Traffic Noise	10
11.2	Assessment of Traffic Noise	11
11.3	Extent of Traffic Noise Increase	12
12.	**INSTALLED PLANT NOISE**	**12**
13.	**OVERALL NOISE ASSESSMENT**	**12**
13.1	Suitability of site for development	12
13.2	Potential impact on local area	12

REFERENCES

FIGURES

Figure 1 Map showing positions of measurement locations
Figure 2 Graph of L_{Amax} L_{Aeq} L_{A10} and L_{A90} noise levels measured at the logging meter
Figure 3 Graph of L_{Amax} L_{Aeq} L_{A10} and L_{A90} noise levels measured at location 1
Figure 4 Graph of L_{Amax} L_{Aeq} L_{A10} and L_{A90} noise levels measured at location 2
Figure 5 Graph of L_{Amax} L_{Aeq} L_{A10} and L_{A90} noise levels measured at location 3
Figure 6 Graph of L_{Amax} L_{Aeq} L_{A10} and L_{A90} noise levels measured at location 4

APPENDICES

APPENDIX A
Results Tables

APPENDIX B
Environmental Terminology

EXECUTIVE SUMMARY

An assessment of environmental noise has been carried out for a proposed residential development site adjacent to Gavray Drive, Bicester.

A 24 hour noise survey was carried out to determine the PPG 24 noise exposure categories (NECs) for the site. The measured noise levels place part of the site into NEC A and part in B. That part of the site in NEC B (where PPG 24 recommends that 'Noise should be taken into account when determining planning applications.') is that closest to the principal noise sources, namely the A4421 and the London to Bicester railway line.

It is concluded that it will be necessary to incorporate suitable noise mitigation into residential development on parts of this site. Suggested options such as consideration of site layout, screening, property orientation and building design including glazing specification are discussed.

The assessment has also considered the potential impacts that this proposed development may have upon the local area and has assessed the effects of these impacts. The consideration has identified traffic noise impacts as likely to have a slight to moderate impact to dwellings to the SW of Gavray Drive. The absolute level of noise exposure of these dwellings is such that the overall effect of the increased noise exposure is considered to be minimal. All other noise sources both operational and constructional are not expected to have an adverse effect upon the local area.

1. INTRODUCTION

It is proposed that the site adjacent to Gavray Drive in Bicester be developed for residential use and for a rail link. Currently the site is grassland interspersed with hedgerows.

A noise survey was carried out to ascertain the existing noise levels from noise sources across the proposed development site. Noise was measured to establish whether the site was suitable on noise grounds for development as residential housing in terms of PPG24.

The noise issues that are likely to occur as a result of this development are discussed and are detailed later in this report and where necessary recommendations are made to mitigate measures to ameliorate any impact on local residents. A glossary of terms is included as Appendix B.

1.1 Site Description

The site to be developed is located between Gavray Drive in the south and the main London to Bicester railway line to the north.

Along the western edge of the site is a freight line which runs roughly north-east to south-west and is on the same level as the site. To the east of the site is the A4421 which does not appear to have any noise barriers on site side but does on its side.

The railway to the north is on an embankment approximately10 m high. At the western end of the site the railway is visually screened by trees. There is a goods depot but any activity here was not audible from the site. There is relatively new housing development to the south of the site beyond Gavray Drive.

The area to be developed is generally flat but there are dry ditches running across it both east to west and north to south. These ditches are generally damp but do not have running water. There is a river up to 2 m wide running from north to south just inside the western half of the site.

Two footpaths cross the site, one from north to south at the western edge of the site and the other east to west across the south-eastern corner of the site.

The land is occupied by grassland divided up by mature hedges. The western third is, on the whole amenity length, the remaining two thirds is generally very tall 1-1.5 m high with criss-crossing pathways.

Traffic on the A4421 was relatively heavy throughout the day but very light during the night. Gavray Drive was never particularly busy as it only provided access to the western end of the new housing development to the south.

Rail traffic on the London to Bicester Line generally consisted of two to three carriage diesel driven passenger trains. Freight traffic on the north to south line was not frequent though that which was observed consisted of 50+ aggregate trucks driven by a large diesel locomotive.

There was distant road traffic noise from the A41 which was particularly noticeable during the night when other more local noise sources were relatively quiet.

1.2 Proposed Development

It is proposed that the development will consist of residential housing and recreational areas across the area. The far western end may contain a rail spur connecting the freight line with the London to Bicester line. The western portion of the site will contain a school with its associated grounds and a community facility.

This examination considers the development of the site in accordance with the development framework plan of 20 October 2004. This plan assumes residential development on both the east and west sections of the site.

2. NOISE CRITERIA

PPG 24 [1] offers guidance on noise when considering the suitability of a site for residential development near to new or existing noise sources. It also defines noise exposure categories (NECs) for day and night-time to assist in assessing whether or not it is appropriate to permit the development of residential properties for a given noise climate. The categories relate to different noise bands depending on the source of noise, i.e. road, rail, air, or mixed noise sources. For this assessment daytime and night road traffic noise was considered to be dominant across most of the site, for the remainder a combination of road and rail noise dominated. The noise exposure category boundaries for road traffic and mixed sources are the same (Table 1).

The noise exposure categories given in PPG 24 for road traffic and mixed sources are reproduced below in Table 1. The associated advice provided in PPG 24 relating to the granting of planning permission for residential use is reproduced in Table 2.

Noise Levels[0] Corresponding to the Noise Exposure Categories for new dwellings $L_{Aeq,T}$ dB				
	Noise Exposure Category			
Noise source	A	B	C	D
Road Traffic 07:00-23:00 23:00-07:00[1]	 <55 <45	 55-63 45-57	 63-72 57-66	 >72 >66
Mixed Sources[2] 07:00-23:00 23:00-07:00[1]	 <55 <45	 55-63 45-57	 63-72 57-66	 >72 >66

Table 1: Noise exposure categories for new dwellings near road traffic noise sources

Notes: [0] Noise Levels: the noise level (s) ($L_{Aeq,T}$) used when deciding the NEC of a site should be representative of typical conditions.

[1] Night time noise levels (23:00-07:00): sites where individual noise events regularly exceed 82 dB L_{Amax} (S time weighting) several times in any hour should be treated as being in NEC C, regardless of the $L_{Aeq,8hr}$ (except where the $L_{Aeq,8hr}$ already puts the site in NEC D).

[2] Mixed Sources: This refers to any combination of road, rail, air and industrial noise sources. The "mixed source" values are based on the lowest numerical values of the single source limits in the table. The "mixed source" should only be used where no individual noise source is dominant.

NEC A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level.
NEC B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.
NEC C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
NEC D	Planning permission should normally be refused

Table 2: Definitions of noise exposure categories for new dwellings near existing noise sources

3. NOISE ASSESSMENT METHODOLOGY

Measurements were conducted to provide suitable data to quantify the noise climate around the area to be developed to provide a baseline noise level for the area. The assessment was carried out in accordance with PPG24. As a proportion of the noise across this site was expected to be from rail a 24-hour noise survey was required. The measurement locations were chosen to give an indication of road and rail noise across the site, in particular the area close to the A4421 and main passenger railway line. L_{Aeq} 16-hour daytime and 8-hour night time measurements are the required measure for assessment of mixed road and rail noise.

Daytime is considered to be from 07:00-23:00.

Night-time is considered to be 23:00-07:00.

This information was used to assess the suitability of the site for development as residential properties.

3.1 Measurement Survey

The noise measurement survey was carried out by Arup Acoustics' engineers Jamie Walker and Julien Francois over a period from 12:00 on Tuesday 29 July 2004 to 12:00 on Wednesday 30 July 2004. Measurements were taken at locations 1 to 4 in rotation over each hour. A logging meter was set up at location 5 to log data every 5 minutes for the 24-hour period.

For each noise measurement, the sound level meter used, noise climate, wind speed and direction, and the precise measured noise levels were noted. L_{A10}, L_{A90}, L_{Aeq} and L_{Amax}, noise indices were recorded as was traffic counts on adjacent roads where necessary. The results are reported in Appendix A.

3.2 Measurement Procedure

The sound level meter (SLM) was mounted on a tripod, with the microphone set approximately 1.2-1.5 m above ground level. A windshield was fitted to the microphone to minimise the effects of wind-induced noise across the microphone diaphragm.

All measurements were taken in an acoustically 'Free Field' condition, at least 3.5 m away from any vertical reflective surfaces. The measurement locations were chosen to provide a

representative indication of the typical ambient noise level across the area proposed for redevelopment as residential housing and school.

The weather conditions during the survey were generally dry and cloudy with wind between 0 and 3.8 m/s there was a short shower between 02:00 and 02:30 though roads seemed to dry fairly quickly. At the time of any measurement the conditions were within acceptable limits with the wind speed being less than 5 ms^{-1}.

The instrumentation used to carry out the noise survey was as follows:

Brüel & Kjær 2260 class 1 precision sound level meter (SLM) 2 off

Brüel & Kjær Type 4231 Calibrator

Kestrel 1000 Anemometer

Compass

Immediately before and after each series of measurements was carried out, the SLMs' calibration was checked using the SPL calibrator. Wind speed was monitored throughout the measurement period and was found to be within acceptable limits (i.e. < 5 m/s).

All noise measuring instrumentation owned and used by Arup Acoustics is checked for calibration to traceable national and international standards on an annual basis. Routine 'in-house' spot checks are also carried out at regular intervals as part of Arup Acoustics' QA policy.

4. MEASUREMENT LOCATION DESCRIPTIONS

Noise measurements were taken at five locations during the survey period and these are shown in Figure 1 and detailed below.

4.1.1 Location 1- North-east corner of the site

The SLM was sited 3 m to the north of a virtually dry pond and 12 m west of the hedge which runs along the east side of the field. The field is covered with long grass and surrounded on all sides by hedges. Gavray Drive was 260 m away to the south-west, the A4421 was 140 m to the east and the London to Bicester railway line was approximately 100 m to the north-east.

During the daytime the A4421 dominated with some very intermittent noise from Gavray Drive. Cars on Gavray Drive were only just audible though larger vehicles were noticeable. When the A4421 and Gavray Drive were quiet distant road noise from the A41 in the west-south-west was audible. There was some, sporadic noise from children playing around lunch time. Birdsong was particularly significant just before sunset and in the morning. There were occasional trains throughout the day though those in the evening, when other noise sources were quiet, were more noticeable. There were occasional aircraft over head and some noise from the wind in the trees. There was no noise from the depot on the north side of the railway line.

During the night-time noise from the A41 was almost constantly heard with intermittent noise from the A4421, a number of HGVs passed which were particularly noisy. Noise from Gavray Drive was also present but very intermittent. The A4421 got louder before the A41.

4.1.2 Location 2- South-east corner of the site

The SLM was sited 7 m north-west of the corner of the field and had hedges 5 m away to the south-east and south-west. To the north-west, north and north-east was an open field covered in long grass. Location 1 was approximately 120 m to the north-east with the railway 100 m further away in the same direction. Gavray Drive was approximately 150 m away to the south-west and the A4421 was approximately 120 m away to the east.

The daytime noise climate was dominated by the A4421 together with the A41 audible during quiet periods. Very infrequent traffic on Gavray Drive was audible including one or two vans and HGVs. Trains were audible though not visible and not frequent. There were a number of aircraft overhead during the day including a loud flypast by a helicopter. There was occasional low noise from Bicester town centre and from the wind in the trees. Birds also had some local input though this varied greatly throughout the day.

The night-time noise was dominated by intermittent traffic on the A4421 including HGVs and fairly constant noise from the A41, the roads were quietest between 02:00 and 05:00. At around 04:00 just as it started to get light, noise from bird song was as significant as road noise from all sources. Trains in the early hours (02:00) of the day and up until midnight were heard, though not throughout the rest of the night.

4.1.3 Location 3- On the footpath between Gavray Drive and Peregrine Way

The measurement location was on the east side of the path adjacent to the rear façade of the closest house on Merganser Drive. Gavray Drive was approximately 30 m away to the north-east and visible at the end of the footpath. The A4421 was approximately 130 m away to the south-east and screened by hedges and two storey residential buildings. The edge of the proposed development was approximately 50 m to the north east.

The daytime noise climate was dominated by the A4421 together with the intermittent traffic on Gavray Drive. The A41 was audible when other noise sources were quiet. Noise from people on the footpath was loud but brief. Lawn mowing and gardening 20-30 m away as well as people in their gardens were heard throughout the daytime measurements though, except for the lawn mower, these events were relatively quiet. Occasional bird song and aircraft overhead also had some input though neither was significant during the day.

The night-time measurements were dominated by the A4421 and the A41 with intermittent input from Gavray Drive. A very small number of trains were heard, although from this location these were very quiet. Bird song was significant during the early hours reaching a peak around 04:00, although bird song was the loudest noise at this time it was still intermittent.

4.1.4 Location 4- On the footpath at the western end of the site

The measurement location was at the northern end of the field 15 m south of where the footpath crossed the line of the north to south hedge. The London to Bicester railway was 60m away to the north-east and the freight railway was 60 m to the north-west. Approximately 90 m to the north was the London to Bicester railway bridge over the freight railway. The footpath continued to the north under this same bridge. Gavray Drive was approximately 150 m away to the south-west and hidden from view by the hedge along the southern edge of the field. The London to Bicester railway was on an approximately 10 m high embankment and trains on it were visible for some distance in both directions.

Day time noise was from a large number of intermittent sources. Trains on the London to Bicester line were frequent and often blew their horns before crossing the bridge over the Freight line and a noise like trains shunting was heard at various times to the west. Traffic on the A41 provided a fairly constant background noise which was audible when other sources were quiet, the same was true of the A4421 though this was more intermittent noise. Bird song was fairly loud at times but not constant. The wind through the trees was audible when the wind was strongest. Some noise sounding like an industrial fan was heard to the west though as this was relatively quiet it was mainly heard when other noise sources were quiet. There were a number of aircraft overhead including two helicopters which were particularly loud though only briefly in the area. In the evening children camping in a field adjacent to the measurement location meant that it was necessary to move the measurement location 100 m

along the footpath to the south-west. This noise continued throughout the whole evening and night.

Night-time noise also had no single dominant source except that the noise from the A41 was the most consistent. Intermittent traffic on the A4421 could be heard faintly, traffic on Gavray drive was also heard though this was even more infrequent. Birdsong at first light was particularly noisy though only after 03:30. A single freight train on the north to south railway line was heard; this was a large train with 50+ aggregate trucks.

4.1.5 Location 5- The Logging meter

The logging meter was placed 10 m east of a hedge 160 m north-east of Gavray Drive. The SLM was on the edge of a large field with a hedge approximately 35 m to the north-east. The London to Bicester railway was approximately 180 m to the north-east and was almost completely obscured by trees along its edge. Location 1 was 200 m away to the east but obscured by a large mature hedge.

5. ASSESSMENT IN ACCORDENCE WITH PPG24

The measured noise levels were taken as a base to construct the boundaries to the NEC areas

The NEC zones referred to below are shown as Figures 7 and 8.

The daytime situation shows that the majority of the site falls within NEC A with two narrow strips parallel to the east and west boundaries of the site. This is shown as Figure7.

Figure 8 illustrates the night time situation which again shows the majority of the site within NEC A. However, the NEC B zone is significantly increased and would occupy approximately 50% of the area of the development on the eastern half of the site.

For NEC A, PPG24 states '*Noise need not be considered as a determining factor when granting planning permission, although the noise level at the high end of the category should not be considered as a desirable level.*'

For NEC B PPG24 states that '*Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.*'

Schools and community facilities can be considered to be, in part at least, noise sensitive. However, the NEC categories are not directly relevant to the classification of the suitability of the site for such developments. The position of the school and community facility in the proposed masterplan is such that they would be well within NEC zone A. In these circumstances the expected noise exposure of the school buildings would be around 50 dB L_{Aeq} over the school day. The school would not need to have any special glazing applied to give satisfactory interior noise levels. However, some attention may be necessary to the means of ventilation and some form of passive ventilation may be required. This feature would be considered at the detail design stage.

6. RAILWAY NOISE

There is a possibility that the area of land at the western end of the site adjacent to the Bletchley Oxford railway will be developed to provide a link from this line to the Bicester Oxford Line. The land is reserved for this development but there is no certainty that this 'Bicester Chord' will be built. A study of the noise effects of the establishment of this link has been carried out by Scott Wilson and reported in their document A011170 (7 May 2004).

When considering the likely noise in the planning context of the development of this rail link Scott Wilson concluded that the 'with scheme' noise levels over the L_{Aeq} ,8hr period were

generally below 45 dB and that the area falls generally within the NEC A zone. Except for a very narrow strip of land adjacent to the railway link. It was similarly shown that the L_{Aeq} 16 hr was below 55 dB except for a similar narrow strip of land next to the chord. Scott Wilson examined the potential use of mitigation of this noise by a 2.4m noise barrier alongside the line at the base of the embankment but concluded that the improvement achieved was not sufficient to warrant the cost involved.

The masterplan document reserves an area of land adjacent to the line of the potential chord and this is sufficient to ensure that the land to be used for residential development is not compromised by the greater than NEC A zone indicated in the Scott Wilson report.

7. RECOMMENDATIONS

Much of the site falls into NEC A which as stated above should require no special measures to allow planning permission for residential development to be granted. If it is proposed that dwellings or noise sensitive receptors be built in NEC B some of the noise mitigation measures suggested below may be required to provide acceptable noise conditions. These would need to ensure a commensurate level of protection against noise for dwellings and their grounds and/or garden in the part of the site that falls into NEC B. Suggested options are listed below.

7.1 Site Layout

A development of this size has a number of uses associated with the residential development that are not of themselves sensitive to noise. This is especially the case when the noise exposure is more significant at night. The opportunity should be taken to place these land uses within zone B.

7.2 Screening

The main sources of noise affecting this site are the A4421 and the London to Bicester railway to the east and north of the site respectively. Well designed screening along the eastern boundary in particular and possibly along the northern would mitigate road traffic and rail noise. The screening may need to provide screening to all floors of any proposed residential dwelling such that there was no line of sight between any noise sensitive windows and the far side of the A4421. Once the layout of the proposed development site is finalised a detailed assessment is recommended to ascertain whether any screening would provide adequate mitigation to reduce noise levels on site. As the London to Bicester railway line is on an embankment the barrier would need to be significantly higher than if the railway was at the same level as the site to be developed.

7.3 Property Orientation

The careful orientation of residential properties could be used to ensure that sensitive habitable rooms, such as bedrooms and living rooms do not directly overlook the A4421 and London to Bicester railway. Where possible, lobby areas, kitchens, stairways, toilets and utility rooms should be used as buffer zones within the property.

7.4 Building Design

The PPG 24 recommendations for noise control for residential development in NEC B are for 'an adequate level of protection against noise'. BS 8233:1999 'Sound insulation and

reduction for buildings' [2] contains recommended internal noise levels for bedrooms ($L_{Aeq\,T}$ = 30 to 35 dB) and living areas ($L_{Aeq\,T}$ = 30 to 40 dB).

The above internal noise levels could be achieved by a combination of some of the factors listed above together with a good standard of acoustic double glazing. For example a façade containing only closed standard thermal glazed windows with a specification of 10/12/6 mm, fitted with good seals would offer at least a 35-40 dB attenuation of the noise from the outside to the inside. However, adequate ventilation would be required when the windows are closed. To ensure that there is no reduction of the sound insulation performance whilst providing ventilation, it is recommended that acoustically lined trickle vents are fitted to the windows or an acoustic air brick installed. To maintain the acoustic integrity of the façade of these dwellings it is recommended that the doors are not glazed but made from solid hardwood closing onto resilient seals.

Façade and glazing mitigation alone would not provide any mitigation to the gardens and/or grounds of the proposed dwelling. The planning authority may therefore wish to see other mitigation employed to protect this amenity. The provision of 2 m high close boarded fences to the gardens is usually sufficient to achieve satisfactory noise conditions in these areas.

7.5 School

As set out in section 5 above some consideration will need to be made of the school ventilation measures at the appropriate design stage.

8. ASSESSMENT OF SITE SUITABILITY

An assessment of environmental noise has been carried out for the proposed residential and associated community facilities development adjacent to Gavray Drive.

Consideration of measured noise levels have been made with the guidance contained in Planning Policy Guidance, PPG 24 "Planning and Noise".

The measured noise levels place the site partly into NEC A, partly into NEC B.

It will be advisable that some noise mitigation be incorporated into properties in NEC B for this development to proceed. No noise mitigation will be required for properties in NEC A. The noise mitigation in NEC B would need to ensure a commensurate level of protection against noise for the dwellings and their grounds and/or garden. Suggested options include consideration of site layout, screening, property orientation and building design including glazing specification.

9. CONSIDERATION OF POTENTIAL NOISE IMPACT OF SITE ON THE LOCAL AREA

Based on the proposal plans the following potential noise changes have been identified:

- construction of the proposed development and infrastructure;
- road traffic noise from any changes in traffic flow or composition on existing roads;
- plant machinery noise associated with buildings.

These sources are now examined in turn and the potential effects classified where appropriate.

10. CONSTRUCTION NOISE

The most significant civil engineering work on this site will be that associated with the provision of the internal estate roads and the building of the new school. There will be some groundwork required with regard to local levelling but large scale earthworks are not envisaged. At this stage of the process, details are not available as to the type of plant that would be used, nor the timing or timescale of a particular activity. It is noted that Gavray Drive has been laid in such a way as to incorporate access points into the proposed development site and this will limit the amount of disruption of traffic on this road that may occur. It will also result in their being a separation of some 40-50 m from the facades of the nearest buildings to the on-site activity.

10.1 Control of Construction Noise

Notwithstanding the limited potential for adverse effects from construction activities, it remains relevant to consider the means whereby this source may be controlled. The Code of Practice BS 5228 sets out methods and procedures whereby construction noise may be minimised and would require that these methods are followed. The selection of the quietest machinery available to carry out any given task would, for example be an advantage if piling operations are to be carried out. Timing a particular on-site operation to coincide with the noisier ambient conditions, perhaps during peak traffic periods, would serve to limit the impact of that operation. The erection of a temporary noise screen would assist in some circumstances.

In order to ensure that the favourable circumstances of this development are maintained it is recommended that a Construction Schedule is drawn up with the contractor at the appropriate time and that this is agreed with the Local Authority. In this way the most appropriate mitigation measure can be specified if required and the overall residual noise from construction activity reduced to a level where it is not significant.

11. TRAFFIC NOISE IMPACT

The proposed development of this area of land for residential purposes will result in increased traffic flows along Gavray Drive and the Eastern Distributor Road around Bicester. In order to gauge the likely effect of these increases in noise terms an analysis has been carried out that examines the change in noise exposure that would result. Two scenarios have been compared. The 'do minimum' situation which would reflect the situation where no development takes place and the 'do something' situation which reflects the situation where the development is in place and fully operational.

11.1 Calculation of Road Traffic Noise

The level of noise that would result at a certain distance from a road depends upon the nature of the traffic in terms of its volume, speed and characteristics of the traffic mix; the physical nature of the road in terms of its gradient and surface; the distance from the road and the existence of any intervening barriers or absorbing surfaces. Road traffic noise levels can be calculated using the procedures of the *Calculation of Road Traffic Noise* CRTN. This method considers the parameters set out above and calculates the $L_{A10,18\ hour}$ level in dB. This index is prescribed for the calculation of traffic noise in the context of the Noise Insulation Regulations but has found relevance in all UK road noise assessment procedures.

For the situation being considered in this examination the only change that is being considered is the volume of road traffic along Gavray Drive and the eastern distributor road, traffic speed and mix being unlikely to change. All other factors and parameters remain unchanged. A

calculation has therefore been carried out that compares the *do minimum* situation with the *do something* situation.

The table below set out the traffic volumes for the *do minimum* situation and for the *do something* situation in terms of 18 hour AAWT. Also shown on the table are the changes in noise exposure that would result at a position adjacent to the road if this development were to be implemented. The tables are presented for the Phase 1and Phase 2 schemes.

	2006 no dev. Do minimum 18 hour AAWT	2016 with dev Do something 18 hour AAWT	Increase factor	Change in noise level dB $L_{A10,\ 18\ hour}$
Gavray Drive	1780	6125	3.4	+5
EDR	14963	20287	1.3	+1

Table 3.1 Change in noise level resulting from traffic change for the development scheme

11.2 Assessment of Traffic Noise

The following significance descriptors are proposed for traffic noise assessment. The threshold at which traffic noise change becomes significant is based on relevant research [Harland (1977)] and current guidance [Department of Transport (1994)]. For greater noise changes, increasing significance categories have been assigned at 5 dB(A) increments as changes of this magnitude are generally accepted as being noticeable by most people. This framework of significance levels, although not based on any official guidance document, is widely recognised and has been frequently adopted in traffic noise assessments.

- **major adverse**: Noise levels warrant mitigation of residential properties on a widespread basis in a community where practicable. This would relate to increases in noise level of 11-15 dB(A).
- **major beneficial**: Reduction of traffic noise to a level where it does not have a significant influence on the ambient noise in the area;
- **moderate adverse**: Noise levels warrant mitigation of residential properties in a community where practicable. This would relate to increases in noise level of 5-10 dB(A).
- **moderate beneficial**: Reductions in noise level of 5-10 dB(A) at residential communities;
- **slight adverse**: Increases in noise levels of 3-5 dB(A) in residential areas or at outdoor recreational areas in close proximity to the highway.
- **slight beneficial**: Reductions in noise level of 3-5 dB(A) at residential communities;
- **negligible**: Changes in noise level of less than 3 dB(A) in residential areas or at outdoor recreational areas in close proximity to the highway.

From Table 3.1 it can be seen that the increase in traffic noise will expose the dwellings adjacent to Gavray Drive to an increase that can be classified as on the boundary between a **slight adverse** effect and a **moderate adverse** effect. It would be expected that most of the exposed population would recognise that an increase of traffic noise had taken place.

Although traffic noise levels are forecast to increase with the scheme in place, it is considered that the noise levels would still be acceptably low. To put this into context, the forecast traffic noise levels would be well below guideline levels for outdoor living areas recommended by the World Health Organisation. Using this same criterion, traffic noise levels are not considered high enough to cause annoyance.

For the dwellings that are primarily exposed to the traffic noise from the eastern distributor road, the traffic noise increase would be considered to be **negligible.** The residents of these dwellings would not be expected to register the change in noise exposure.

11.3 Extent of Traffic Noise Increase

The traffic noise analysis set out above assumes that the increases in traffic volumes for the development are relevant for the whole length of Gavray Drive. Traffic figures are available only for the activity at the junction of Gavray Drive with the Eastern Distributor Road. This being the case the analysis is restricted to the area between the last exit onto Gavray Drive, from both the existing development and the proposed development, and the junction. However, in reality it can reasonably be assumed that the proportional change, and therefore the noise level increase, would be relevant to any position adjacent to this road.

12. INSTALLED PLANT NOISE

There is almost no likelihood that there will be any significant plant or machinery installed with the residential element of this development. The school building would almost certainly opt to install natural ventilation and the only plant would be that associated with heating. The school is some 70 m from the nearest existing dwelling and at this distance such plant would not have a significant effect. The proposed community facility would be expected to have some plant provided, such as a chiller or heating plant. To avoid any potential impact on the existing residential receptors on the adjacent area of Gavray Drive, any such plant should be specified such that the resulting noise level at the nearest noise sensitive receptor does not have a rating level that exceeds the existing background noise level. The same consideration should be given for the exposure of the school by the plant of the community facility.

13. OVERALL NOISE ASSESSMENT

13.1 Suitability of site for development

The studies set out above have shown that the site is suitable for residential development and that within the guidance offered in PPG 24 planning permission is unlikely to be withheld on noise grounds.

13.2 Potential impact on local area

The potential effect of the development on the local area is limited to an increase in road traffic noise that indicates a slight to moderate effect at the dwellings adjacent to Gavray Drive. It is however considered that this change, although probably noticeable would not significantly prejudice the satisfactory traffic noise conditions in this area. °

REFERENCES

[1] Department of the Environment (1994), *Planning Policy Guidance 24*, Department of the Environment.

[2] British Standards Institution (1999) BS *8233 British Standard code of practice for sound insulation and noise reduction for buildings*, British Standards Institution.

[3] World Health Organisation (1999), Guidelines for Community Noise, World Health Organization.

ArupAcoustics

FIGURES

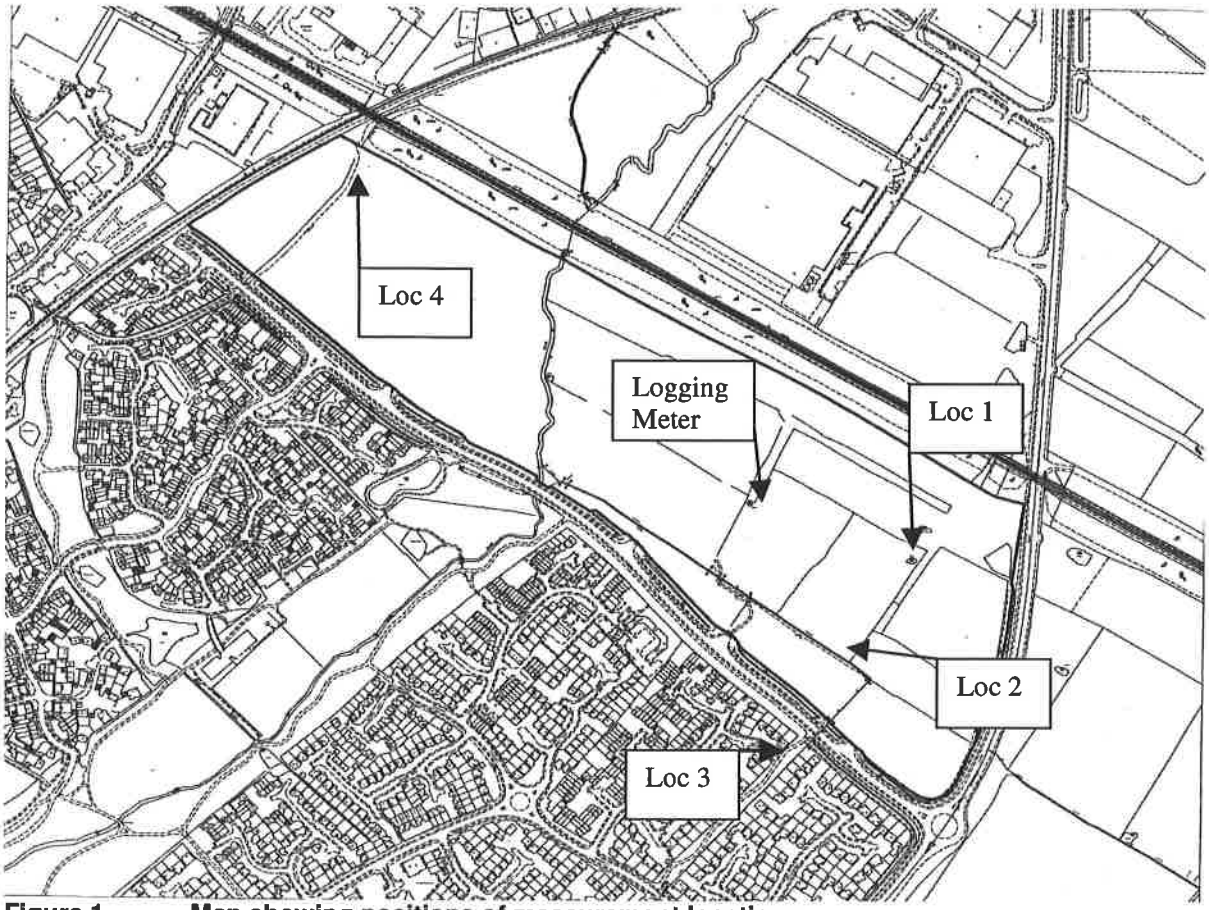


Figure 1 **Map showing positions of measurement locations**

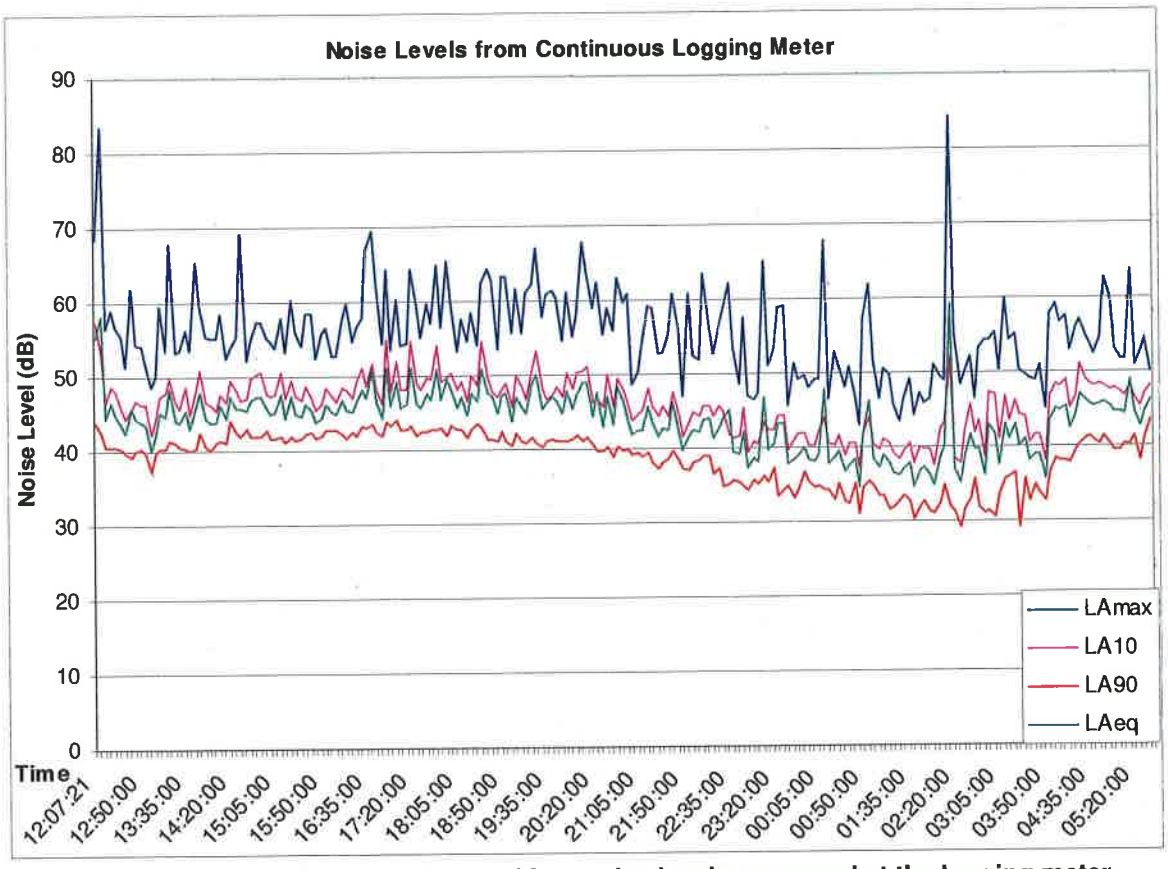


Figure 2 Graph of L_{Amax} L_{Aeq} L_{A10} and L_{A90} noise levels measured at the logging meter

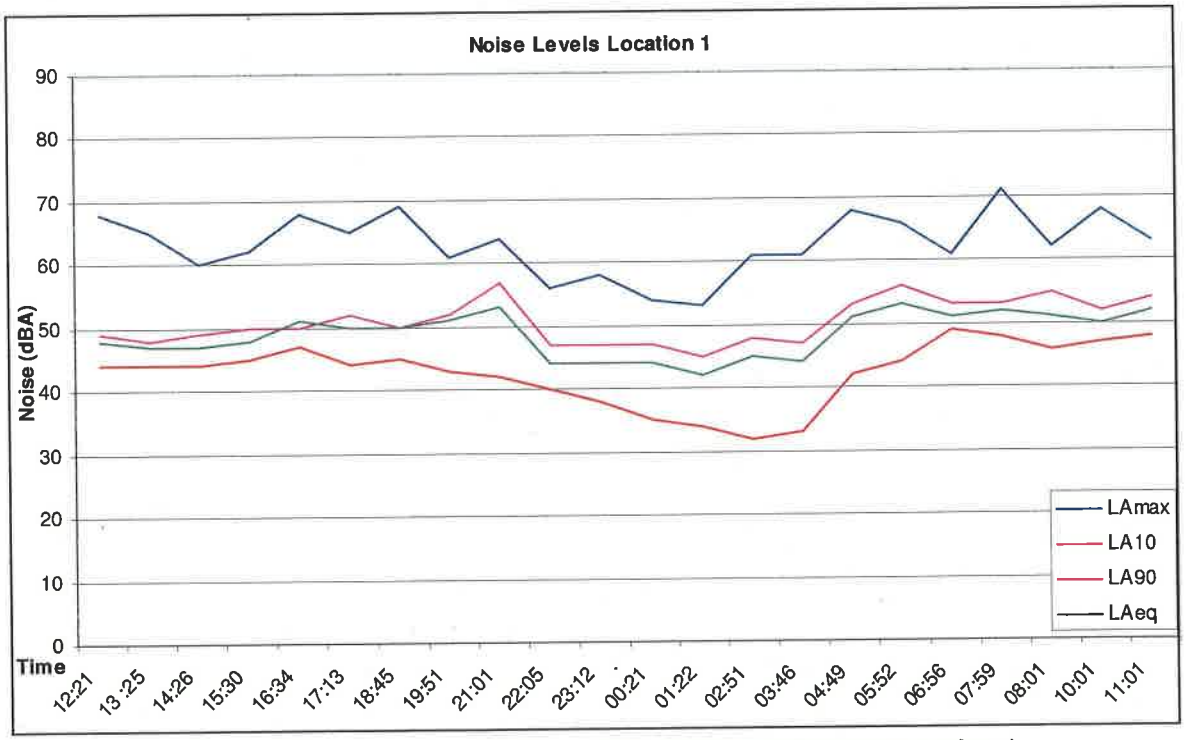


Figure 3 Graph of L_{Amax} L_{Aeq} L_{A10} and L_{A90} noise levels measured at location 1

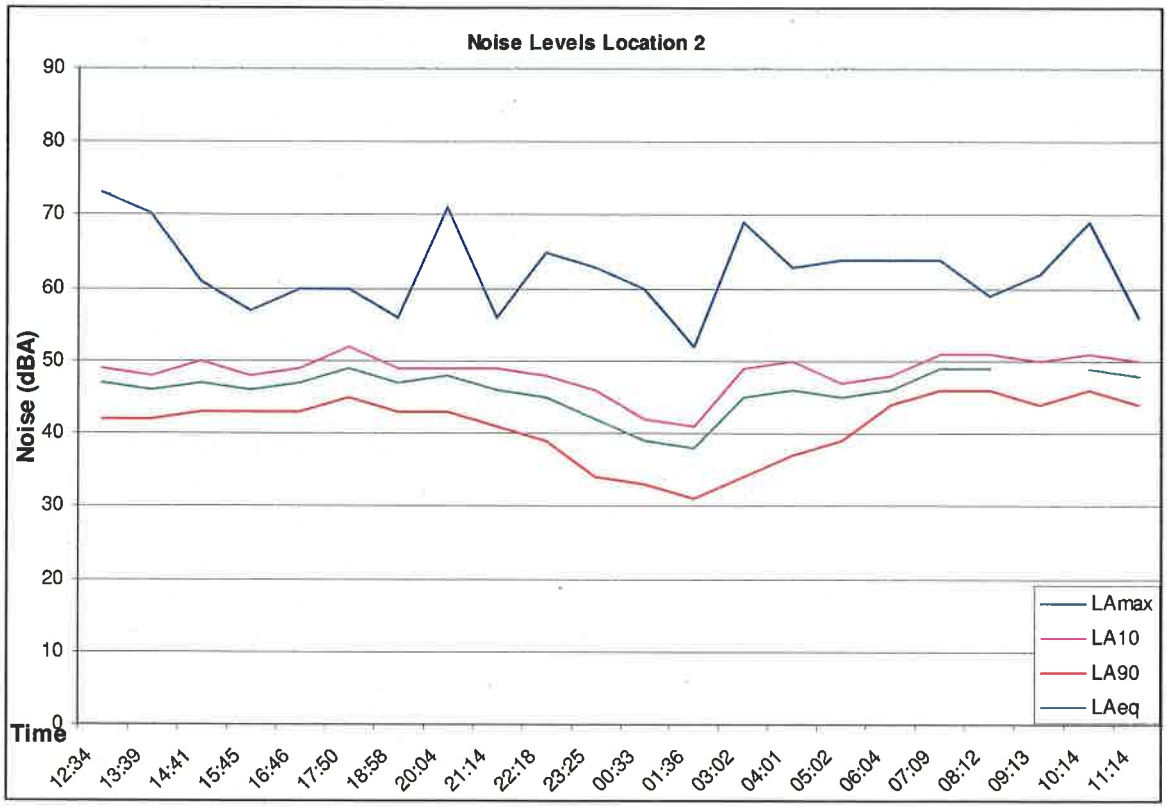


Figure 4 Graph of L_{Amax} L_{Aeq} L_{A10} and L_{A90} noise levels measured at location 2

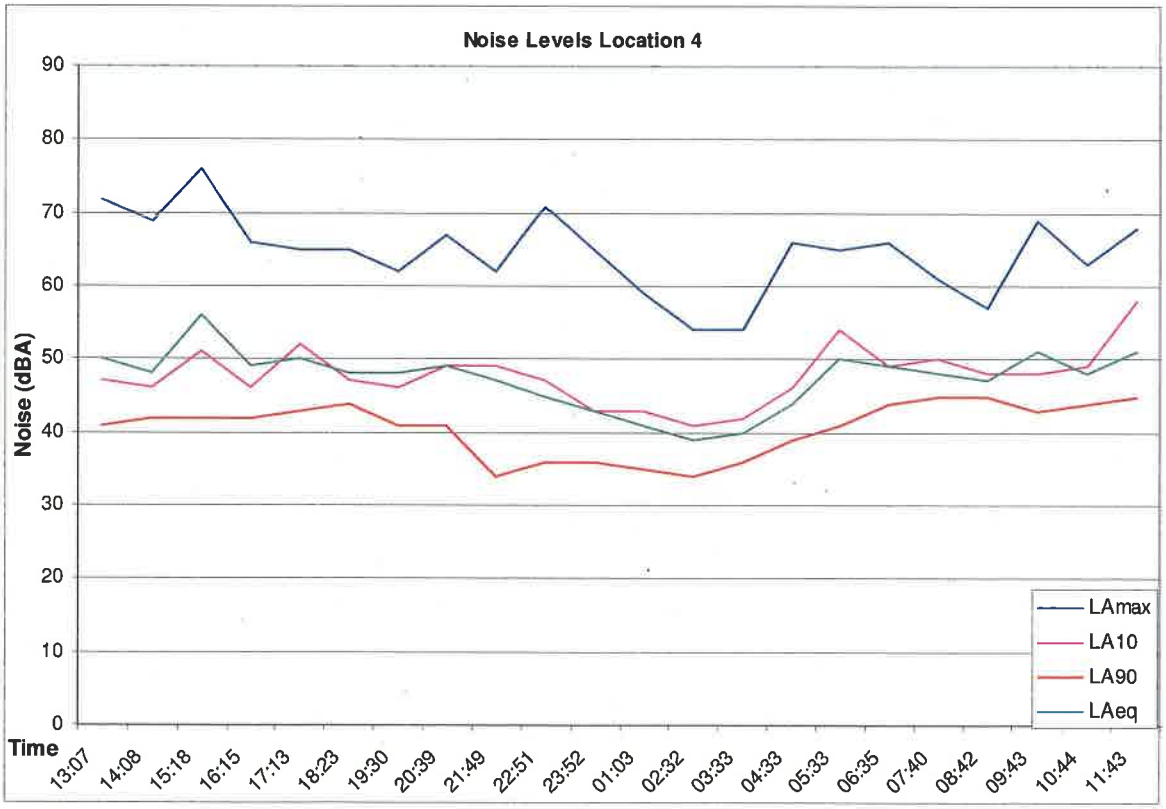


Figure 5 Graph of L_{Amax} L_{Aeq} L_{A10} and L_{A90} noise levels measured at location 3

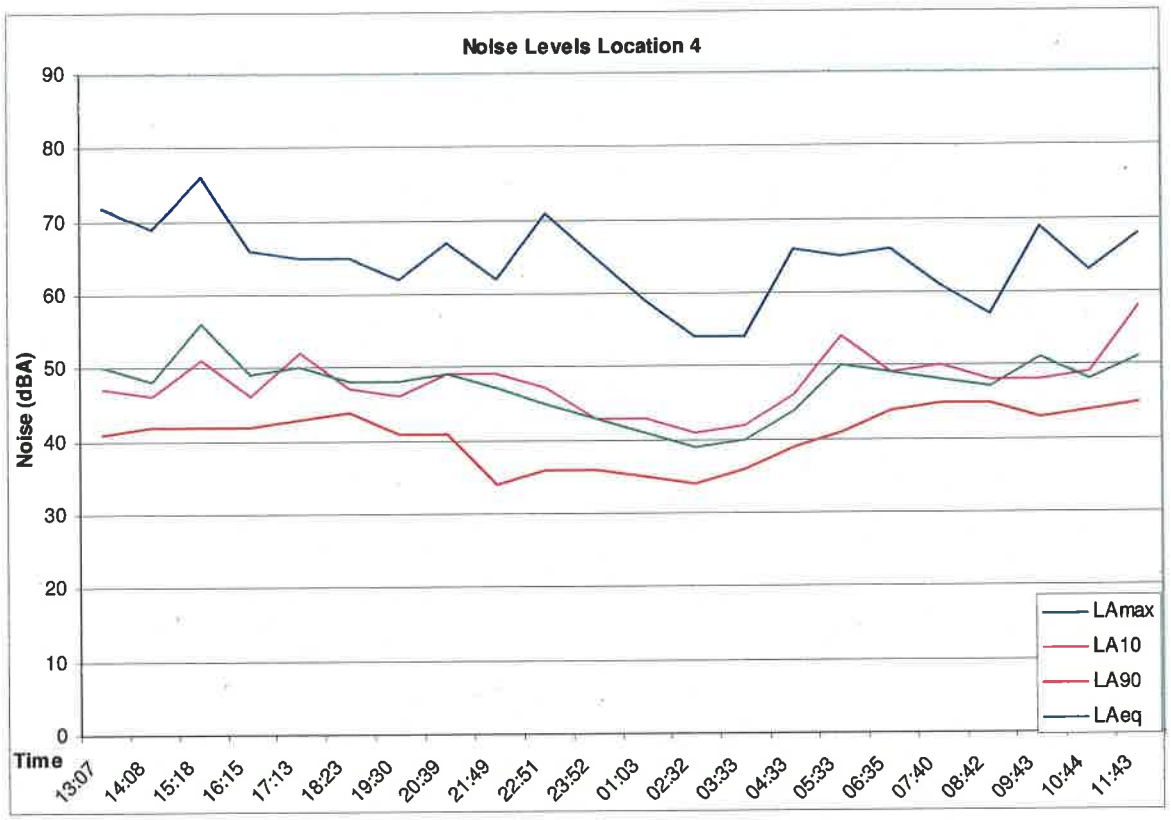


Figure 6 **Graph of L_{Amax} L_{Aeq} L_{A10} and L_{A90} noise levels measured at location 4**

Figure 7 Daytime NEC zones

Figure 8 **Night time NEC zones**

ArupAcoustics

APPENDIX A

Results Tables

Date	Time		Wind		Noise Level, dB (A)						Comments
	Start	Finish	Speed (ms^{-1})	Direction	L_{min}	L_{90}	L_{10}	L_1	L_{Amax}	L_{eq}	
29.06.04	12:11										
	14 :30										I visited meter & checked batteries
	16:35										I checked meter, all OK
	02:17										Visit to check water proofing and raining slightly
	22:15										

Table 2: Logging meter Bicester

Date	Time		Wind		Noise Level, dB (A)						Comments
	Start	Finish	Speed (ms^{-1})	Direction	$L_{min.}$	L_{90}	L_{10}	L_1	L_{Amax}	L_{eq}	
29.06.04	12:21		2.4 ave 3.6 max	SW		44	49	58	68	48	Noise from A4421 & wind in trees, regular loud bird song. Children playing to SW, 1 x train, 2 x plane. Distant building noise to S, road noise concentrated to S
	13 :25		1.4 ave 1.8 max	W		44	48	52	65	47	As above, but with more road noise from WSW distant.1 x lorry on Gavray Drive no aircraft or trains
	14:26		2.1 ave 2.6 max	SW		44	49	52	60	47	As above, no lorry
	15:30		1.4 ave 1.9 max	SW		45	50	57	62	48	More noise from A4421 & A41, birds quieter
	16:34		2.1 ave 2.6 max	SW		47	50	62	68	51	A4421 & A41 (40/60), birds and wind in grass, sometimes significant.1 x train & 50m hammering, 100m to NW. Birds are loudest thing , but intermittent

Date	Time		Wind		Noise Level, dB (A)						Comments
	Start	Finish	Speed (ms^{-1})	Direction	L_{min}	L_{90}	L_{10}	L_1	L_{Amax}	L_{eq}	
	17:13	17:33	1.2	SW		44	52	60	65	50	Noise from A41 & A4421, wind in trees, birds, train
	18:45		NS			45	50	63	69	50	A41 & A4421, birds 2 x plane. Hammer1100m toward the depot 1 x train
	19:51		NS			43	52	74	61	51	A41 & A4421, 2 x train (2 max),birds
	21:01		NS			42	57	67	64	53	Birds, train, A4421 (more & more quiet)
	22:05		NS			40	47	50	56	44	A41 & A4421 (more & more quiet)
	23:12		NS			38	47	50	58	44	A41 & A4421 (more & more quiet)
29.06.04	00:21		NA			35	47	51	54	44	Gavray Drive with A41 in background & A4421
	01:22		calm			34	45	51	53	42	A4421 is loudest with A41 in background, rain 2am 2.30
	02:51		calm			32	48	58	61	45	Light rain as above, though industrial noise to North audible when all else quiet, fan?
	03:46		0.6 ave 1.1 max	SW		33	47	54	61	44	Traffic on A4421 is loudest though intermittent ,A41 constant background, birds
	04:49		calm			42	53	63	68	51	Bird song constant and dominates, A41 also constant with A4421 intermittently significant
	05:52		calm			44	56	61	66	53	As above, though roads much louder, particularly A4421
	06:56		calm			49	53	55	61	51	Birds/A41 & A4421 intermittent
	07:59		< 1			48	53	58	71	52	A41 & A4421, birds, 2 x planes, 1 x train & 1 x klaxon
	08:01		< 1			46	55	58	62	51	1 x train, 2 x plane, A41 & A4421, birds & road noise
	10:01		2.8	SW		47	52	55	68	50	1 x train, mainly A41 & A4421 intermittent
	11:01		2.1	SW		48	54	58	63	52	Mainly A41, train x 1, wind in trees

Table 3: Location 1 : North end of field as shown on Figure 1

Date	Time		Wind		Noise Level, dB (A)						Comments
	Start	Finish	Speed (ms^{-1})	Direction	L_{min}	L_{90}	L_{10}	L_1	L_{Amax}	L_{eq}	
29.06.04	12:34		0.7 0.9	SW		42	49	53	73	47	Main noise source from road to South & occasion cars on Gavray Drive. Clanging from building site? To SW 200m? lots of birdsong 50m noise from wind in grass, occasional motorcycle noise from west
	13:39		calm			42	48	52	70	46	As above, 1 x train & horn
	14:41		0.7 1.1	SW		43	50	53	61	47	1 x aircraft & noise from south. A41 & children playing in distance also some noise from Gavray Drive & scaffolding
	15:45		0.7 ave 0.9 max	SW		43	48	51	57	46	Noise from A41, some from town to west & a little from Gavray Drive. Birds quieter, though still present. Some wind in trees
	16:46	16:53	0.7 ave 1.3 max	S		43	49	52	60	47	1 x train, noise from south mainly from A41 though some from A4421 & occasional car on Gavray Drive. A few birds, occasional hammering
	17:50			NS		45	52	54	60	49	Noise from A41 & A4421, few birds, aircraft. Train (E-W) & W-E
	18:58			NS		43	49	53	56	47	A41 & A4421, birds, 1 x plane
	20:04					43	49	54	71	48	A41 & A4421, birds 1 x train
	21:14					41	49	52	56	46	Background noise from South, birds 1 x train
	22:18			NS		39	48	53	65	45	A41 & A4421, strange animal barking, 1 x plane
	23:25					34	46	50	63	42	A41, 2 x train
	00:33		calm			33	42	46	60	39	A41, very distant alarm to west Gavray Drive & A4421, occasional distant shout
	01:36		calm			31	41	46	52	38	As above, no alarm, rain 2:00-2:30

Date	Time		Wind		Noise Level, dB (A)						Comments
	Start	Finish	Speed (ms^{-1})	Direction	L_{min}	L_{90}	L_{10}	L_1	L_{Amax}	L_{eq}	
	03:02		calm			34	49	55	69	45	As above though 2 very loud HGVs on A4421. Birds, restarted clock relatively quiet at present
	04:01		calm			37	50	55	63	46	Bird song dominates A41 in background occasionally A4421
	05:02		calm			39	47	50	64	45	As above, with some noise from West A41?
	06:04		calm			44	48	50	64	46	As above, roads noisier than before, 50/50 with birds
	07:09		calm			46	51	53	64	49	As above, but road noise noisier than birds, train x 1
	08:12		< 1			46	51	55	59	49	Helicopter x 1, plane x 1, train x 1 A41/A4421
	09:13		< 1			44	50	54	62		Train x 1, plane x 1, A41 & A4421
	10:14		NS			46	51	53	69	49	A41 & A4421, plane x 1
	11:14		NS			44	50		56	48	Train x 1

Table 4: Location 2 Southern corner of field as shown on Figure 1

Date	Time		Wind		Noise Level, dB (A)						Comments
	Start	Finish	Speed (ms^{-1})	Direction	L_{min}	L_{90}	L_{10}	L_1	L_{Amax}	L_{eq}	
	12:49		1.3 ave 2.0 max	SW		40	50	60	68	49	Noise from scaffold poles to SE 100m, background from birds & A4124 & A41
	13:51		1.1 ave 1.4 max	S		39	50	60	76*	49	As above & 2 people talked as passed by*
	14:59		2.0 ave 2.7 max	S							As above, no scaffold noise, with lawn mower going roughly 40% of time, no people talking, traffic on Gavray Drive, 5 x cars & 1 x van
	15:57		calm			44	51	60	*83	55	A4421 mow loudest, with A41 (50/50) birds still pretty constant & some noise from gardening 20m away, 2 x cars & 1 x van. *dog barking 10m away
	16:56		1.8 2.2	WSW		43	55	62	*73	53	2 x aircraft, 1 high 1 low – helicopter, 6 x cars, 2 x vans* Background noise as above with music form nearby house (?) & wind in trees
	18:04			NS		45	56	68	78	56	Cars on Gavray Drive x 16, A41, A4421, Aircraft
	19:12			NS		42	53	61	67	50	Cars on Gavray Drive x 11, A41, A4421, gardening motor engine close
	20:19	20:27		NS		38	47	65	58	46	Cars on Gavray Drive x 5, 1 x plane, A41 & A4421, stopped before because battery is low and calm
	21:28			NS		38	48	58	64	47	A41 & A4421
	22:33			NS		35	45	54	63	43	A41 & A4421, people talking in Gavray Drive
	23 :40			NS			43	55	64	42	A41 & A4421, people talking on Gavray Drive, 3 x cars in Gavray Street
	00:45			calm			40	45	52	37	A41, A4421 occasional traffic on Gavray Drive, 1 x train
	1 :49			calm			38	47	58	37	As above, started to rain, 2 am – 2.30 am
	03:16			calm		31	43	51	55	40	As above, birds occasionally, not yet significant
	04:15			calm		34	42	47	53	39	Birdsong loudest but intermittent, A41 & A4421 (70/30) Background, light rain
	05:15			calm		38	52	58	66	48	As above

Date	Time		Wind		Noise Level, dB (A)						Comments
	Start	Finish	Speed (ms^{-1})	Direction	L_{min}	L_{90}	L_{10}	L_1	L_{Amax}	L_{eq}	
	06:16			calm		44	47	53	68	46	As above
	07:22			calm		45	51	58	65	43	As above, it is raining a bit
	08:25					45	53	60	66	50	Mainly A41, 11 x cars on Gavray Drive. It's raining again
	9 :26			NS		46	52	58	65	50	A41, 13 x cars on Gavray Drive
	10:27			NS		46	52	59	69	50	1 x aircraft, A41, 5 x cars on Gavray Drive
	11:27		1.5	W		46	52	59	66	50	A41, 8 x cars on Gavray Drive, grass cutting 2 houses closer

Table 5: Location 3 on walk way between Gavray Drive 4

Date	Time		Wind		Noise Level, dB (A)						Comments
	Start	Finish	Speed (ms^{-1})	Direction	L_{min}	L_{90}	L_{10}	L_1	L_{Amax}	L_{eq}	
	13:07	13:14	calm			41	47	64	*72	50	Noise from town cars etc & possible trains shunting to west. *person asking what I am doing. Bird song loudest with road noise from west in background. Some noise form children 300m? to SW 1 x train & horn on East west line
	14:08		2.0 ave 2.4 max	SW		42	46	59	69	48	Bird song & road noise from SW is loudest, some road noise from A4421 & A41 and from wind in trees, occasional loud noise from SW (clunking-train shunting?) and a quiet whistle from South, almost constant but very quiet
	15:18	15:24	calm			42	51	72	*76	56	As above, *2 x trains and horn, 1 x plane
	16:15		1.2 ave 1.6 max	SW		42	46	62	66	49	Background from road noise to E & S (60/40) with birds, 1 x train accelerating so very noisy
	17:13		2.6 max 3.8 max	S		43	52	62	65	50	Noise from road to south and industrial road noise from west. Car horns to SW & 2 x aircraft. Some bird noise, 1 x train, children talking 20m
	18:23			NS		44	47	62	65	48	A41/A4421 noise form birds, 2 x plane, 1 x train. People are talking @ 50m
	19:30			NS		41	46	60	62	48	1 x train, birds, road noise from South (industrial) people are talking
	20:39					41	49	62	67	49	A lot of people on the point, I stand 100m from the point, noise from South and small motorbike, people are talking
	21:49					34	49	57	62	47	Still a lot of people, noisier, stopped because too much noise from people
	22:51					36	47	56	71	45	Still some people and road A41
	23:52					36	43	52	65	43	Still some children, road noise
	01:03		calm			35	43	44	59	41	As above, rain 2 am -2.30 am
	02:32		calm			34	41	45	54	39	Very light rain, 2 x cars in Gavray Drive, otherwise as above. A41 dominant, A4421 significant, children still there
	03:33	03:38	1.2 ave 2.3 max	SW		36	42	49	*54	40	As above, birds now much louder,*children passing, stopped due to children not moving away
	04:33		calm			39	46	51	66	44	Bird song loudest. A41 & road to west is background, some noise from children 100m to north

Date	Time		Wind		Noise Level, dB (A)						Comments
	Start	Finish	Speed (ms^{-1})	Direction	L_{min}	L_{90}	L_{10}	L_1	L_{Amax}	L_{eq}	
	05:33		0.7 ave 1.0 max	SW		41	54	59	65	50	As above, just caught the tail end of freight train, children pretty much quiet, birdsong almost constant
	06:35					44	49	62	66	49	A41 & birds, 1 x aircraft, children are waking up, 3 x planes, children quiet
	07:40		calm			45	50	54	61	48	Road noise, birds, 3 x planes, children quiet
	08:42					45	48	53	57	47	Road, birds 1 x plane
	9:43		2.5	W		43	48	66	69	51	No children, road noise, industrial from W-SW, 1 x train
	10:44		2.0	W		44	49	60	63	48	1 x train, road noise from W-SW
	11:43		2.4	W		45	58	63	68	51	Road noise from W-SW, 2 x aircraft, 1 x train, 2 x helicopter

Table 6: Location 4 on footpath at NW end of site

ArupAcoustics

APPENDIX B

Environmental Terminology

ENVIRONMENTAL TERMINOLOGY

dB(A)

The unit generally used for measuring environmental, traffic or industrial noise is the A-weighted sound pressure level in decibels, denoted dB(A). An A-weighting network can be built into a sound level measuring instrument such that sound levels in dB(A) can be read directly from a meter. The weighting is based on the frequency response of the human ear and has been found to correlate well with human subjective reactions to various sounds. It is worth noting that an increase or decrease of approximately 10 dB corresponds to a subjective doubling or halving of the loudness of a noise, and a change of 2 to 3 dB is subjectively barely perceptible.

EQUIVALENT CONTINUOUS SOUND LEVEL

Another index for assessment for overall noise exposure is the equivalent continuous sound level, L_{eq}. This is a notional steady level which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating levels can be described in terms of a single figure level.

STATISTICAL NOISE LEVELS

For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index which allows for this variation. The L_{10}, the level exceeded for ten per cent of the time period under consideration, has been adopted in this country for the assessment of road traffic noise. The L_{90}, the level exceeded for ninety per cent of the time, has been adopted to represent the background noise level. The L_1, the level exceeded for one per cent of the time, is representative of the maximum levels recorded during the sample period. A weighted statistical noise levels are denoted L_{A10}, dBL_{A90} etc. The reference time period (T) is normally included, e.g. $dBL_{A10,\ 5\ min}$ or $dBL_{A90,8hr}$.

APPENDIX 1: OXFORDSHIRE SITES AND MONUMENTS RECORD INFORMATION

APPENDIX 1 OXFORDSHIRE SITES AND MONUMENTS RECORD INFORMATION

PRN No	NGR (all SP)	Site Name	Type
OX 103 / 16071	5990 2220	Bicester Park	An evaluation at Bicester Park by Oxford Archaeology in 1996 discovered evidence of a low status Roman / Saxon settlement
OX36 / OX47 / 16120	5920 2220	Bicester Fields Farm	Geophysical survey and evaluation by Oxford Archaeology in 1998 revealed Iron Age enclosures, pits and gullies. Middle Iron Age to Late Iron Age pottery recovered. Well preserved ridge and furrow
601	5868 2196	Bicester London Road	Railway Station
2789	6043 2281	Medieval Cross, Church of St Mary, Launton	Cross
5142	6043 2282	St Mary' Church, Launton	Church
558	5890 2190	Site of Brickworks	Brickworks
D1801	5860 2190	Post-Medieval pesthouse	Infectious diseases hospital
10165	5870 2170	Site of Toll house	Toll House
1802	5867 2225	17/17A London Road and Lock Up	Lock Up
11501	5863 2224	8-16 London Road (site of)	House, pit
12779	5863 2174	Undated earthwork? Fishponds	Fishpond
11500	5863 2224	Medieval pottery, 8-16 London Road	Findspot
16540	6025 2302	Iron Age to Roman pottery and features on Bicester Perimeter Road, Launton	Ditch, posthole
12695	6013 2319	?Medieval / Post-Medieval windmill mound, Launton	Windmill Mound
D5630	5976 2332	Prehistoric ring ditches and enclosure	Enclosure, ring ditch
2791	6045 2268	Post Medieval ornamental ponds, Launton	Ornamental ponds
2790	6044 2271	Remains of Medieval Market Cross, Launton	Market cross
D5631	5887 2318	Prehistoric ring ditch (barrow circle?)	Ring ditch
3257	5980 2140	Scheduled Monument: Wretchwick Deserted Medieval Village	Deserted Settlement

APPENDIX 2: GEOPHYSICAL SURVEY

Land north of Gavray Drive

Bicester

Oxfordshire

Geophysical Survey

Contents

1. Introduction and Archaeological Background
2. Methodology and Presentation
3. Results and Discussion
4. Conclusions

Bibliography

Acknowledgements

Figures

Appendices

Summary

A geophysical evaluation comprising magnetic scanning followed by selected detailed survey was undertaken at a site east of Bicester covering a total area of 16.25 hectares. The whole of the site was scanned but approximately 45% was not suitable for detailed survey due to the presence of dense, long grass. Consequently detailed magnetometer survey covering 10% of the site (1.6 hectares) was undertaken in the western part of the site. No anomalies indicative of archaeological activity were identified either during the scanning across the whole site or in the selected sample detailed survey blocks. On the basis of the geophysical evaluation the site is considered to have a low archaeological potential.

Authorised for distribution by:

.....

Archaeological Services WYAS

PO Box 30, Nepshaw Lane South, Morley, Leeds LS27 0UG

1. Introduction and Archaeological Background

1.1 Archaeological Services WYAS was commissioned to carry out a geophysical (fluxgate gradiometer) evaluation of an area of land north of Gavray Drive on the eastern outskirts of Bicester (see Fig. 1), by Sally Randell of CPM Environmental Planning and Design.

1.2 The proposed development area, centred at NGR SP 596 223, comprises 16.25 hectares of agricultural land divided into five separate fields (see Fig. 2) bounded to the south by Gavray Drive, to the east by a field boundary and to the north and west by railway tracks. The three easternmost fields were separated from the remainder of the site by Langford Brook. All five fields were under permanent pasture and were suitable for magnetometer scanning. However the three fields to the east were not suitable for detailed survey due to the presence of dense, high grass. No other problems were encountered during the fieldwork that was carried out between June 21st and 23rd 2004.

1.3 Topographically the site is generally flat. On the Soil Survey of England and Wales map sheet for Eastern England, the soils are recorded as being of the Wickham 2 soil association comprising drift over Jurassic and Cretaceous clay or mudstone. These soils are described as slowly permeable, seasonally waterlogged, fine loamy over clayey soils.

1.4 Recent archaeological work on the edge of Bicester, including on the floodplain of Langford Brook, has revealed that prehistoric and Romano-British occupation in the area is much greater than previously thought and the area more extensively farmed. Information obtained from the Oxfordshire County Council Sites and Monument Record indicates the presence of prehistoric ring ditches and an enclosure in two locations to the north of the site under evaluation. Archaeological investigations at Slade Farm, on the north-western side of Bicester, recovered worked flint dating to the Mesolithic period as well as evidence of Bronze Age and Iron Age occupation. This included a wide linear ditch of Iron Age date possibly relating to a droveway. Several pits and possible palisade gullies appeared to be associated with this feature. An Iron Age ring ditch was identified to the west of the linear feature, probably foundation trenches for the walls of roundhouses. In addition an irregular sub-rectangular feature and a linear gully with two possible post-holes at its base contained Mesolithic microliths.

1.5 More recent archaeological investigations (geophysical survey and trial trenching) at Bicester Fields Farm to the south-west of the site revealed evidence of later prehistoric settlement in the form of a sub rectangular enclosure and associated pits and gullies. A possible circular structure was also revealed on the outer edge of the enclosure ditch. The pottery indicated a Middle to Late Iron Age date. Post-Medieval quarrying had destroyed any archaeology in the south-eastern part of the site. Open area excavation expanded on the results of the evaluation revealing the plan of a substantial rectilinear ditched enclosure of Middle to Late Iron Age date covering one hectare, with a possible causeway formed of a dump of burnt stone. A central building was indicated by a group of stone-packed postholes and curvilinear gullies. There was also evidence of animal and human burial.

1.6 An evaluation to the east of the proposal site in 1996 revealed evidence of a low status Roman settlement of 2nd century date comprising of a number of ditches and gullies, interpreted as a phase of unenclosed settlement, succeeded by an enclosed settlement.

1.7 The archaeological potential of the site was consequently considered to be fairly high despite the presence of Langford Brook that bisects the site.

2. Methodology and Presentation

2.1 The general objectives of the geophysical evaluation were:

- to identify any areas of possible archaeological interest
- to establish the extent and character of any archaeological magnetic anomalies.

2.2 As the area that may be impacted by the proposed development (16.25 hectares) was relatively large it was proposed that magnetic scanning be undertaken (using Geoscan FM36 fluxgate gradiometers) across the whole site in order to achieve the first objective. The second objective was to be achieved by selected detailed survey of areas of potential highlighted by the scanning. It was proposed that detailed survey would be carried out to cover a maximum of 20% of the total site area (3.25 hectares), depending on the results of the scanning. Apparently 'blank' areas as well as those identified as of potential were targeted. No sample detailed block was less than 0.36 hectares, an area equivalent to a block measuring 60m by 60m.

2.3 The survey methodology and report format comply with the recommendations outlined in the English Heritage Guidelines (David 1995) as a minimum standard. All figures reproduced from Ordnance Survey mapping are done so with the permission of the controller of Her Majesty's Stationery Office. © Crown copyright.

2.4 A general site location plan, incorporating the 1:50000 Ordnance Survey mapping, is shown in Figure 1. Figure 2 is a site location plan, showing the processed greyscale gradiometer data, superimposed onto an Ordnance Survey digital base map supplied by the client, at a scale of 1:5000. The processed data is displayed in greyscale format, at a scale of 1:500, in Figures 3, 6, 9, 12, and 15 with the accompanying interpretations shown at the same scale in Figures 4, 7, 10, 13 and 16. Figures 5, 8, 11, 14 and 17 show the unprocessed ('raw') data in XY trace plot format, also at a scale of 1:500.

2.5 Technical information on the equipment used, data processing and magnetic survey methodology is given in Appendix 1. Appendix 2 details the survey location information and Appendix 3 describes the composition and location of the archive.

The figures in this report have been produced following analysis of the data in 'raw' and processed formats and over a range of different display levels. All figures are presented to most suitably display and interpret the data from this site based on the experience and knowledge of Archaeological Services staff.

3. Results and Discussion

3.1 Magnetometer Scanning

3.1.1 During scanning it was observed that the magnetic background noise was relatively quiet, fluctuating on average between +/- 0.5 nT. This is probably due to the low magnetic susceptibility of the clay-based soils coupled with the possible presence of alluvium deposited from Langford Brook that bisects the site. Nevertheless it was surmised that any occupational activity within the survey area would be likely to be identified by magnetic scanning and/or detailed survey.

3.1.2 Many ferrous 'spikes' were identified across the site; one area where there was a cluster of these anomalies was subsequently covered by detailed magnetometry and the results are displayed in Block 2. No other areas of archaeological potential were identified so blocks 1, 3, 4 and 5 were located to maximise site coverage over the western part of the site where it was possible to undertake detailed survey.

3.2 Detailed Survey

Block 1

3.2.1 Block 1 was positioned to cover the north-eastern part of the site in an area that was particularly quiet when scanned. Only 'iron spike' anomalies, which are likely to be caused by modern ferrous debris in the topsoil, have been identified in this block thus confirming the negative scanning result.

Block 2

3.2.2 This was the only block that was specifically targeted over an area thought to be of potential archaeological interest. During the scan a cluster of isolated dipolar ('iron spike') responses was identified. A block was therefore positioned to clarify whether this cluster could be associated with any other features of possible archaeological origin.

3.2.3 Plenty of dipolar responses (more so than in any other block) have been confirmed by the detailed survey but the random spacing and lack of any other anomalies suggests that these 'spikes' are due to modern ferrous debris introduced into the topsoil.

Block 3

3.2.4 Block 3 was also positioned at random to sample the north-west part of the site. There are many dipolar 'iron spike' anomalies and a few small areas of magnetic disturbance recorded in the data set, again probably caused by modern activity.

Block 4

3.2.5 This block was positioned to sample the east of the site. Isolated dipolar responses are predominant again in the data set with a presumed modern origin.

Block 5

3.2.6 Block 5 was located at random in the westernmost field where a lack of anomalous responses was noted during scanning. Only 'iron spike' anomalies have been identified.

4. Conclusions

4.1 The detailed survey has confirmed the negative results of the magnetic scanning phase of the survey with no anomalies likely to be indicative of archaeological activity having been identified.

4.2 Although several archaeological sites have been identified in the immediate area no magnetic anomalies have been identified during this survey to indicate that such activity extended into, or occurred within, the current evaluation area.

4.3 It is possible that alluvium from Langford Brook could be masking the magnetic responses from any underlying archaeological features. However, on the basis of the geophysical survey, the archaeological potential of the site is deemed to be fairly low.

The results and subsequent interpretation of data from geophysical surveys should not be treated as an absolute representation of the underlying archaeological and non-archaeological remains.

Bibliography

David, A., 1995. *Geophysical Survey in Archaeological Field Evaluation: Research and Professional Services Guidelines* No. 1. English Heritage

Acknowledgements

Project Management

A.Webb BA

Fieldwork

T. P. Schofield HND BSc PIFA

A. Hancock BSc PgDip

Report

T.P. Schofield

Graphics

T. P. Schofield

Figures

Figure 1 Site location (1:50000)
Figure 2 Site location showing greyscale gradiometer data (1:5000)
Figure 3 Greyscale plot of gradiometer data; Block 1 (1:500)
Figure 4 Interpretation of gradiometer data; Block 1 (1:500)
Figure 5 XY trace plot of gradiometer data; Block 1 (1:500)
Figure 6 Greyscale plot of gradiometer data; Block 2 (1:500)
Figure 7 Interpretation of gradiometer data; Block 2 (1:500)
Figure 8 XY trace plot of gradiometer data; Block 2 (1:500)
Figure 9 Greyscale plot of gradiometer data; Block 3 (1:500)
Figure 10 Interpretation of gradiometer data; Block 3 (1:500)
Figure 11 XY trace plot of gradiometer data; Block 3 (1:500)
Figure 12 Greyscale plot of gradiometer data; Block 4 (1:500)
Figure 13 Interpretation of gradiometer data; Block 4 (1:500)
Figure 14 XY trace plot of gradiometer data; Block 4 (1:500)
Figure 15 Greyscale plot of gradiometer data; Block 5 (1:500)
Figure 16 Interpretation of gradiometer data; Block 5 (1:500)
Figure 17 XY trace plot of gradiometer data; Block 5 (1:500)

Appendices

Appendix 1 Magnetic Survey: Technical Information
Appendix 2 Survey Location Information
Appendix 3 Geophysical Archive

Appendix 1

Magnetic Survey: Technical Information

1. Magnetic Susceptibility and Soil Magnetism

1.1 Iron makes up about 6% of the Earth's crust and is mostly present in soils and rocks as minerals such as maghaemite and haemetite. These minerals have a weak, measurable magnetic property termed magnetic susceptibility. Human activities can redistribute these minerals and change (enhance) others into more magnetic forms so that by measuring the magnetic susceptibility of the topsoil, areas where human occupation or settlement has occurred can be identified by virtue of the attendant increase (enhancement) in magnetic susceptibility. If the enhanced material subsequently comes to fill features, such as ditches or pits, localised isolated and linear magnetic anomalies can result whose presence can be detected by a magnetometer (fluxgate gradiometer).

1.2 In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut, which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected. Less magnetic material such as masonry or plastic service pipes that intrude into the topsoil may give a negative magnetic response relative to the background level.

1.3 The magnetic susceptibility of a soil can also be enhanced by the application of heat. This effect can lead to the detection of features such as hearths, kilns or areas of burning.

2. Types of Magnetic Anomaly

2.1 In the majority of instances anomalies are termed ***'positive'***. This means that they have a positive magnetic value relative to the magnetic background on any given site. However some features can manifest themselves as ***'negative'*** anomalies that, conversely, means that the response is negative relative to the mean magnetic background. Such negative anomalies are often very faint and are commonly caused by modern, non-ferrous, features such as plastic water pipes. Infilled natural features may also appear as negative anomalies on some geological substrates.

2.2 Where it is not possible to give a probable cause of an observed anomaly a '?' is appended.

2.3 It should be noted that anomalies that are interpreted as modern in origin may be caused by features that are present in the topsoil or upper layers of the subsoil. Removal of soil to an archaeological or natural layer can therefore remove the feature causing the anomaly.

2.4 The types of response mentioned above can be divided into five main categories which are used in the graphical interpretation of the magnetic data:

Isolated dipolar anomalies (iron spikes)

These responses are typically caused by ferrous material either on the surface or in the topsoil. They cause a rapid variation in the magnetic response giving a characteristic 'spiky' trace. Although ferrous archaeological artefacts could produce this type of response, unless there is supporting evidence for an archaeological interpretation, little emphasis is normally given to such anomalies, as modern ferrous objects are common on rural sites, often being present as a consequence of manuring.

Areas of magnetic disturbance

These responses can have several causes often being associated with burnt material, such as slag waste or brick rubble or other strongly magnetised/fired material. Ferrous structures such as pylons, mesh or barbed wire fencing and buried pipes can also cause the same disturbed response. A modern origin is usually assumed unless there is other supporting information.

Linear trend

This is usually a weak or broad linear anomaly of unknown cause or date. An agricultural origin, either ploughing or land drains is a common cause.

Areas of magnetic enhancement/positive isolated anomalies

Areas of enhanced response are characterised by a general increase in the magnetic background over a localised area whilst discrete anomalies are manifest by an increased response (sometimes only visible on an X–Y trace plot) on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an 'iron spike' anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often therefore be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

Linear and curvilinear anomalies

Such anomalies have a variety of origins. They may be caused by agricultural practice (recent ploughing trends, earlier ridge and furrow regimes or land drains), natural geomorphological features such as palaeochannels or by infilled archaeological ditches.

3. Methodology

3.1 Magnetic Susceptibility Survey

3.1.1. There are two methods of measuring the magnetic susceptibility of a soil sample. The first involves the measurement of a given volume of soil, which will include any air and moisture that lies within the sample, and is termed volume specific susceptibility. This method results in a bulk value that it not necessarily fully representative of the constituent components of the sample. The second technique overcomes this potential problem by taking into account both the volume and mass of a sample and is termed mass specific susceptibility. However, mass specific readings cannot be taken in the field where the bulk properties of a soil are usually unknown and so volume specific readings must be taken. Whilst these values are not fully

representative they do allow general comparisons across a site and give a broad indication of susceptibility changes. This is usually enough to assess the susceptibility of a site and evaluate whether enhancement has occurred.

3.2 Gradiometer Survey

3.2.1. There are two main methods of using the fluxgate gradiometer for commercial evaluations. The first of these is referred to as ***magnetic scanning*** and requires the operator to visually identify anomalous responses on the instrument display panel whilst covering the site in widely spaced traverses, typically 10m apart. The instrument logger is not used and there is therefore no data collection. Once anomalous responses are identified they are marked in the field with bamboo canes and approximately located on a base plan. This method is usually employed as a means of selecting areas for detailed survey when only a percentage sample of the whole site is to be subject to detailed survey.

3.2.2. The disadvantages of magnetic scanning are that features that produce weak anomalies (less than 2nT) are unlikely to stand out from the magnetic background and so will be difficult to detect. The coarse sampling interval means that discrete features or linear features that are parallel or broadly oblique to the direction of traverse may not be detected. If linear features are suspected in a site then the traverse direction should be perpendicular (or as close as is possible within the physical constraints of the site) to the orientation of the suspected features. The possible drawbacks mentioned above mean that negative results from magnetic scanning should **always** be checked with at least a sample detailed magnetic survey (see below).

3.2.3. The second method is referred to as ***detailed survey*** and employs the use of a sample trigger to automatically take readings at predetermined points, typically at 0.5m intervals, on zig-zag traverses 1m apart. These readings are stored in the memory of the instrument and are later dumped to computer for processing and interpretation. Detailed survey allows the visualisation of weaker anomalies that may not have been detected by magnetic scanning.

3.2.4. The Geoscan FM36 fluxgate gradiometer and ST1 sample trigger were used for the detailed gradiometer survey. Readings were taken, on the 0.1nT range, at 0.5m intervals on zig-zag traverses 1m apart within 20m by 20m square grids. The instrument was checked for electronic and mechanical drift at a common point after every three grids and calibrated as necessary. The drift from zero was not logged.

3.3 Data Processing and Presentation

3.3.1. The detailed gradiometer data has been presented in this report in X-Y trace and greyscale formats. In the former format the data shown is 'raw' with no processing other than grid biasing having been done. The data in the greyscale images has been selectively filtered.

3.3.2. An X-Y plot presents the data logged on each traverse as a single line with each successive traverse incremented on the Y-axis to produce a 'stacked' plot. A hidden line algorithm has been employed to block out lines behind major 'spikes' and the data has been clipped at 10nT. The main advantage of this display option is that the full range of data can be viewed, dependent on the clip, so that the 'shape' of individual anomalies can be discerned and

potentially archaeological anomalies differentiated from 'iron spikes'. In-house software (XY3) was used to create the X-Y trace plots.

3.3.3. In-house software (Geocon 9) was used to interpolate the data so that 1600 readings were obtained for each 20m by 20m grid. Contors software was used to produce the greyscale images. All greyscale plots are displayed in the range −1nT to 2nT, unless otherwise stated, using a linear incremental scale.

Appendix 2

Survey Location Information

A Trimble Geodimeter 600s total station theodolite was used to set out and tie-in the survey grid in each of the fields. Temporary reference objects (survey marker stakes) were left in each part of the site for geo-referencing and the grids tied-in relative to these markers and to field boundaries. The survey grids were then superimposed onto an Ordnance Survey map base supplied by the client as a best fit to produce the grid locations. Overall there was a good correlation between the local survey and the digital map base and it is estimated that the average 'best fit' error is better than ±1.5m. However, it should be noted that Ordnance Survey co-ordinates for 1:2500 Superplan map data have an error of ±1.9m at 95% confidence. This potential error must be considered if co-ordinates are measured off for relocation purposes from points other than those listed below.

The locations of the temporary reference objects are shown on Figure 2 and the Ordnance Survey grid co-ordinates tabulated below.

Station	Easting	Northing
A	459321.08	222522.92
B	459285.88	222485.77
C	459322.67	222434.27
D	459250.58	222496.60
E	459228.70	222547.94
F	459280.91	222580.86

Archaeological Services WYAS cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party or for the removal of any of the survey reference points.

Appendix 3

Geophysical Archive

The geophysical archive comprises:-

- an archive disk containing compressed (WinZip 8) files of the raw data, report text (Word 2000), and graphics files (CorelDraw6 and AutoCAD 2000) files.
- a full copy of the report

At present the archive is held by Archaeological Services WYAS although it is anticipated that it may eventually be lodged with the Archaeology Data Service (ADS). Brief details will also be forwarded for inclusion on the English Heritage Geophysical Survey Database after the contents of the report are deemed to be in the public domain (i.e. available for consultation in the relevant Sites and Monument Record Office).

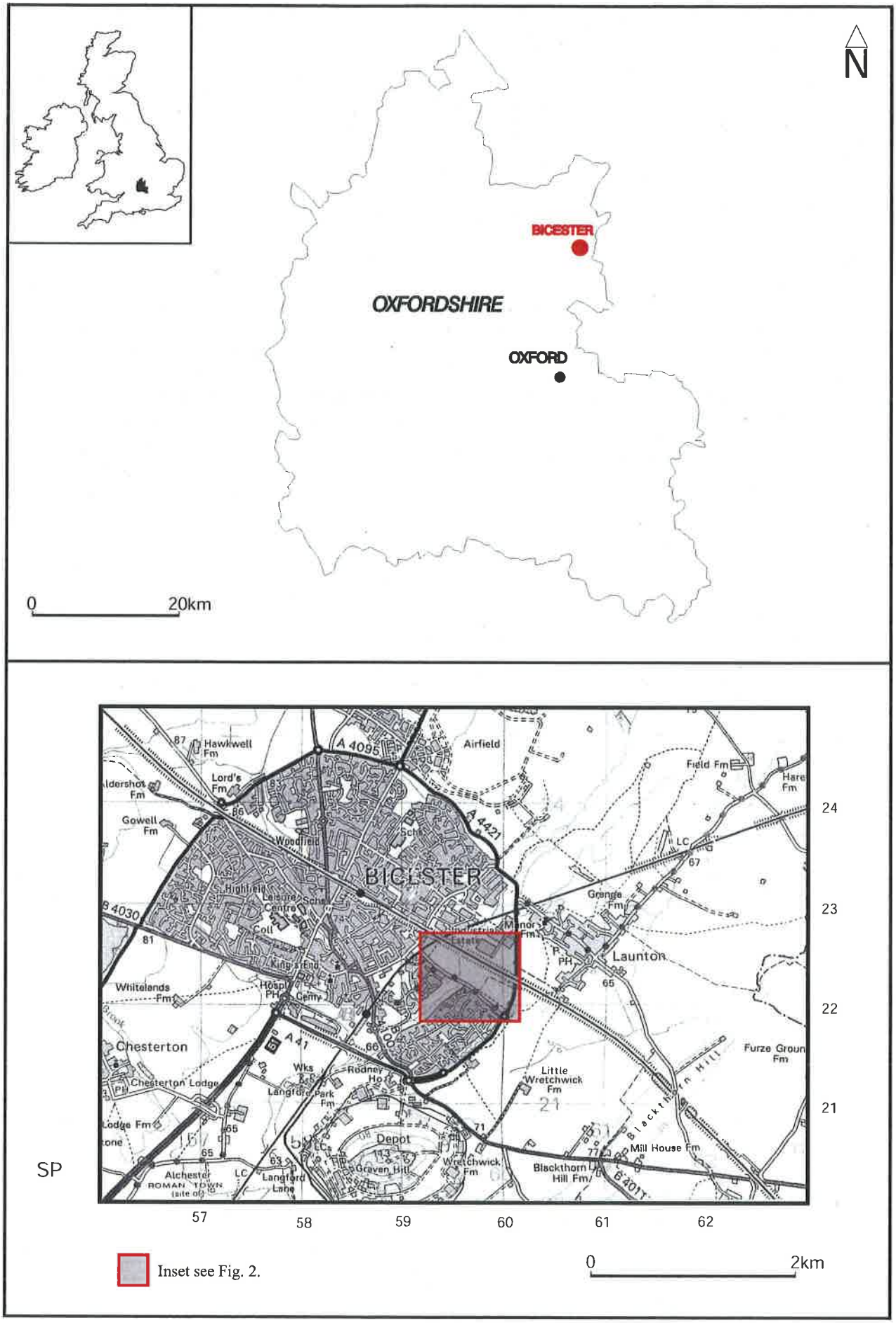


Fig. 1. Site location

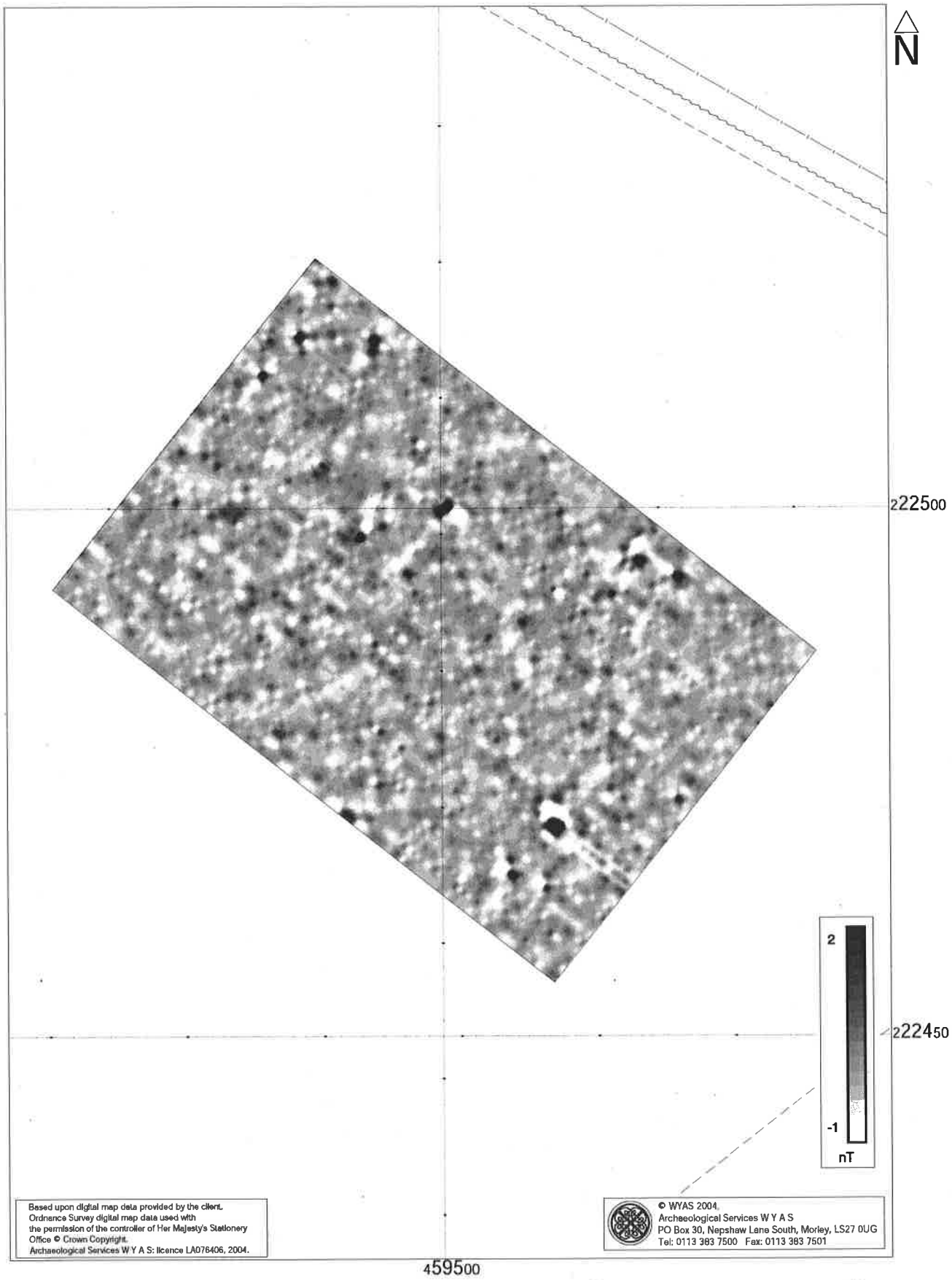


Fig. 3. Greyscale plot of gradiometer data; Block 1

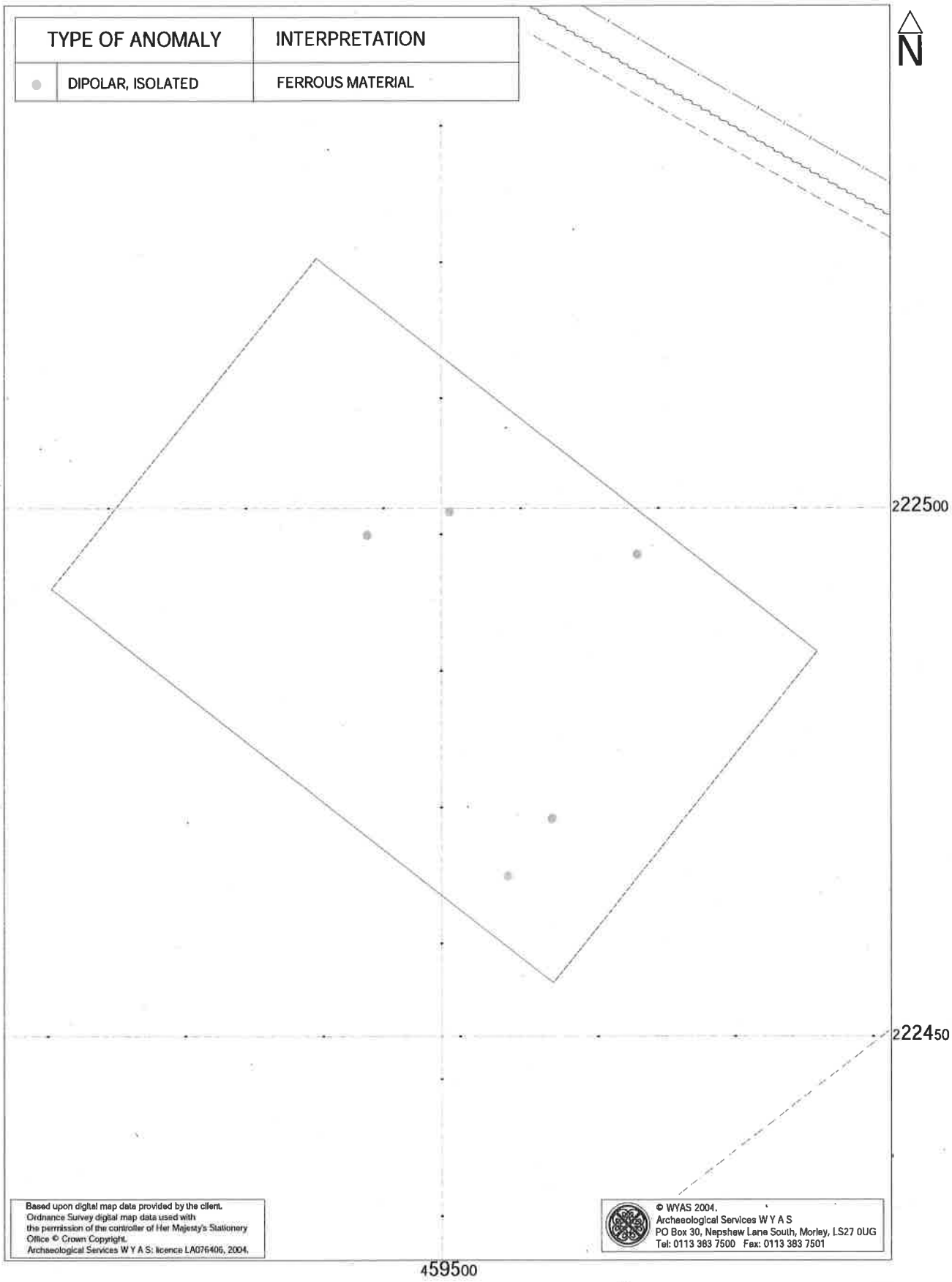


Fig. 4. Interpretation plot of gradiometer data; Block 1

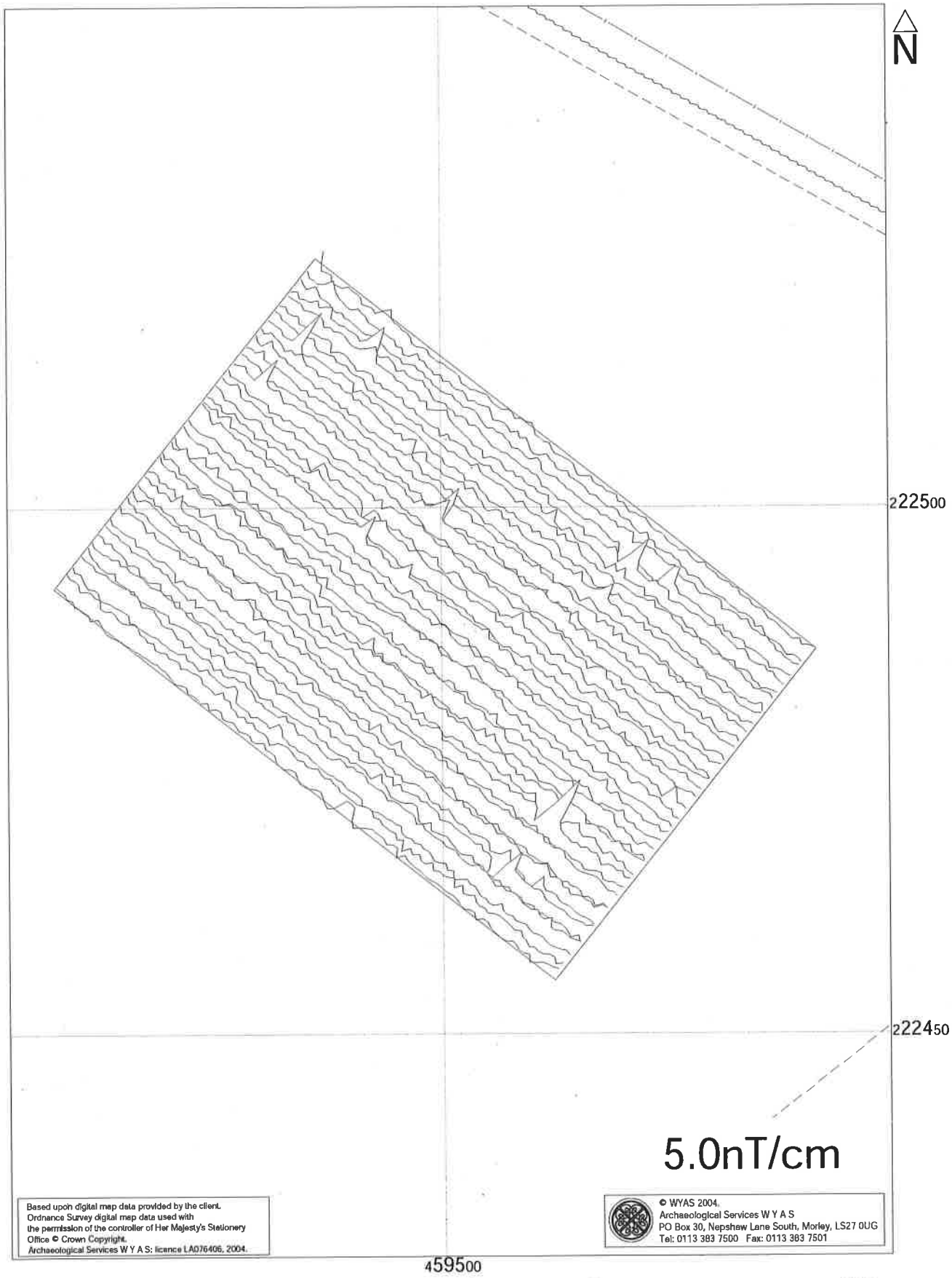


Fig. 5. XY trace plot of gradiometer data; Block 1

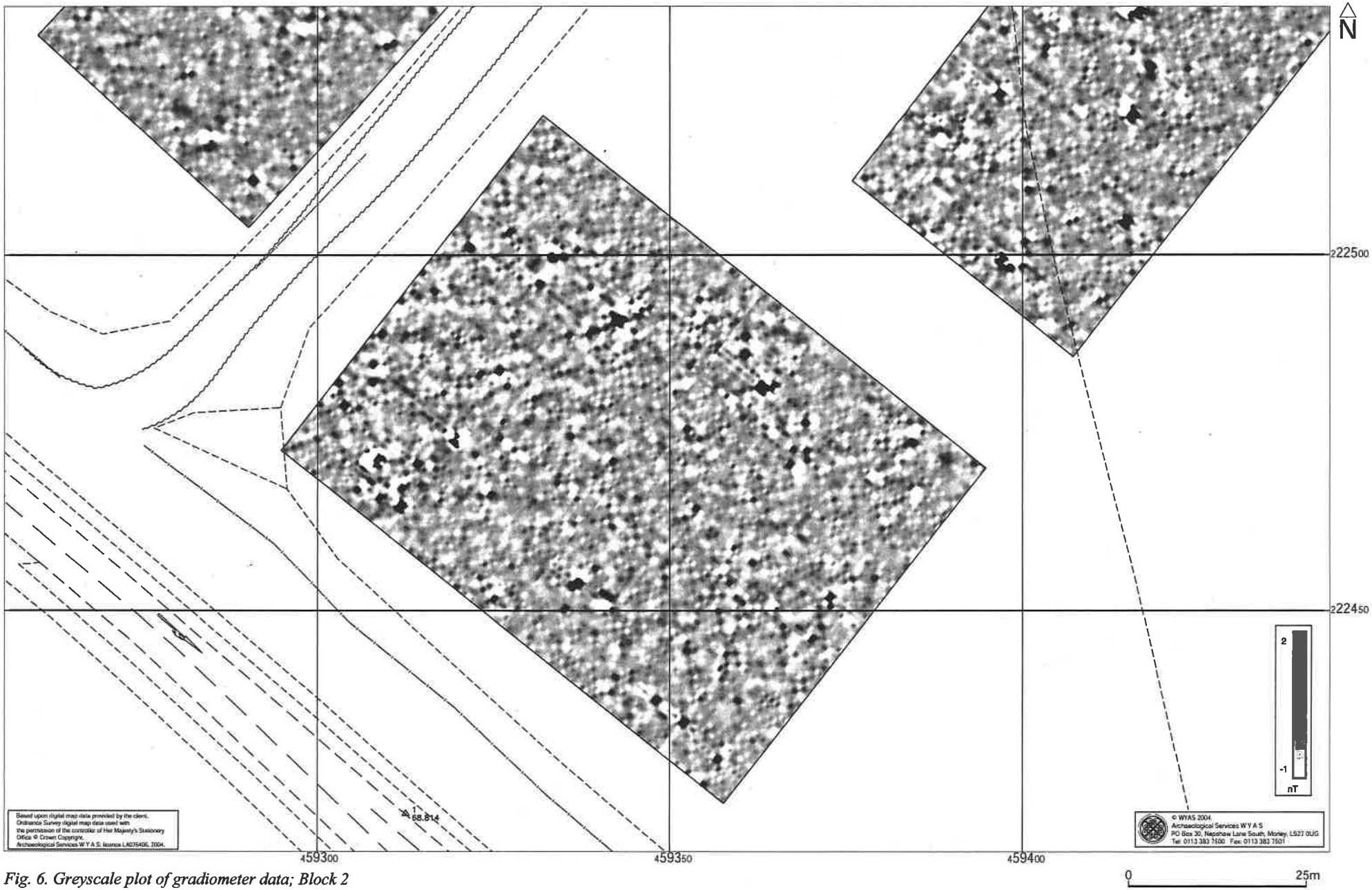


Fig. 6. Greyscale plot of gradiometer data; Block 2

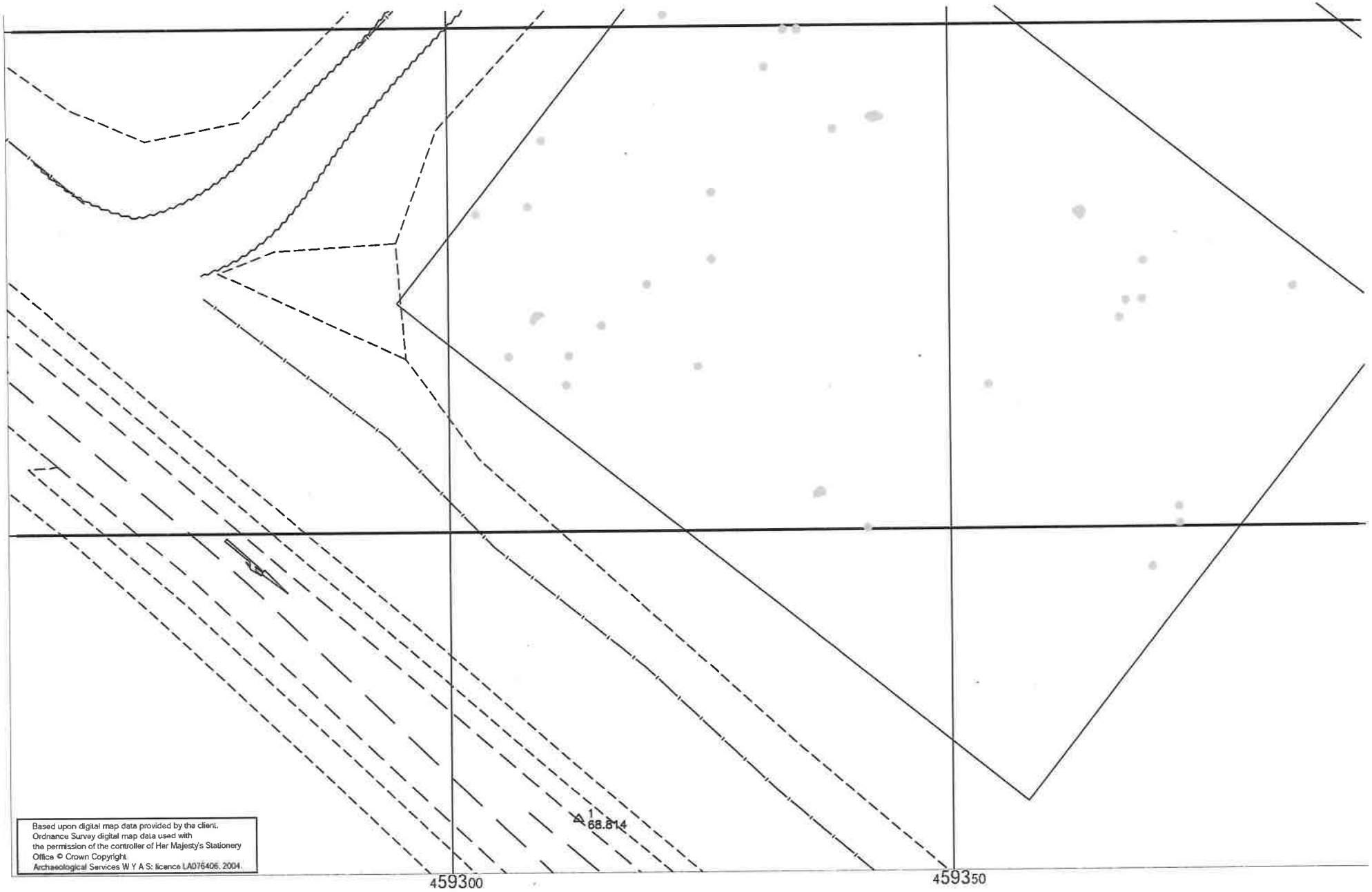


Fig.7. Interpretation plot of gradiometer data; Block 2

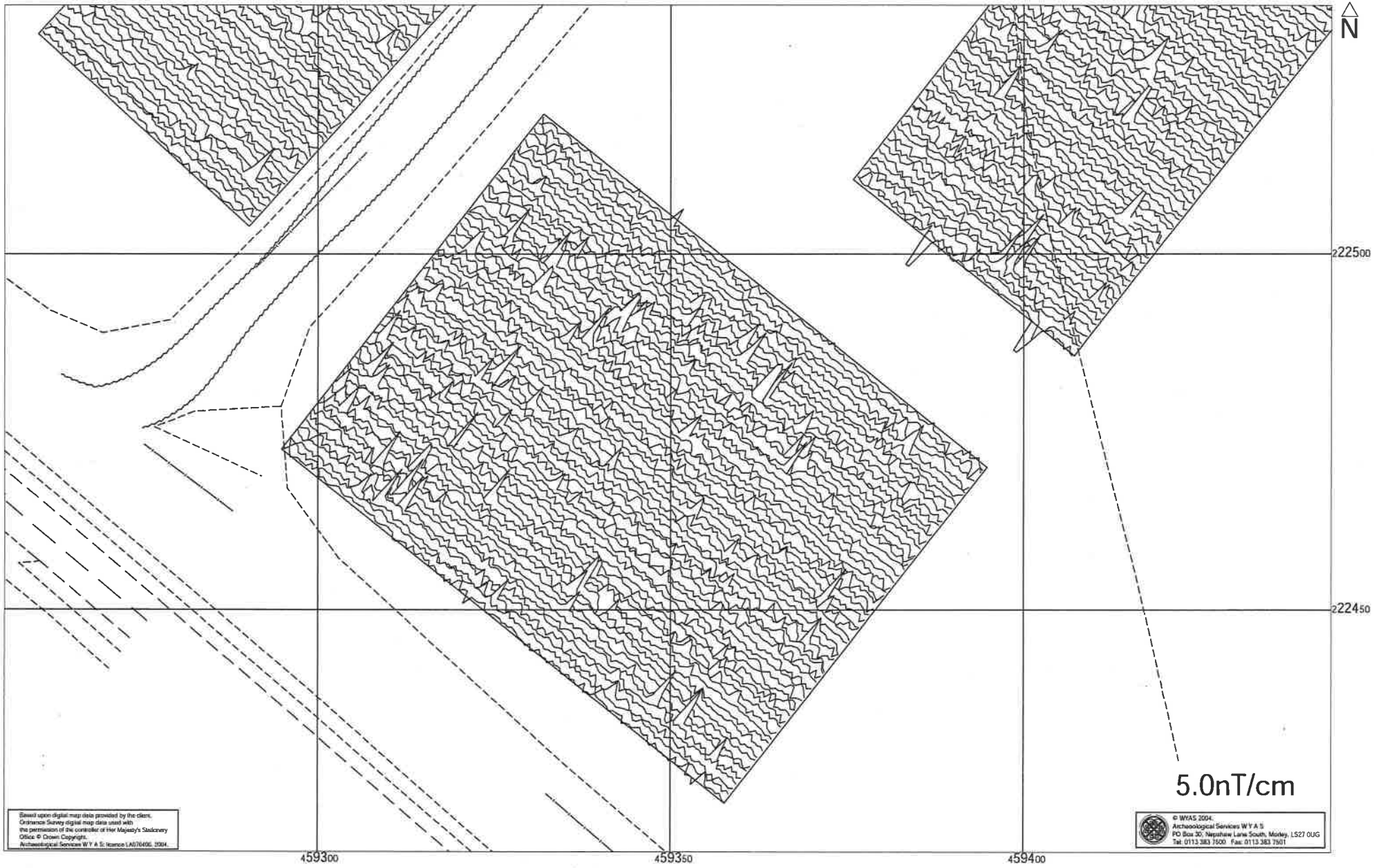


Fig. 8. XY trace plot of gradiometer data; Block 2

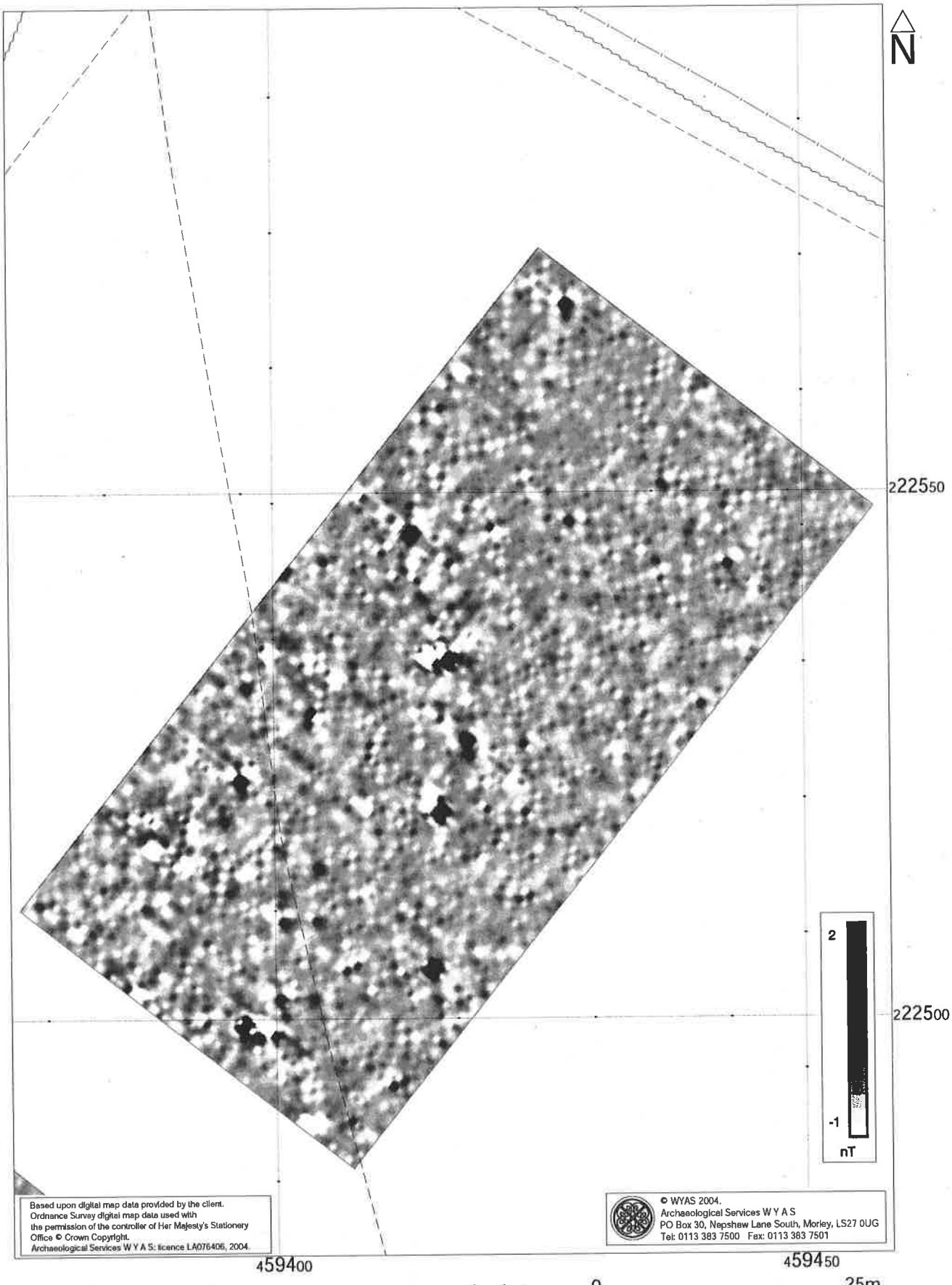


Fig. 9. Greyscale plot of gradiometer data; Block 3

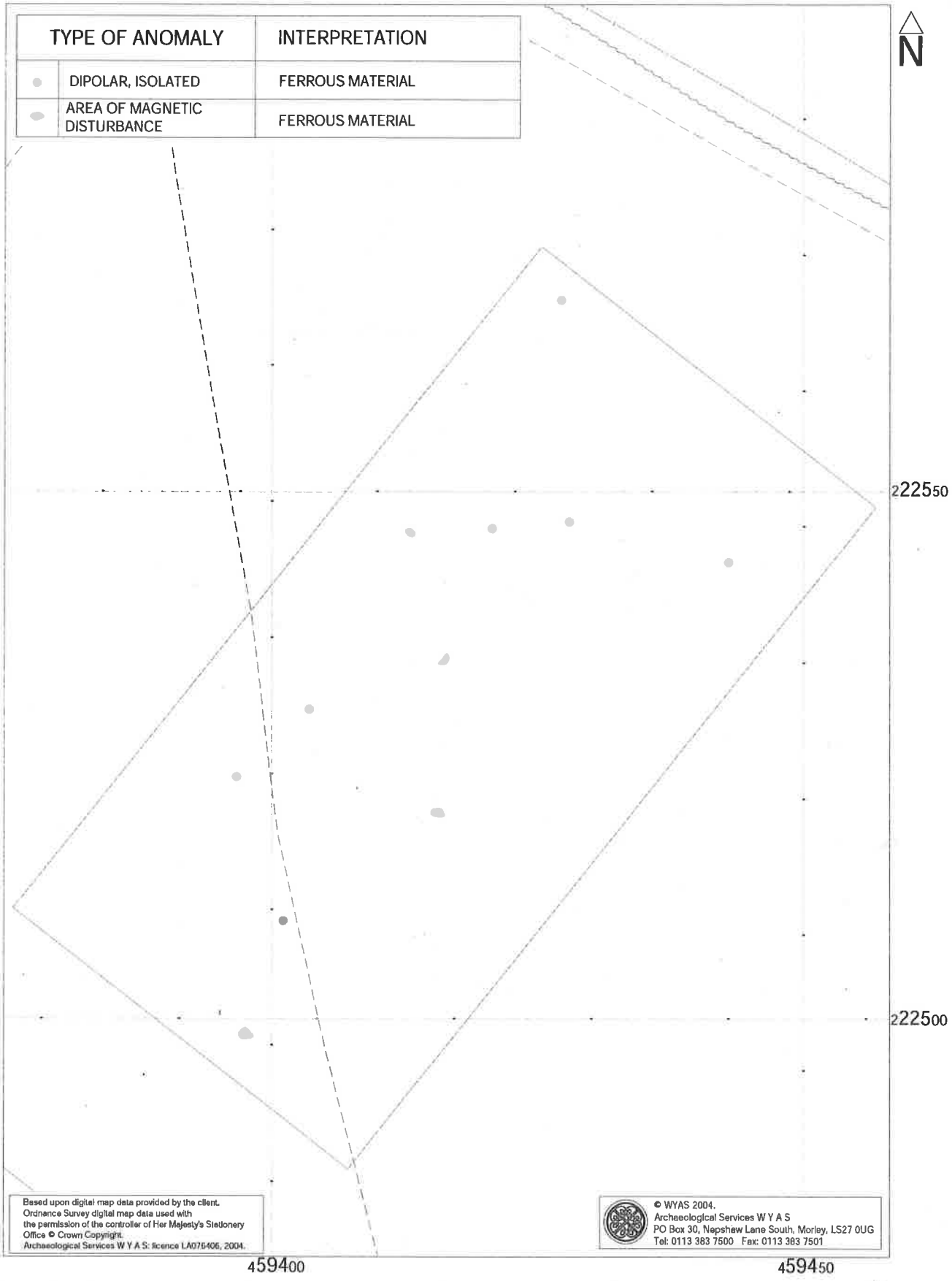


Fig. 10. Interpretation plot of gradiometer data; Block 3

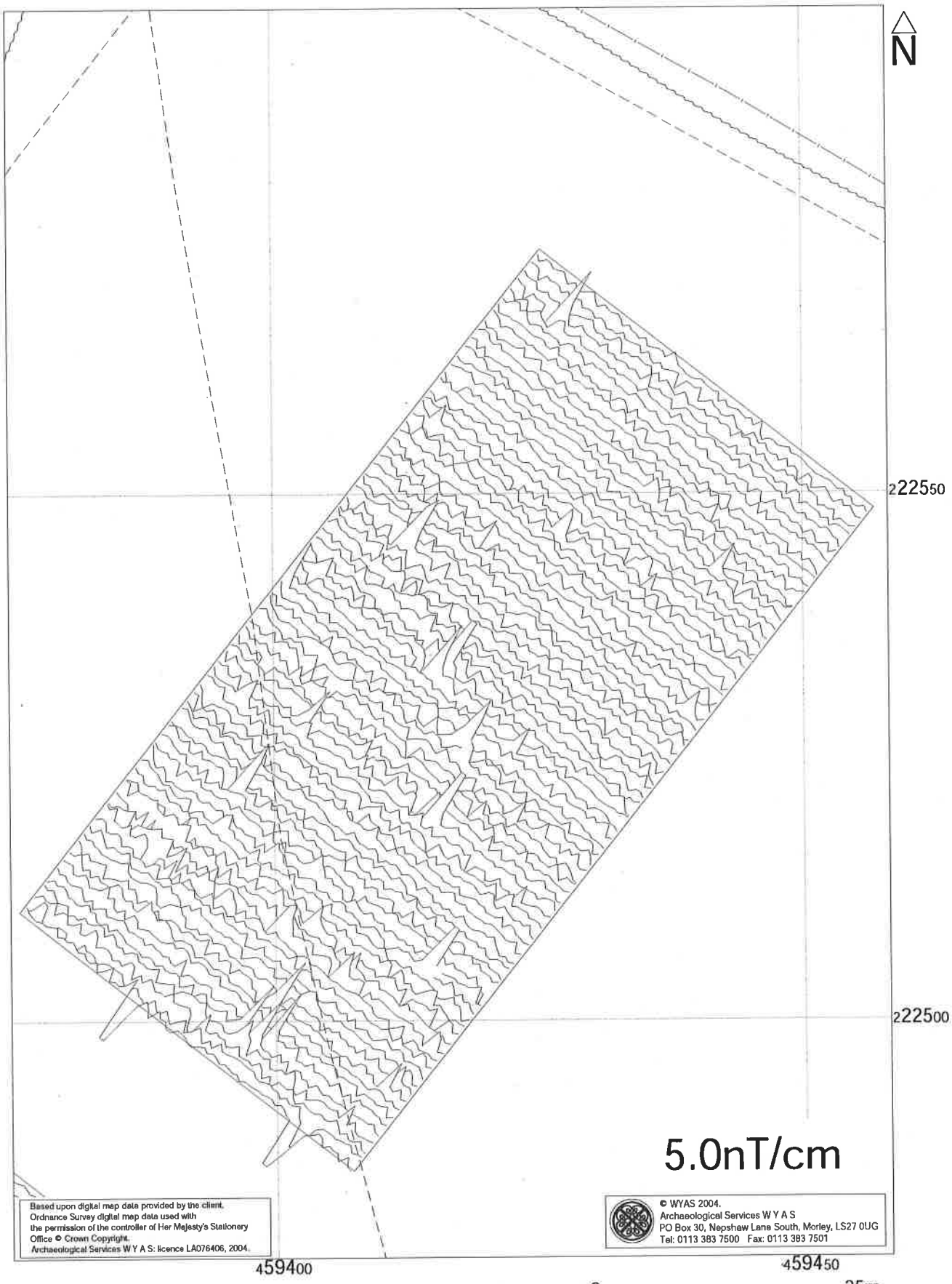


Fig. 11. XY trace plot of gradiometer data; Block 3

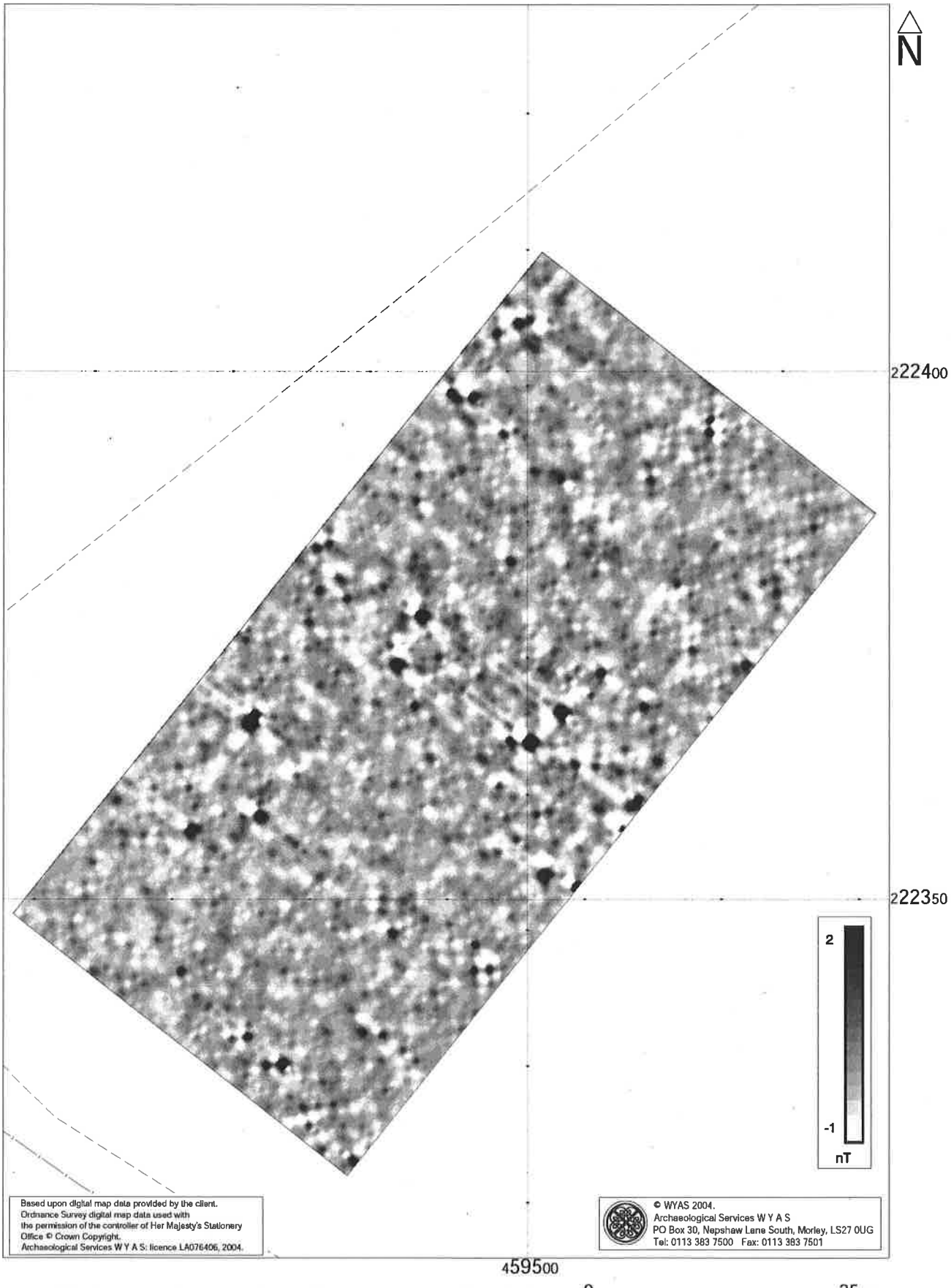


Fig. 12. Greyscale plot of gradiometer data; Block 4

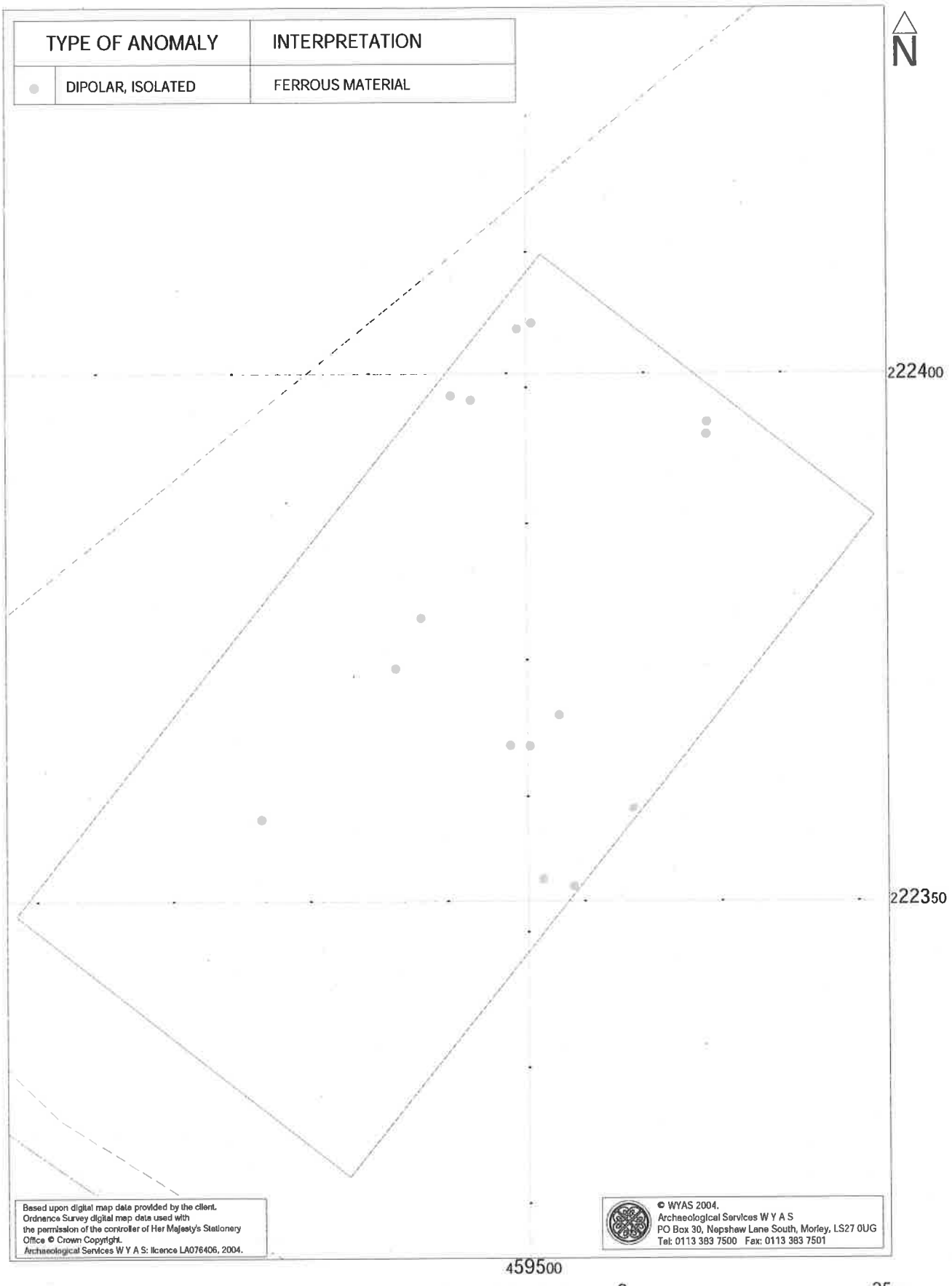


Fig. 13. Interpretation plot of gradiometer data; Block 4

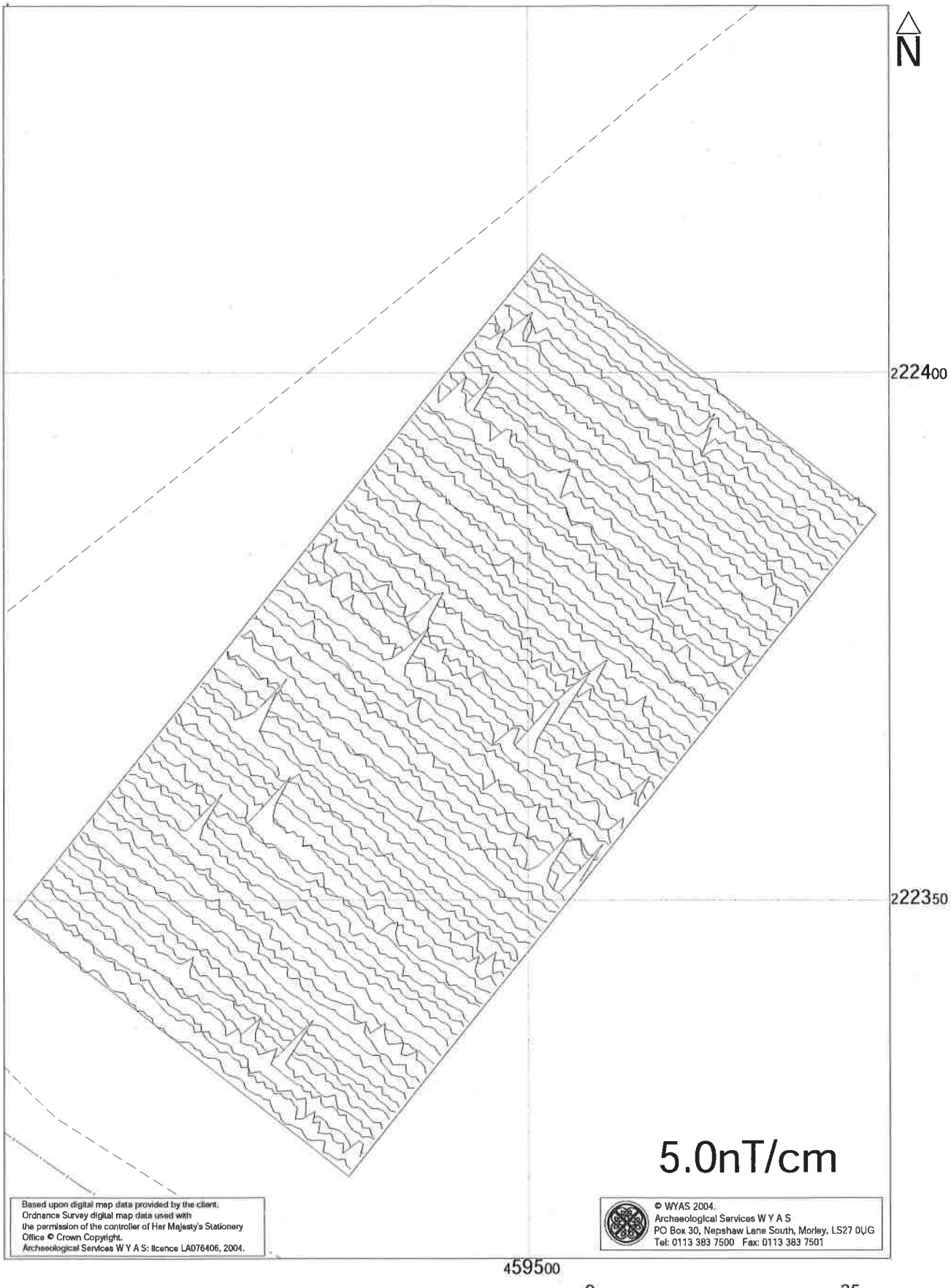


Fig. 14. XY trace plot of gradiometer data; Block 4

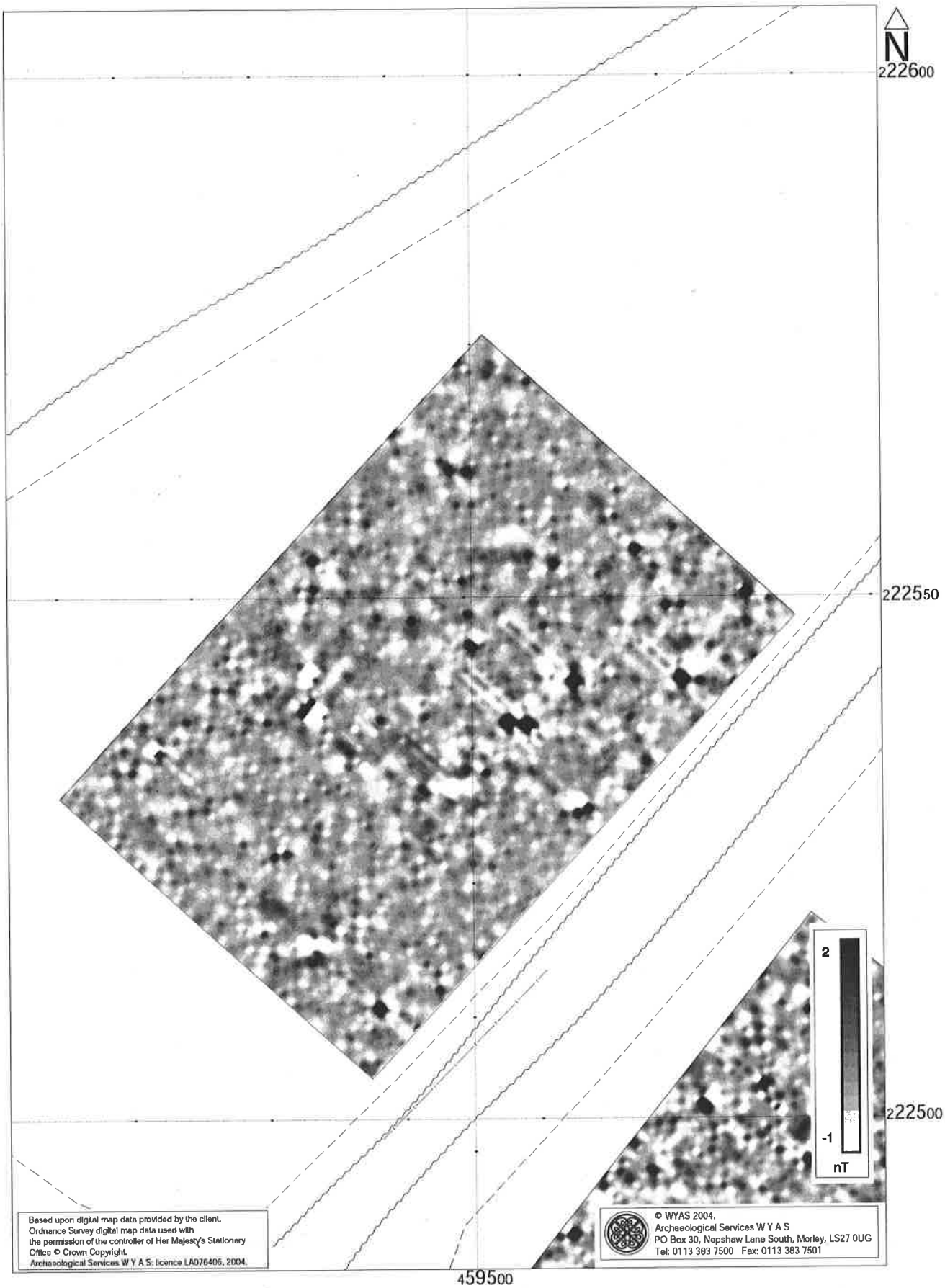


Fig. 15. Greyscale plot of gradiometer data; Block 5

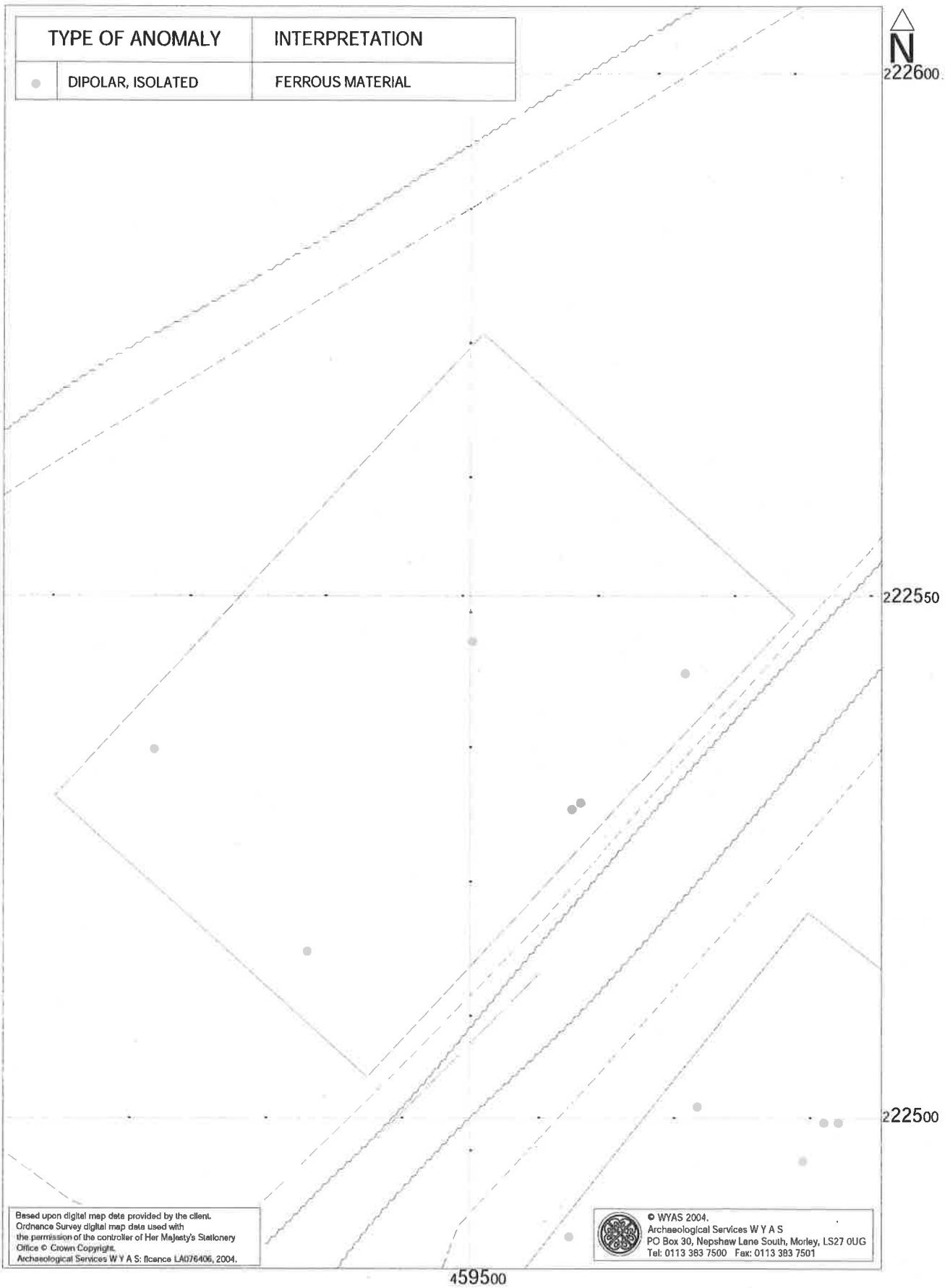


Fig. 16. Interpretation plot of gradiometer data; Block 5

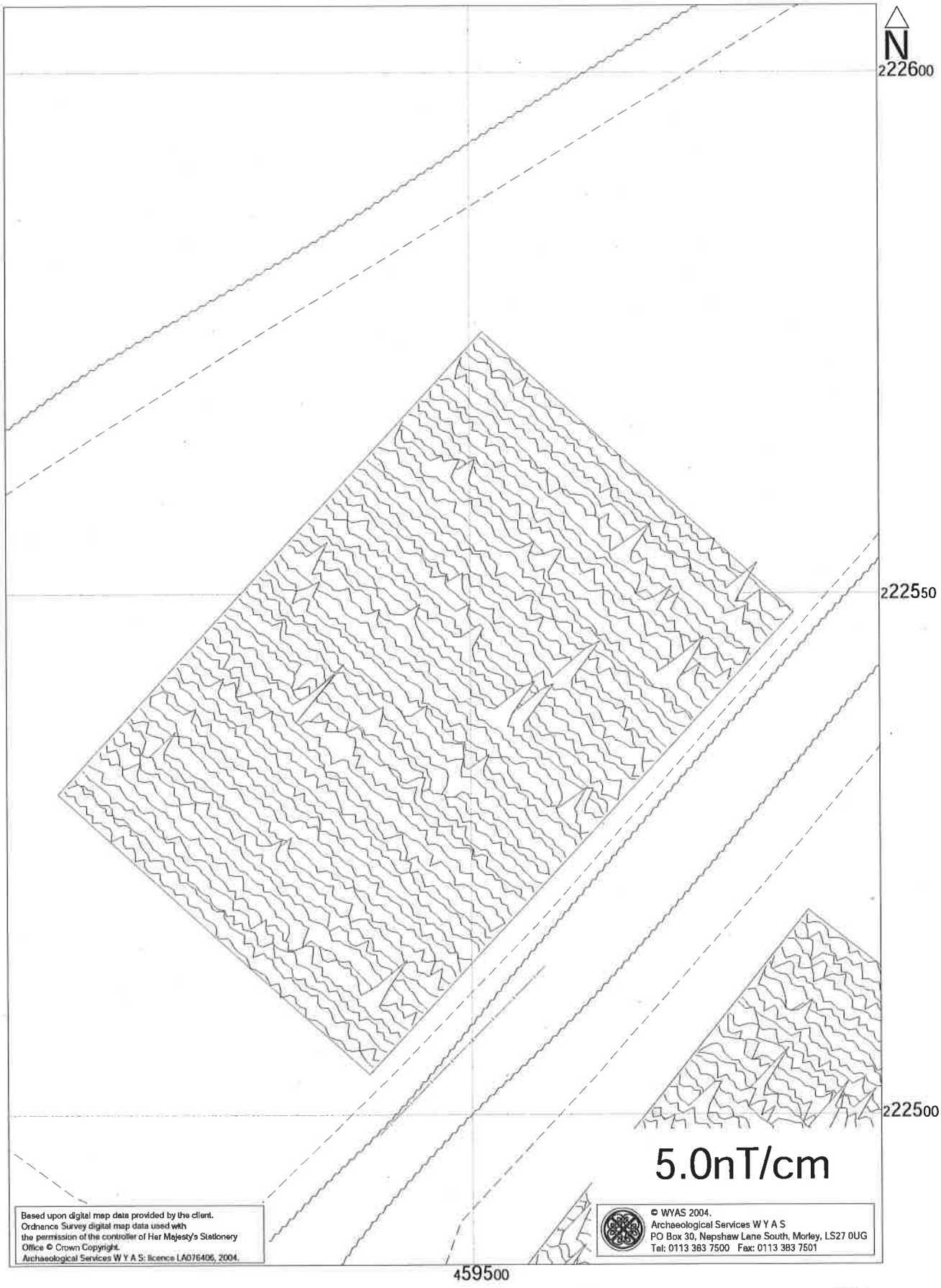


Fig. 17. XY trace plot of gradiometer data; Block 5

See Transport Assessment

No Appendices

No Appendices