GEOPHYSICAL SURVEY REPORT

Land at Seven Hills, Ipswich, Suffolk

JAC27176
Land at
Seven Hills
Geophysical Survey
Report
Version 02
17th August 2022

rpsgroup.com

TIGERGEO

Seven Hills, Ipswich, Suffolk

Geophysical Survey Report
(Magnetic Survey– Archaeology)

Version 1.2

Project code: SHS211

HER No. NAC151

Produced for: RPS Group

Lead Author:

MJ Roseveare, Senior Geophysicist

BSc(Hons) MSc MEAGE FGS MCIfA

17th August 2022

Environmental Geophysics – Survey, Research and Consultancy

TIGERGEO

Seven Hills, Ipswich, Suffolk

Digital data

Item and version	Sent to	Sent date
CAD: Interpretation DXF	Serena Ranieri	8th December 2021

Audit

Version	Author	Checked	Date
1_0	MJ Roseveare	ACK Roseveare	8th December 2021
1_1 (added HER numbers)	MJ Roseveare	MJ Roseveare	10th January 2021
1_2 (added HER number)	D Lewis	D Lewis	17th August 2022

Project metadata

Project Code	SHS211
Client	RPS Group
Fieldwork Date	16th - 18th November 2021
Field Personnel	ACK Roseveare, A Gerea
Data Processing Personnel	A Gerea
Reporting Personnel	MJ Roseveare, D Lewis
Report Date	17th August 2022
Report Version	1.2

TigerGeo Limited

TigerGeo Limited - Registered in England & Wales 09895326 - D-U-N-S 22-127-7456

Registered Office: 2 Wyevale Business Park, Kings Acre, Hereford, Herefordshire HR4 7BS UK

+44 (0) 1989 477 020 – www.tigergeo.com - @TigerGeoUK – also on LinkedIn & Facebook

EuroGPR Member 129, licensed to undertake radar survey in the UK by OFCOM – 1065067/1

Non-Technical Summary

TigerGeo was commissioned by Serena Ranieri of RPS Group to undertake a geophysical survey of land at Seven Hills, Ipswich, Suffolk, to assess the potential of the site to contain below ground deposits of archaeological interest. The National Mapping Programme (NMP) has identified a number of probable Bronze age barrows within and adjacent to the site which is located to the north and east of Felixstowe Road, Seven Hills, Ipswich, and comprises multiple fields on gently undulating arable land.

The survey was undertaken using an array of fluxgate magnetometers on a non-magnetic platform towed by an ATV. After survey, the data was observed to have a highly variable background of small but locally intense anomalies densely scattered across the site, thought to be derived from municipal compost contaminated with tiny ferrous metal fragments.

This has inevitably limited the potential of the survey to detect weakly magnetic features, however, evidence for at least one (HER LVT023) and maybe two Bronze Age barrows was found, plus a number of linear ditch fills that seem to represent an unknown former system of enclosure.

Table of Contents

1 Introduction

TigerGeo was commissioned by Serena Ranieri of RPS Group to undertake a geophysical survey of land at Seven Hills, Ipswich, Suffolk. This was undertaken to assess the potential of the site to contain below ground deposits of potential archaeological interest. It was undertaken using an array of fluxgate magnetometers on a non-magnetic platform towed by an ATV.

2 Location

The survey area is located to the north and east of Felixstowe Road, Seven Hills, Ipswich, and comprises multiple fields on gently undulating arable land.

Country	England
County	Suffolk
Nearest Settlement	Ipswich
Central Co-ordinates	623465,240736
Survey Area (ha)	27.8

3 Context

3.1 Environment

The below information is taken from the British Geological Survey and Ordnance Survey mapping, and includes information about the natural deposits within the proposed survey area and current and historic land use.

Soilscapes Classification	Freely draining slightly acid loamy soils (6)
Superficial 1:50000 BGS	Crag Formation - Sand (RCG)
Bedrock 1:50000 BGS	Kesgrave Catchment Subgroup - Sand And Gravel (KGCA)
Topography	Gently undulates
Hydrology	Freely draining
Current Land Use	Agricultural - Arable
Historic Land Use	Agricultural - Mixed
Vegetation Cover	Mostly none, turnips in southern area, weedy growth in parts of east field

3.2 Archaeology

An archaeological desk-based assessment has been prepared for the site (RPS, 2021). The below paragraphs are extracted from the Executive Summary and highlight the potential of the site to contain Bronze Age barrows and other features. They state that:

"*The assessment has identified Scheduled Monuments to the east and west of the study site comprising elements of a Bronze Age barrow field. The proposed development will not have either a direct or indirect impact upon any designated archaeological assets.*

The assessment has identified non-designated archaeological assets within the study site boundary. The assets have been identified through crop marks visible on aerial photographs. Although no intrusive archaeological investigation of the features has been undertaken their form conforms to round barrows and are probably Bronze Age in date. The barrows within the site and two further unscheduled barrows to the east link the two groups of Scheduled Monuments. Unlike the Scheduled barrows which are visible as upstanding earthworks the two crop marks within the study site boundary and the two to the east are not visible to the naked eye, probably as a direct result of their location within an arable framing regime.

The assessment has identified two round barrows within the study site along with a rectangular enclosure, observed as cropmarks, with a further two barrows to the east. However, some care should be taken when considering these barrows as in the HER record it states that 3 of these were excavated prior to the construction of the Ipswich Bypass, located 200m to the north."

4 Discussion

4.1 Data character

The data has a highly variable background of small but locally intense anomalies densely scattered across the site and this implies the spreading of green compost contaminated with shredded ferrous items, typical of unscreened municipal compost. This has proved a significant impediment to interpretation of the data.

In these circumstances the topsoil becomes laden with tiny metal fragments, many of which are ferrous and hence magnetisable. Because each fragment is relatively close to the magnetic sensor, the magnetic field from it dominates the local surroundings and hence all the sensor measures is a sea of small extent magnetic fields of (for example) 2 -3 nT, locally stronger depending upon the metal itself. This completely obscures deeper magnetic sources, e.g. from features of archaeological interest, which themselves may only manifest anomalies of similar amplitude at the surface.

4.2 Geology, soils and hydrology

The magnetic character of the Crag Formation Sand, the superficial geological unit, is not apparent due to masking by the debris in the compost. Any lateral variations of background apparent magnetic susceptibility are therefore not detectable.

At [9] strong linear anomalies pass across the corner of the site in a band up to 40 m wide and these seem to originate from within the superficial deposits. They will have a natural origin and could be the line of a former channel or similar incised feature.

4.3 Land use

There is little evidence for past land use, ridge and furrow cultivation sometimes being detectable despite the masking effects of the probable compost but was not detected here.

At [1] there is a ferrous utility, maybe a water pipe, in which case the southern end which is now in the middle of the field, may be the location of a well or similar structure.

There are two areas of strongly magnetic debris [4] and [5] and each has a relatively well defined northern edge although more irregular elsewhere. Both are of about the same size, so about 20 x 60 m and seem likely to include ferrous materials. It is possible that these are the remains of heaps of compost made before being spread on the fields. The southern area [5] has an associated region of more magnetic but relatively debris free ground covering about 14 x 60 m to the north.

4.4 Archaeology

Despite the problems posed by the probable compost, some features of archaeological interest were detected. Some of these were already known from cropmarks digitised by the National Mapping Programme (NMP), e.g. [2] and [10] but several others were not.

An indistinct probable ditch fill [2] extends for about 214 m across the site and this is similar to the cropmark digitised by the NMP. The function of this is unknown but others seem to exist and may be elements of a former field system.

A slightly irregular ring-ditch at [10] is also recorded as a cropmark by the NMP and is about 24 m in diameter but not perfectly circular. There is no sign of internal features in that the discrete anomalies that do exist are as likely to be due to the probable compost. This appears to be the monument recorded as HER LVT023.

A second ring-shaped cropmark recorded by the NMP at 623544, 240820 has no magnetic expression and a small number of linear cropmarks, similar to [2] and likely also to have been boundary ditches, appear not to have coincident magnetic anomalies.

At [3] there is a weak and indistinct anomaly, possibly the fill of a ring ditch and if so one at least 20 m in diameter. If it is a ring ditch then another Bronze Age barrow similar to [10] would be a possibility.

Another probable linear ditch fill [6] is at least 110 m long and has the appearance of an enclosure boundary while another, [8], has a similar but non-parallel alignment, so perhaps evidence for a system of enclosure and maybe detected as a cropmark by the NMP further to the west.

Two less certain examples may exist at [7] and [11], both only visible for about 30 m although [7] may continue for about the same distance to the east.

4.5 Conclusions

One suspected (from NMP data) Bronze Age barrow appears to have been confirmed (HER LVT023) while a second has not (HER LVT022). A third HER record LVT058 not seen during NMP mapping nor in the magnetic data. A fourth example [3] may be evident within the magnetic data but is not within the NMP or HER data sets. For both LVT022 and LVT058, if any associated magnetic anomalies are weak then they may be obscured by the debris.

There appears to be evidence of a previously unknown system of enclosure removed prior to OS map editions of the 1880s. Whether this is of prehistoric or much later date cannot be determined from the survey.

The presence of strongly magnetic debris across much of the survey has limited the scope for detection of some features of interest.

4.6 Caveats

Geophysical survey is reliant upon the detection of anomalous values and patterns in physical properties of the ground, e.g. magnetic, electromagnetic, electrical, elastic, density and others. It does not directly detect underground features and structures and therefore the presence or absence of these within a geophysical interpretation is not a direct indicator of presence or absence in the ground. Specific points to consider are:

- some physical properties are time variant or mutually interdependent with others;
- for a buried feature to be detectable it must produce anomalous values of the physical property being measured;
- any anomaly is only as good as its contrast against background textures and noise within the data.

TigerGeo will always attempt to verify the accuracy and integrity of data it uses within a project but at all times its liability is by necessity limited to its own work and does not extend to third party data and information. Where work is undertaken to another party's specification any perceived failure of that specification to attain its objective remains the responsibility of the originator, TigerGeo meanwhile ensuring any possible shortcomings are addressed within the normal constraints upon resources.

5 Methodology

5.1 Soil properties

Magnetic survey for any purpose relies upon the generation of a clear magnetic anomaly at the surface, i.e. strong enough to be detected by instrumentation and exhibiting sufficient contrast against background variation to permit diagnostic interpretation. The anomaly itself is dependent upon the chemical properties of a particular volume of ground, its magnetic susceptibility and hence induced magnetic field, the strength of any remanent magnetisation, the shape and orientation of the volume of interest and its depth of burial. Finally the choice and configuration of measurement instrumentation will affect anomaly size and shape.

Sites present a complex mixture of these factors and for some the causative affects are not known. However, depth of burial and size are usually fairly constrained and background susceptibility can be estimated (or measured). The degree of remanent magnetisation is harder to predict and depends on both the natural magnetic properties of the soil and any chemical processes to which it has been subjected. Fortunately heat will raise the susceptibility of most soils and topsoil tends to be more magnetic than subsoil, by volume.

It is hard to draw reliable conclusions about what sort of geology is supportive of magnetic survey as there are many factors involved and in any case magnetic response can vary across geological units as well as being dependent upon post-deposition and erosional processes. In general a relatively non-magnetic parent material contrasting with a magnetisable erosion product, i.e. one which contains iron in the form of oxides and hydroxides, will allow archaeological structures to exhibit strong magnetic contrast against their surroundings and especially if the soil has been heated or subjected to certain processes of fermentation. In the absence of either, magnetic enhancement becomes entirely reliant upon the geochemistry of the soil and enhancement will often be weaker and more variable.

Analysis of the British Geological Survey (BGS) Geochemical Atlas (G-Base) for total soil iron reveals that for England and Wales 50% of the samples (the interquartile range) lie between 1.9% and 3.6% percentage iron with the median at 2.7%.

The principal magnetic iron mineral is the oxide magnetite which sometimes occurs naturally but is more often formed during the heating of soil. Subsequent cooling yields a mixture of this, non-magnetic oxide haematite and another magnetic oxide, maghaemite. Away from sources of heat, other magnetic iron minerals include the sulphides pyrite and greigite while in damp soils complex chemistry involving the hydroxides goethite and lepidocrocite can create strong magnetic anomalies. There are thus a number of different geochemical reaction pathways that can both augment and reduce the magnetic susceptibility of a soil. In addition, this susceptibility may exhibit depositional patterns unrelated to visible stratigraphy.

Most structures of archaeological interest detected by magnetic survey are fills within negative or cut features. Not all fills are magnetic and they can be more magnetic or less magnetic than the surrounding ground. In addition, it is common for fills to exhibit variable magnetic properties through their volume, basal primary silt often being more magnetic than the material above it due to the increased proportion of topsoil within it. However, a fill containing burnt soil may be much more magnetic than this primary silt and sometimes a feature that has contained standing water can produce highly magnetic silts through mechanical depositional processes (depositional remanent magnetisation, DRM).

A third structural factor in the detection of buried structures is the depth of topsoil over the feature. As fills sink, the hollow above accumulates topsoil and hence a structure can be detected not through its own magnetisation but through the locally deeper topsoil above it. The volume of soil required depends upon the magnetic susceptibility of the soil but just a few centimetres are often sufficient. Such a thin deposit can, however, easily be lost through subsequent erosion by natural factors or ploughing.

5.2 Instrumentation

Instrumentation plays a significant part in the performance of magnetic survey in an archaeological context and it is the instrument configuration that governs the form and strength of an anomaly. Vertical gradiometers are insensitive to laminar structures, e.g. broad lenses of topsoil within the upper fills of features but they have a high lateral resolution. Their response is strongly governed by the depth of a material below the lower sensor and hence topsoil with a significant payload of magnetic debris can appear as a mass of noise.

The array system is designed to be non-magnetic and to contribute virtually nothing to the magnetic measurement, whether through direct interference or through motion noise.

5.3 Survey

Measured variable	Vertical gradient of vertical component of magnetic flux density / nT/m
Instrument	Array of Sensys FGM650-3 sensors with a Mercury6508 digitiser
Configuration	Gradiometric transverse array (4 sensors, ATV towed)
Sensitivity	0.1 nT @ 200 Hz (manufacturer's specification)
QA Procedure	Continuous observation
Spatial resolution	1.0m between lines, 0.15m fixed along line interval (live stacking)

The system continuously displays all incoming data as well as line speed and spatial data resolution per acquisition channel during survey. Rest mode system noise is therefore easy to inspect simply by pausing during survey, and the continuous display makes monitoring for quality intrinsic to the process of undertaking a survey.

5.4 Processing

All data processing is minimised and limited to what is essential for the class of data being collected, e.g. reduction of orientation effects, suppression of single point defects (drop-outs or spikes) etc. The processing stream for this data is as follows:

Process	Software	Parameters
Measurement & GNSS receiver data alignment	Proprietary	
Temporal reduction, regional field suppression	Proprietary	Bandpassed 0.3 – 20.0s
Gridding	Surfer	Kriging, 0.25m x 0.25m
Smoothing	Surfer	Gaussian lowpass 3x3 data (0.75m)

The initial processing uses proprietary software developed in conjunction with the multisensor acquisition system. Gridded data is ported as data surfaces (not images) into Manifold GIS for final imaging, contouring and detailed analysis. Specialist analysis is undertaken using proprietary software.

5.5 Interpretation

5.5.1 Introduction

Numerous sources are used in the interpretive process, which takes into account shallow geological conditions, past and present land use, drainage, weather before and during survey, topography and any previous knowledge about the site and the surrounding area. Old Ordnance Survey mapping is consulted and also older sources if available. Geological information (for the UK) is sourced only from British Geological Survey resources and aerial imagery from online sources. LiDAR data is usually sourced from the Environment Agency or other national equivalents, SAR from NASA and other topographic data from original survey.

Information from nearby surveys is consulted to inform upon local data character, variations across soils and near-surface geological contexts. Published data from other surveys may also be used if accompanied by adequate metadata.

Interpretation of magnetic data is undertaken using total intensity data, vertical pseudo-gradient and where relevant, shallow field, component models in parallel although for clarity only a subset of these may be presented in the report.

5.5.2 The contribution from geology and soils

On some sites, e.g. some gravels and alluvial contexts, there will be anomalies that can obscure those potentially of archaeological interest. They may have a strength equal to or greater than that associated with more relevant sources, e.g. ditch fills, but can normally be differentiated on the basis of anomaly form coupled with geological understanding. Where there is ambiguity, or relevance to the study, these anomalies will be included in this category.

Not all changes in geological context can be detected at the surface, directly or indirectly, but sometimes there will be a difference evident in the geophysical data that can be attributed to a change, e.g. from alluvium to tidal flat deposits, or bedrock to alluvium. In some cases the geophysical difference will not exactly coincide with the geological contact and this is especially the case across transitions in soil type.

Geophysical data varies in character across areas, due to a range of factors including soil chemistry, near surface geology, hydrology and land use past and present. These all contribute to the texture of the data, i.e. a background character against which all other anomalies are measured.

5.5.3 Agricultural inputs

Coherent linear dipolar enhancement of magnetic field strength marking ditch fills, narrow bands of more variable magnetic field or changes in apparent magnetic susceptibility, are all included within the category of former field boundaries if they correlate with those depicted on the Tithe Map or early Ordnance Survey maps. If there is no correlation then these anomaly types are not categorised as a field boundaries.

Banded variations in apparent magnetic susceptibility caused by a variable thickness of topsoil, depositional remanent magnetisation of sediments in furrows or susceptibility enhancement through heating (a by product of burning organic matter like seaweed) tend to indicate past cultivation, whether ridge-based techniques, medieval ridge and furrow or post medieval 'lazy beds'. Modern cultivation, e.g. recent ploughing, is not included.

In some cases it is possible to identify drainage networks either as ditch-fill type anomalies (typically 'Roman' drains), noisy or repeating dipolar anomalies from terracotta pipes or reduced magnetic field strength anomalies from culverts, plastic or non-reinforced concrete pipes. In all cases identification of a herring bone pattern to these is sufficient for inclusion within this category.

5.5.4 Features of archaeological interest

Any linear or discrete enhancement of magnetic field strength, usually with a dipolar character of variable strength, that cannot be categorised as a field boundary, cultivation or as having a geological origin, is classified as a fill potentially being of archaeological interest. Fills are normally earthen and include an often invisible proportion of heated soil or topsoil that augments local magnetic field strength. Inverted anomalies are possible over non-earthen fills, e.g. those that comprise peat, sand or gravel within soil. This category is subject to the 'habitation effect' where, in the absence of other sources of magnetic material, anomaly strength will decrease away from sources of heated soil and sometimes to the extent of non-detectability.

Former enclosure ditches that contained standing water can promote enhanced volumetric magnetic susceptibility through depositional remanence and remain detectable regardless of the absence of other sources of magnetic enhancement.

Anything that cannot be interpreted as a fill tends to be a structure, or in archaeological terms, a feature. This category is secondary to fills and includes anomalies that by virtue of their character are likely to be of archaeological interest but cannot be adequately described as fills. Examples include strongly magnetic bodies lacking ferrous character that might indicate hearths or kilns. In some cases anomalies of ferrous character may be included.

On some sites the combination of plan form and anomaly character, e.g. rectilinear reduced magnetic field strength anomalies, might indicate the likely presence of masonry, robber trenches or rubble foundations. Other types of structure are only included if the evidence is unequivocal, e.g. small ring ditches with doorways and hearths. In some circumstances a less definite category may be assigned to the individual anomalies instead.

It is sometimes possible to define different areas of activity on the basis of magnetic character, e.g. texture and anomaly strength. These might indicate the presence of middens or foci within larger complexes. This category does not indicate a presence or absence of discrete anomalies of archaeological interest.

5.6 Glossary

Acronym / term	Type	Definition
A	Physical quantity	SI unit Amp of electric current
BGS	Organisation	British Geological Survey
CIfA	Organisation	Chartered Institute for Archaeologists
dB	Physical quantity	Decibel, unit of amplification / attenuation
DRM	Process	Depositional Remanent Magnetisation
EAGE	Organisation	European Association of Geoscientists and Engineers
EGNOS	Technology	European Geostationary Navigation Overlay Service
ERT	Technology	Electrical resistivity tomography
ETRS89	Technology	European Terrestrial Reference System (defined 1989)
ETSI	Organisation	European Telecommunications Standards Institute
EuroGPR	Organisation	European Ground Penetrating Radar Association, the trade body for GPR professionals
G-BASE	Data	British Geological Survey Geochemical Atlas
GeolSoc	Organisation	Geological Society of London, the chartered body for the geological profession
GNSS	Technology	Global Navigation Satellite System
GPR	Technology	Ground penetrating radar
GPS	Technology	Global Positioning System (US)
inversion	process	A combination of forward and backward modelling intended to construct a 2D or 3D model of the physical distribution of a variable from data measured on a 1D or 2D surface. It is fundamental to ERT survey
IP	Physical quantity	Induced polarisation (or chargeability) units mV/V or ms
m	Physical quantity	SI unit metres of distance
mbgl	Physical quantity	Metres below ground level
MHz	Physical quantity	SI unit mega-Hertz of frequency
MS	Physical quantity	Magnetic susceptibility, unitless
mS	Physical quantity	SI unit milli-Siemens of electrical conductivity
nT	Physical quantity	SI unit nano-Tesla of magnetic flux density
OFCOM	Organisation	The Office of Communications, the UK radio spectrum regulator
Ohm	Physical quantity	SI unit Ohm of electrical resistance
OS	Organisation	Ordnance Survey of Great Britain
OSGB36	Data	The OS national grid (Great Britain)
OSTN15	Technology	Current coordinate transformation from ETRS89 to OSGB36 co-ordinates
RDP	Physical quantity	Relative Dielectric Permittivity, unitless
RTK	Technology	Real Time Kinematic (correction of GNSS position from a base station)
s	Physical quantity	SI unit seconds of time
TMI	Physical quantity	Total magnetic intensity (measured flux density minus regional flux density)
TRM	Process	Thermo-Remanent Magnetisation
V	Physical quantity	SI unit Volt of electric potential
WGS84	Data	World Geodetic System (defined 1984)

5.7 Bibliography

British Geological Survey (www.mapapps2.bgs.ac.uk/ukso) and (www.mapapps.bgs.ac.uk/geologyofbritain)

RPS, 2021, "Archaeological Desk-Based Assessment: Land North of Felixstowe Road, Seven Hills, Ipswich, Suffolk" Report Ref. JAC27176

5.8 For reference

Aspinall, A, *et al*, 2008, "Magnetometry for Archaeologists", Geophysical Methods for Archaeology, Altamira Press

Blakely, R J, 1996, "Potential Theory in Gravity and Magnetic Applications", Cambridge University Press

David, A, *et al*, 2008, "Geophysical Survey in Archaeological Field Evaluation", English Heritage

Milsom, J, 2003, "Field Geophysics", 3rd edition, The Geological Field Guide Series, Wiley

Rawlins, B G *et al*, 2012, "The advanced soil geochemical atlas of England and Wales". British Geological Survey, Keyworth

Schmidt, A, 2013, "Geophysical Data in Archaeology: A Guide to Good Practice", ADS

Scollar, I, 1990, "Archaeological Prospecting and Remote Sensing", Topics in Remote Sensing 2, Cambridge University Press

Tarling, D H, *et al*, (ed.), 1999, "Palaeomagnetism and Diagenesis in Sediments", Geological Society, London, Special Publications, 151

Telford, W M, *et al*, 1990, "Applied Geophysics", 2nd Edition, Cambridge University Press

5.9 Archiving and dissemination

An archive is maintained for all projects, access to which is permitted for research purposes. Copyright and intellectual property rights are retained by TigerGeo on all material it has produced, the client having full licence to use such material as benefits their project. Where required, digital data and a copy of the report can be archived in a suitable repository, e.g. the Archaeology Data Service, in addition to our own archive.

The archive contains all survey and project data, communications, field notes, reports and other related material including copies of third party data (e.g. CAD mapping, etc.) in digital form. Many are in proprietary formats while report components are available in PDF format.

The client will determine the distribution path for reporting, including to the end client, other contractors, the local authority including the Historic Environment Record etc., and will determine the timetable for upload of the project report to the OASIS Grey Literature library or supply of report or data to other archiving services, taking into account end client confidentiality.

TigerGeo reserves the right to display data rendered anonymous on its website and in other marketing or research publications.

6 Supporting information

6.1 Standards and quality (archaeology)

For work within the archaeological sector TigerGeo has been awarded CIfA (Chartered Institute for Archaeologists) Registered Organisation status.

A high standard of client-centred professionalism is maintained in accordance with the requirements of relevant professional bodies including the Geological Society of London (GeolSoc) and the Chartered Institute for Archaeologists (CIfA). Senior members of TigerGeo are professional members of the GeolSoc (FGS), CIfA (MCIfA & ACIfA grades) and other appropriate bodies, including the European Association of Geoscientists and Engineers (EAGE) Near Surface Division (MEAGE) and the Institute of Professional Soil Scientists (MISoilSci).

In addition TigerGeo is a member of EuroGPR and all ground penetrating and other radar work is in accordance with ETSI EG 202 730.

The management team at TigerGeo have almost 50 years of combined experience of near surface geophysical project design, survey, interpretation and reporting, based across a wide range of shallow geological contexts. Added to this is the considerable experience of our lead geophysicists in a variety of commercial and academic roles. All geophysical staff have graduate and in many cases also post-graduate relevant qualifications pertaining to environmental geophysics from recognised centres of academic excellence.

During fieldwork there is always a fully qualified (to graduate or post-graduate level) supervisory geophysicist leading a team of other geophysicists and geophysical technicians, all of whom are trained and competent with the equipment they are working with. Data processing and interpretation is carried out by a suitably qualified and experienced geophysicist under the direct supervision and guidance of the Senior Geophysicist. All work is monitored and reviewed throughout by the Senior Geophysicist who will appraise all stages of a project as it progresses.

Data processing and interpretation adheres to the scientific principles of objectiveness and logical consistency. A standard set of approved external sources of information, e.g. from the British Geological Survey, the Ordnance Survey and similar sources of data, in addition to previous TigerGeo projects, guide the interpretive process. Due attention is paid to the technical constraints of method, resolution, contrast and other geophysical factors.

There is a strong culture of internal peer-review within TigerGeo, for example, all reports pass through a process of authorship, technical review and finally proof-reading before release to the client. Technical queries resulting from TigerGeo's work are reviewed by the Senior Geophysicist to ensure uniformity of response prior to implementing any edits, etc.

Work is undertaken in accordance with the high professional standards and technical competence expected by the Geological Society of London and the European Association of Geoscientists and Engineers.

All work for archaeological projects is also conducted in accordance with the following standards and guidance:

- David et al, "Geophysical Survey in Archaeological Field Evaluation", English Heritage, 2008;
- "Standard and guidance for Archaeological Geophysical survey", Chartered Institute for Archaeologists, 2014 (Updated 2016);

and TigerGeo meets with ease the requirements of English Heritage in their 2008 Guidance "Geophysical Survey in Archaeological Field Evaluation" section 2.8 entitled "Competence of survey personnel".

6.2 Key personnel

Martin Roseveare, MSc BSc(Hons) MEAGE FGS MCIfA	**Senior Geophysicist, Director**
Martin specialised (MSc) in geophysical prospection for shallow applications and since 1997 has worked in commercial geophysics. Elected a GeolSoc Fellow in 2009 he is now working towards achieving CSci. A member of the European Association of Geoscientists & Engineers, he has served on the EuroGPR and CIfA GeoSIG committees and on the scientific committees of the 10th and 11th Archaeological Prospection conferences. He has reviewed papers for the EAGE Near Surface conference, was a technical reviewer of the Irish NRA geophysical guidance and is a founding member of the ISSGAP soils group. Professional interests include the application of geophysics to agriculture and the environment, e.g. groundwater and geohazards. He is also a software writer and equipment integrator with significant experience of embedded systems.	
Anne Roseveare, BEng(Hons) DIS MISoilSci	**Operations Manager, Environmental Geophysicist, Data Analyst**
On looking beyond engineering, Anne turned her attention to environmental monitoring and geophysics. She is a Member of the British Society of Soil Science / Institute of Professional Soil Scientists (BSSS/IPSS) and has specific areas of interest in soil physics & hydrology, agricultural applications and industrial sites. Working in shallow geophysics since 1998, Anne is a founding member of the ISSGAP soils group, also was the founding Editor of the International Society for Archaeological Prospection (ISAP). Specifications, logistics, health and safety, data handling & analysis are integral parts of her work, though she is happily distracted by the possibilities of discovering lost cities, hillwalking, dance and good food.	
Daniel Lewis, MA BA(Hons) ACIfA	**Consultant Archaeologist**
Daniel studied archaeology at the University of Nottingham and worked in field archaeology for many years, managing urban and rural fieldwork projects in and around Herefordshire. When the desk became more appealing he jumped into the world of consulting, working on small and large multi-discipline projects throughout England and Wales. At the same time, he returned to University, gaining an MA in Historic Environment Conservation. With experience in the heritage sector since 1998, Daniel has a diverse portfolio of skills. Here he ensures that geophysical work within the heritage sector is well grounded in archaeology. His spare time includes much running up mountains.	
Alexandra Gerea, MSc, BSc, PhD Candidate	**Geophysical Processor & Analyst**
Alexandra has a BSc in Geophysics and an MSc in Applied Geo-biology and is in the final stages of a PhD in the UK after living in Portugal for six months working on her master's degree. Since 2008 she has used most mainstream processing applications across electrical, magnetic and radar methods. She combines a love of nature and science and is currently studying plant roots in agricultural environments using geophysical methods. When not doing that she enjoys travelling, hiking, nature, yoga, books, foreign languages and cats. A few years ago she found a passion for electronics and started building different devices including intelligent gardening systems and coding in Python.	

7 Appendices

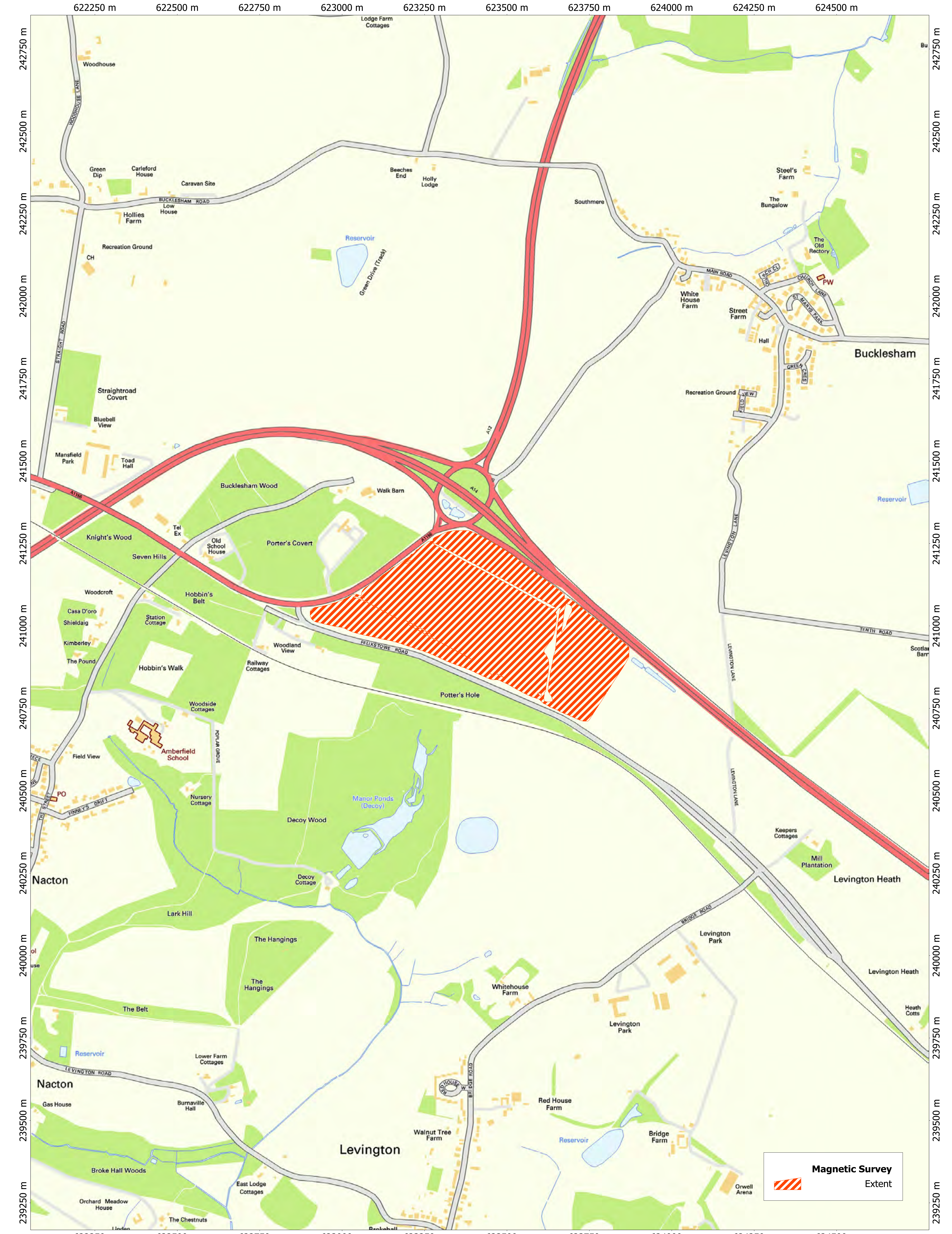
7.1 Appendix 1 – OASIS summary report

(Page left intentionally blank)

Summary for tigergeo1-505024

OASIS ID (UID)	tigergeo1-505024
Project Name	Magnetometry Survey at Seven HIlls Ipswhich, Suffolk
Activity type	Magnetometry Survey
Project Identifier(s)	Seven Hills, Ipswich, Suffolk
Planning Id	
Reason For Investigation	Planning: Pre application
Organisation Responsible for work	Tigergeo Limited
Project Dates	16-Nov-2021- 18-Nov 2021
Location	Seven HIlls Ipswich, Suffolk NGR : TM 23465 40736 LL : 52.0200142317935, 1.2554782600613 12 Fig : 623465,240736
Administrative Areas	Country : England County : Suffolk District : East Suffolk Parish : Levington
Project Methodology	TigerGeo was commissioned by Serena Ranieri of RPS Group to undertake a geophysical survey of land at Seven Hills, Ipswich, Suffolk, to assess the potential of the site to contain below ground deposits of archaeological interest. The National Mapping Programme (NMP) has identified a number of probable Bronze age barrows within and adjacent to the site which is located to the north and east of Felixstowe Road, Seven Hills, Ipswich, and comprises multiple fields on gently undulating arable land. The survey was undertaken using an array of fluxgate magnetometers on a non-magnetic platform towed by an ATV. After survey, the data was observed to have a highly variable background of small but locally intense anomalies densely scattered across the site, thought to be derived from municipal compost contaminated with tiny ferrous metal fragments. This has inevitably limited the potential of the survey to detect weakly magnetic features, however, evidence for at least one (HER LVT023) and maybe two Bronze Age barrows was found, plus a number of linear ditch fills that seem to represent an unknown former system of enclosure.
Project Results	One suspected (from NMP data) Bronze Age barrow appears to have been confirmed (HER LVT023) while a second has not (HER LVT022). A third HER record LVT058 not seen during NMP mapping nor in the magnetic data. A fourth example [3] may be evident within the magnetic data but is not within the NMP or HER data sets. For both LVT022 and LVT058, if any associated magnetic anomalies are weak then they may be obscured by the debris. There appears to be evidence of a previously unknown system of enclosure removed prior to OS map editions of the 1880s. Whether this is of prehistoric or much later date cannot be determined from the survey. The presence of strongly magnetic debris across much of the survey has limited the scope for detection of some features of interest.
Keywords	Round Barrow - BRONZE AGE - FISH Thesaurus of Monument Types Linear Feature - UNCERTAIN - FISH Thesaurus of Monument Types
HER	Suffolk HER - NAC151

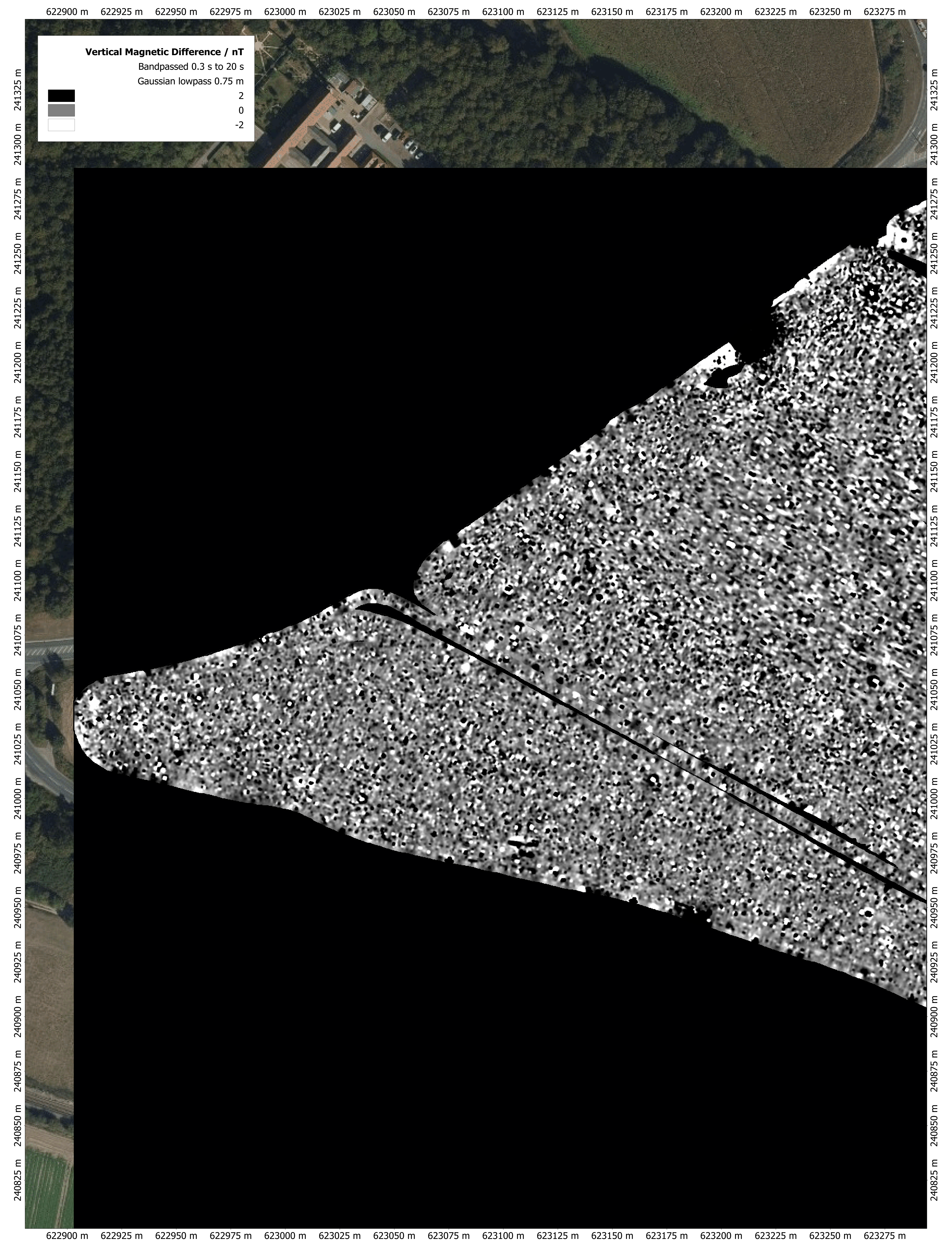
Archives	



SHS211 Seven Hills, Ipswich
DWG 01 Site Location

Orthographic Scale: 1:10000 @ A3 Spatial Units: Meter. Do not scale off this drawing

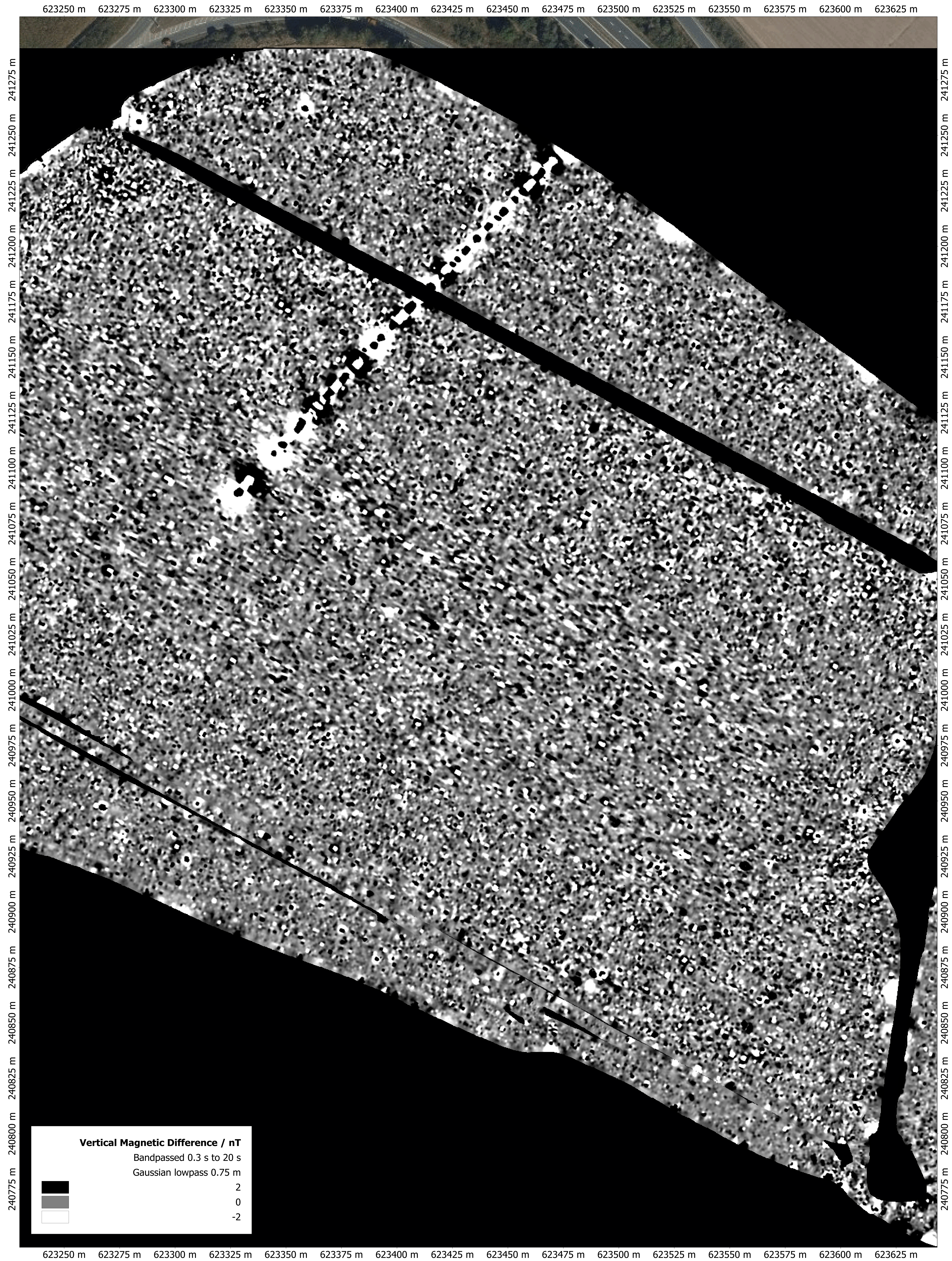
TIGERGEO



SHS211 Seven Hills, Ipswich
DWG 02a Magnetic Data - West

Orthographic Scale: 1:1500 @ A3 Spatial Units: Meter. Do not scale off this drawing
File: SHS211.map

TIGERGEO



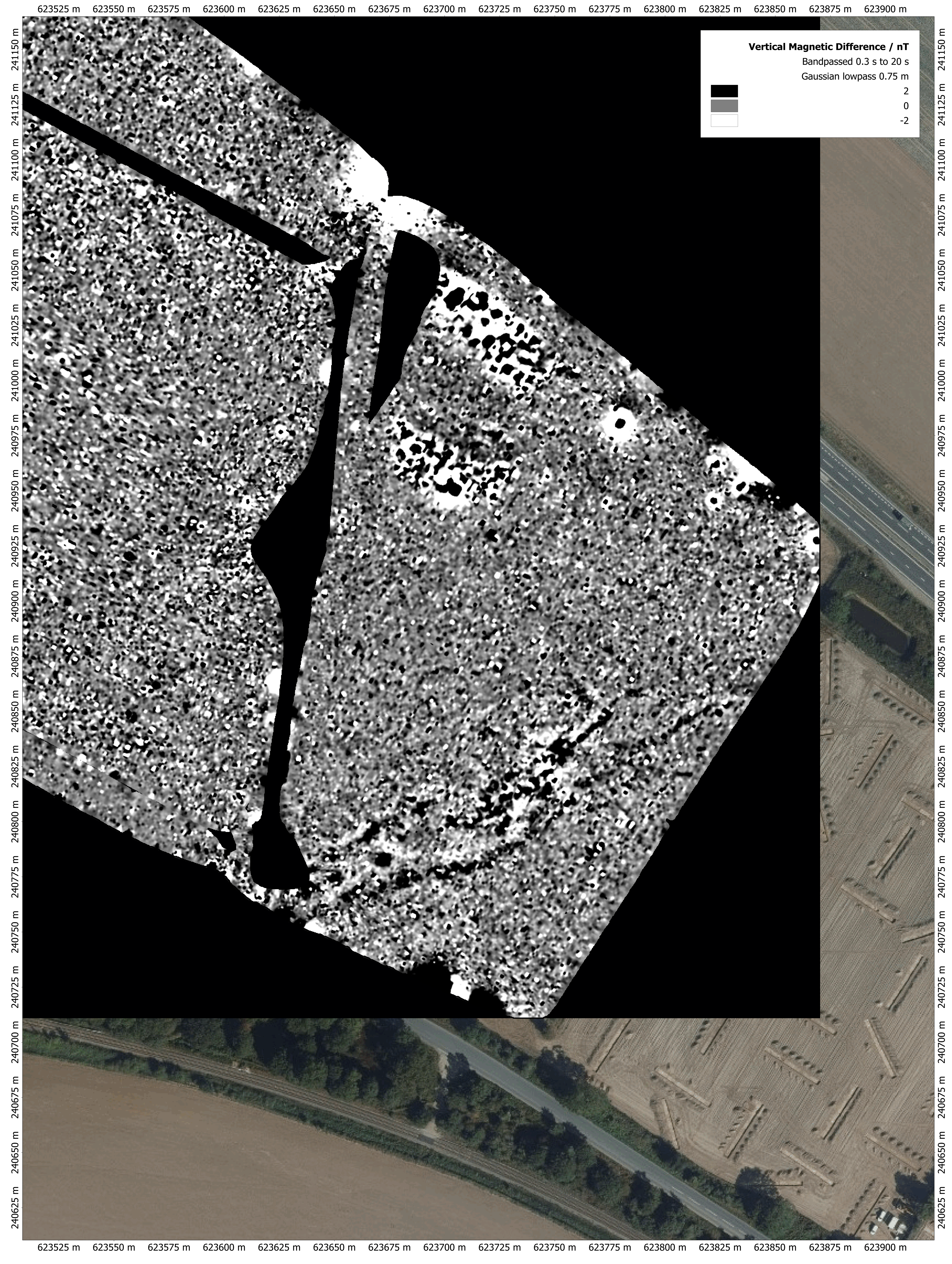
SHS211 Seven Hills, Ipswich

DWG 02b Magnetic Data - Central

Orthographic Scale: 1:1500 @ A3 Spatial Units: Meter. Do not scale off this drawing

File: SHS211.map

TIGERGEO



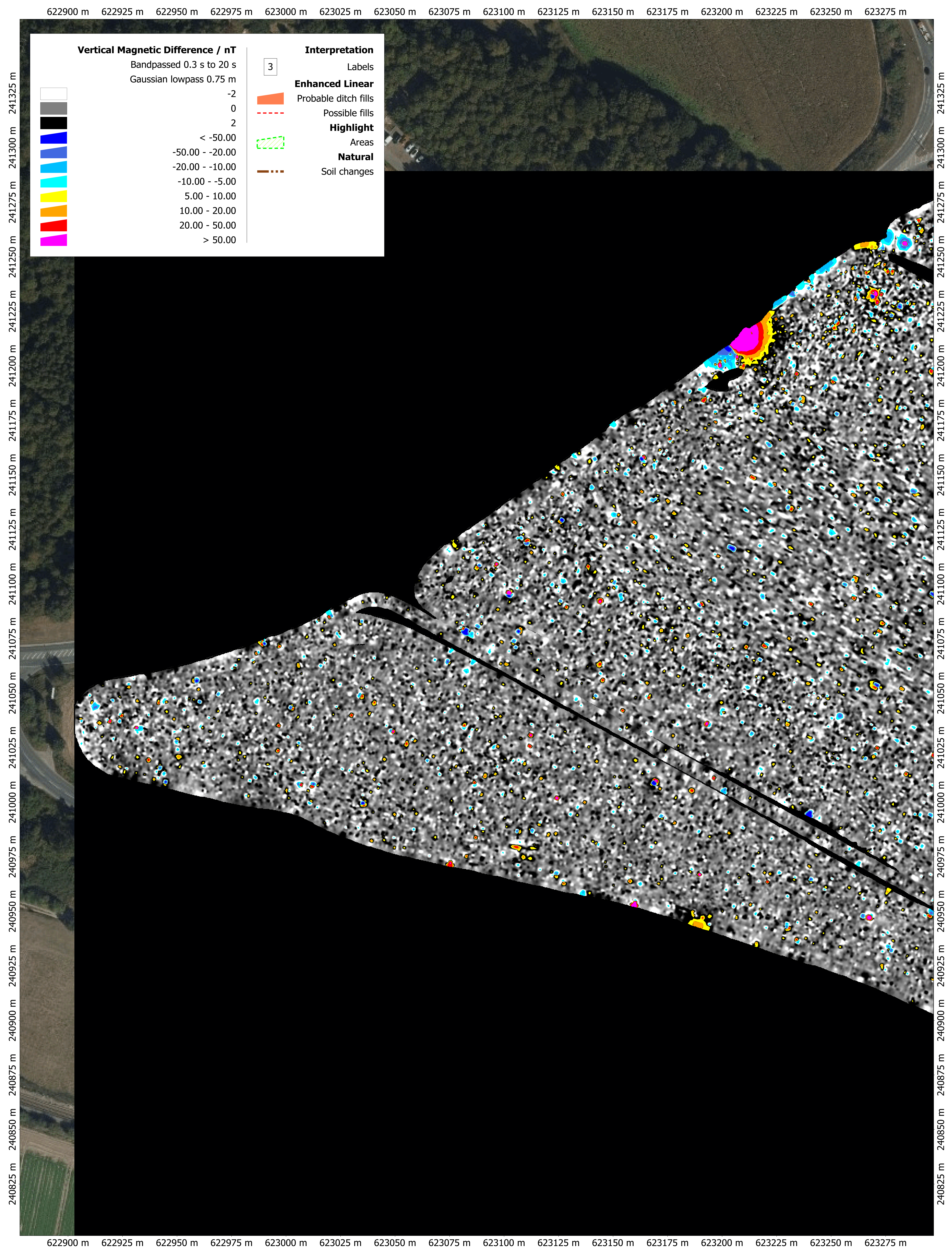
SHS211 Seven Hills, Ipswich

DWG 02c Magnetic Data - East

Orthographic Scale: 1:1500 @ A3 Spatial Units: Meter. Do not scale off this drawing

File: SHS211.map

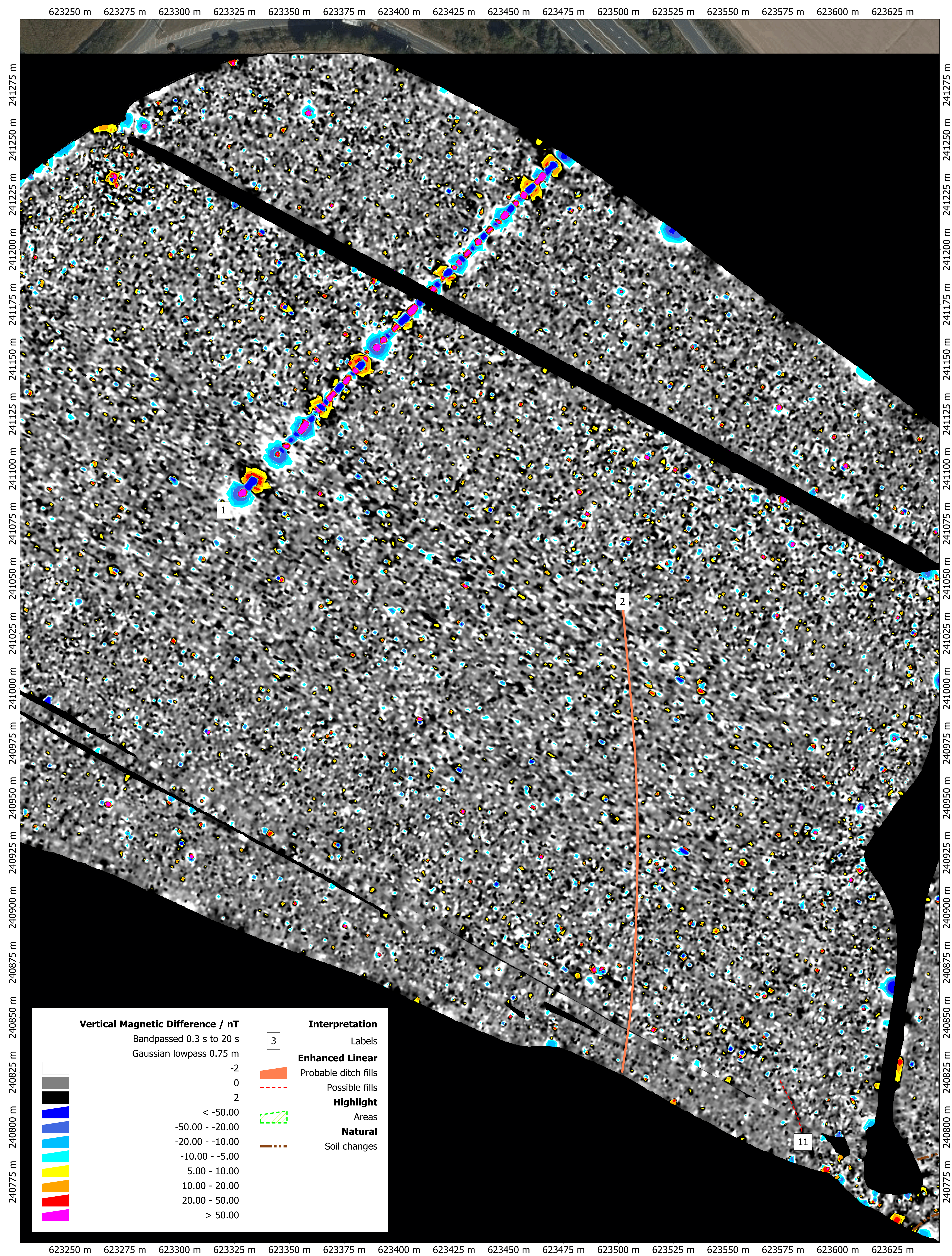
TIGERGEO



SHS211 Seven Hills, Ipswich
DWG 03a Interpretation - West

Orthographic Scale: 1:1500 @ A3 Spatial Units: Meter. Do not scale off this drawing
File: SHS211.map

TIGERGEO



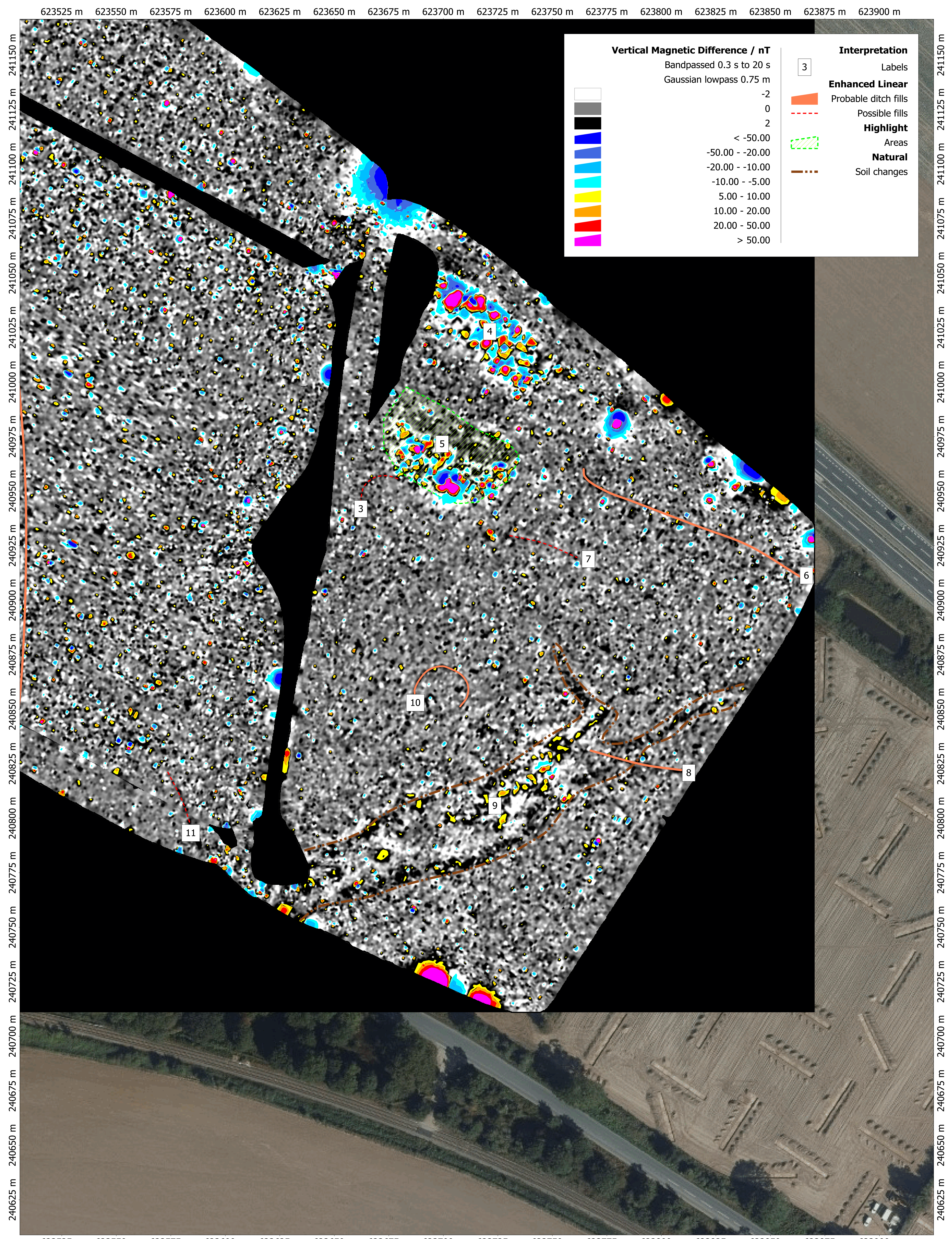
SHS211 Seven Hills, Ipswich

DWG 03b Interpretation - Central

Orthographic Scale: 1:1500 @ A3 Spatial Units: Meter. Do not scale off this drawing

File: SHS211.map

TIGERGEO



SHS211 Seven Hills, Ipswich
DWG 03c Interpretation - East

Orthographic Scale: 1:1500 @ A3 Spatial Units: Meter. Do not scale off this drawing
File: SHS211.map

TIGERGEO