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The following report was produced prior to the finalisation of the application site boundary. The final application site boundary is shown on Figure 1.1 in ES Appendix 1.1. Therefore, references within the report to the site boundary do not reflect the site area and site boundary submitted with the OPA.

The reports were correct at the time of preparation, and all information within the Environmental Statement assessment reflects the latest relevant information.



Otterpool Park, Stanford Kent

Detailed Gradiometer, Ground Penetrating
Radar and Electromagnetic Survey Report



Ref:
227401.03
September 2020



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69 College Road,
Maidstone,
Kent
ME15 6SX

www.wessexarch.co.uk

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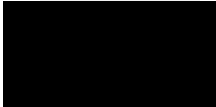
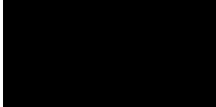

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Document Information

Document title	Otterpool Park, Folkestone & Hythe, Kent
Document subtitle	Detailed Gradiometer, Ground Penetrating Radar and Electromagnetic Survey Report
Document reference	227401.03
Client name	Arcadis LLP
Address	Level 1 2 Glass Wharf Temple Quay Bristol BS2 0FR
Site location	Otterpool Park Stanford Folkestone and Hythe
County	Kent
National grid reference	Area 1: 609662 137571 (TR 09662 37571) Area 2: 610757 137204 (TR 10757 37204) Area 3: 611507 136822 (TR 11507 36822) Area 4: 612298 136824 (TR 12298 36824) Area 5: 612064 135788 (TR 12064 35788) Area 6: 612269 137255 (TR 12269 37255) Area 7: 611784 136564 (TR 11784 36564) Area 8: 612009 137285 (TR 12009 37285)
Statutory designations	Area 6 Scheduled Monument: Westenhanger Castle (NHLE 1020761)
Planning authority	Folkestone & Hythe District Council
Planning reference	Y19/0257/FH
WA project name	Otterpool Park, Folkestone & Hythe, Kent
WA project code	227401
Date(s) of fieldwork	27/03/20 – 07/05/20
Fieldwork directed by	Patricia Voke
Project management by	Tom Richardson
Document compiled by	Patricia Voke
Contributions from	Nicholas Crabb
Graphics by	Patricia Voke

Quality Assurance

Issue and date	Status	Author	Approved by
1 29/05/2020	Draft	PV	NLC 
2 10/06/2020	Draft second submission	PV	NLC 
3 16/09/2020	Final third submission following Comments from the Client and Kent County Council	PV	TR 



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Summary

A detailed gradiometer survey, ground penetrating radar (GPR) and electromagnetic (EM) survey was conducted over land at Otterpool Park, Folkestone & Hythe, Kent. The survey covered eight areas to the south of the M20, west of the Village of Westenhanger in south-east Kent. The project was commissioned by Arcadis LLP with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features in support of a planning application for the development of 585 ha of land in the vicinity of Otterpool Park into a new garden town.

The site comprises a mixture of pasture and arable fields and was undertaken between 27/03/20 to 07/05/20. The site comprises 80 ha of detailed gradiometer survey in Areas 1 – 5 and 8, detailed gradiometer survey of up to 5.5 ha and 1 ha of GPR in Area 6, and 1.6 ha of EM in Area 7.

The detailed gradiometer survey has been successful in detecting anomalies of archaeological origin in Area 1 – 6 and 8. This includes numerous ditch-like features, some of which may form a series of land divisions and enclosures potentially associated with settlement activity at the nearby Westenhanger Castle. Those located further away are perhaps more likely associated with Romano-British settlement in the area which is likely centred around the villa and located in areas covered by previous phases of investigations undertaken as part of this scheme.

A small number of possible structural features have also been located (e.g. in Area 8 and Area 3), but the interpretation for these features is less clear. They could also be related to Romano-British occupation as limestone structures were identified at the site of a Roman villa 800 m south of Area 8 but may relate to an alternative phase of activity.

Numerous large pit-like features have been interpreted across the site, many of which most likely relate to former quarry or extraction activity (Area 5 and 8). It is not apparent, however, whether this relates Romano-British or later historic periods. However, some of these pits could be associated with more widespread quarrying activity identified in 2018 at a site 400 m west of Area 5 (Headland 2018a).

Three pylons identified in Area 3 and correspond with features visible on historic Google Earth images potentially relate to radio or communication masts possibly associated with Second World War infrastructure.

Numerous anomalies have been located across the site that relates to variations in the bedrock or superficial geological deposits. This includes possible periglacial fissures on areas underlain by the Hythe formation (Area 1) and features relating to the differential composition of both head and alluvial deposits within the vicinity of the River East Stour, as well as in the bases of valleys. It is not possible from these results alone to comment on the precise character and extent of this deposition, but some of these may contain or overlie further paleoenvironmental or archaeological remains than has been presented here.

The EM survey undertaken in Area 7 aimed to investigate whether any significant archaeological remains were located below alluvial material adjacent to the River East Stour that might be an attributable activity associated with the Romano-British Villa. Although areas of lower conductivity and higher magnetic susceptibility were detected, it is not possible to ascribe this to evidence for specific archaeological activity. Given the small scale of the survey, it is more likely that these relate to very localised variations in the underlying superficial and bedrock geology. However, it is equally difficult to define the character of the deposits in this area based on this data alone.

Lastly the GPR survey of the areas surrounding Westenhanger Castle revealed a variety of probable structural remains, some of which likely relate to more widespread 14th - 16th century activity than



has been previously noted. This includes evidence for small buildings and the remains of the internal curtain wall of the enclosed quadrangular castle. A rectangular building thought to be the original Westenhanger Parish church has also been identified west of the castle adjacent to the existing late 16th century barn. In close proximity to the possible church, foundations of a square tower or agricultural building have also been distinguished. Numerous more modern features such as pathways, roads and services have also been identified throughout the GPR survey areas.

Acknowledgements

Wessex Archaeology would like to thank Arcadis LLP for commissioning the geophysical survey. The assistance of Kate Clover is gratefully acknowledged in this regard.

The fieldwork was undertaken by Patricia Voke and Finlay Wood. Patricia Voke processed and interpreted the geophysical data. Patricia Voke wrote the report and prepared the illustrations. The geophysical work was quality controlled by Nicholas Crabb and the project was managed on behalf of Wessex Archaeology by Mark Williams.



Otterpool Park, Folkestone & Hythe, Kent

Detailed Gradiometer, Ground Penetrating Radar, and Electromagnetic Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned by Arcadis LLP to carry out gradiometer, ground penetrating radar (GPR) and electromagnetic (EM) survey at Otterpool Park, Stanford, Kent. The site comprises eight parcels of land located in the vicinity of Otterpool Park, Folkestone & Hythe, Kent, CT21 4JD (**Figure 1**). The geophysical survey areas are centred on:

- Area 1: NGR 609662 137571 – 8 ha gradiometer survey
- Area 2: NGR 610757 137204 – 2 ha gradiometer survey
- Area 3: NGR 611507 136822 – 15 ha gradiometer survey
- Area 4: NGR 612298 136824 – 40 ha gradiometer survey
- Area 5: NGR 612064 135788 – 7 ha gradiometer survey
- Area 6: NGR 612269 137255 – 5.5 ha gradiometer survey and 1 ha GPR survey
- Area 7: NGR 611784 136564 – 1.6 ha EM survey
- Area 8: NGR 612009 137285 – 8 ha gradiometer survey

1.1.2 The survey forms part of an ongoing programme of archaeological works being undertaken in support of a planning application for the development of 585 ha of land in the vicinity of Otterpool Park into a new garden town. The development will include up to 8,500 residential dwellings, and other uses including commercial, retail, education, health, community and leisure facilities, parking, landscaping and public open space.

1.1.3 A planning application (Y19/0257/FH) has been submitted to Folkestone & Hythe District Council in 2019.

1.1.4 This geophysical survey is part of staged approach in determining the archaeological potential of the site, and follows other non-intrusive archaeological work, including Cultural Heritage Desk Based Assessment (Arcadis 2016), five geophysical surveys (Headland Archaeology 2018a-b; Sumo 2018a-c; Magnitude 2018), and a geoarchaeological DBA (Oxford Archaeology 2018a). Intrusive work has also been carried out including a watching brief on ground investigations (Wessex Archaeology 2018) and trial trenching evaluation (Oxford Archaeology 2018b). An environmental impact assessment has also been undertaken for the whole development site (Arcadis 2019).

1.2 Scope of document

1.2.1 This report presents a brief description of the methodology followed by the detailed survey results and the archaeological interpretation of the geophysical data.

1.3 The site

1.3.1 The entire development site comprises 585 ha between the M20 and the B2067 Aldington Road close to the village of Lympe, Kent and is bisected by the A20 Ashford Road.

1.3.2 The geophysical surveys (Area 1 – 8) are located over land south of the M20, directly north of the village of Lympe, and 5 km west of the town of Hythe in the county of Kent.



- 1.3.3 For ease of reference, and as each survey area is discretely located, the site conditions and geology of each area will be discussed separately with the results of the geophysical survey below.

2 ARCHAEOLOGICAL BACKGROUND

2.1 Introduction

- 2.1.1 The archaeological and historical background was assessed in a prior desk-based assessment (DBA) (Arcadis 2018), which considered the recorded historic environment resource within a 1 km study area of the 709 ha proposed development. The DBA used information from the Kent Historic Environment Record (KHER) and the National Heritage List for England (NHLE). Additional sources of information are referenced, as appropriate. While not exhaustive, a summary of the findings of the DBA are summarised below.

2.2 Summary of archaeological and historical context

- 2.2.1 Cartographic analysis has shown that the site has had a long history as agricultural land with some diversification in the modern period. There are 41 listed buildings, 2 registered parks and gardens, and 7 scheduled monuments within 1 km of the site. There are also 4 military crash sites, 47 non-designated built heritage assets, and 121 non-designated archaeological assets recorded within 500 m of the site.

- 2.2.2 The key assets within the site include Bronze Age barrows, a Roman villa, and the scheduled monument of Westenhanger Castle (NHLE 1020761). This includes landscape features associated with Westenhanger Castle, such as the walled garden and deer park. Airfield defences such as Picket Hamilton fort and the Battle HQ RAF Lympne represent some of the more modern assets. These are all discussed in more detail below.

2.3 Archaeological and historical context

- 2.3.1 There is one scheduled monument, Westenhanger Castle (NHLE 1020761), in the north of the development site, in Area 6. It is situated at the edge of the floodplain of the River East Stour. The castle is bounded on its northern edge by a railway line (CTRL/HS1) and the M20. The monument is described as a 14th century fortified house with associated structures and landscaping which remain both above and below ground. It comprises both the earthwork and structural remains of the moated inner court, a 16th century barn and stable, the buried remains of the outer court, and the buried remains of the church, medieval hall, walled garden and cemetery. The site is also associated with surrounding landscape features including a deer park and water control system, and was possibly the site of two manors, Westenhanger and Ostenhanger (Easternhanger), which were reunited in the 16th century. However, there is currently little evidence of two manors, later conjoined and the difference in place names might actually indicate a single manor known under two names.
- 2.3.2 Whilst there is some potential for an earlier Saxon settlement on the site of Westenhanger Castle one of the earliest mentions of the estate is of being in royal hands in 1035. By the 14th century Westenhanger Castle – a pre-existing moated manor – was crenelated by the construction of stone walls and turrets surrounding the manor. Many modifications and refurbishments were made to the Castle in the Tudor period including by Henry VIII who took possession of the Castle in c. 1540. He either created or enlarged the deer park surrounding the castle.
- 2.3.3 A walled garden referred to in a survey of 1559 may well have been added to the Castle at this time. This is thought to have been located on the south-side of the moat in an area that was depicted as a 'Walled Orchard' on the 19th century tithe map, although this is largely

outside the scheduled area with the majority of the potential walled garden currently located under the northern arm of the Folkestone Racecourse (Arcadis 2019).

- 2.3.4 The moat encloses an area of ground around 60 m² and is 10 – 14 m wide. The feature is still water-filled on the south and south-east sides. To the north of the castle are a series of banks and ditches which delineate platforms and enclosures which fell inside the area of the deer park laid out in 1542. Westenhanger Castle deer park has been identified from historic mapping and LiDAR evidence. The deer park would have included areas of woodland, to provide good hunting, with the whole park probably enclosed by some sort of fence. As well as providing ground for the management and hunting of deer it is likely that the parts of the park may have included areas of pasture for the keeping of livestock, game bird, boar hare and pig. The deer park would have fulfilled an important role in the social life of the castle, providing royal hunting grounds, but also through the combination of pasture, park, woodland, river and ponds provided a range of foodstuffs and materials to support the functions of the household. The deer park had a symbolic value as viewed from the castle but the only remains of this now can be found to the north-east of the moat where an earthwork bank is located: this was part of the park pale (the ditch and boundary of the deer park). The deer park is made up of and contains various landscape features:
- The deer park boundary ditch identified by KHER; fieldwork and walkover surveys
 - Causeway to Westenhanger Castle
 - Tudor garden of Westenhanger Castle
 - Possible former orchard of the castle and possible other fields or orchards identified from LiDAR data
 - Trackway from the former Pound House on Stone Street to Westenhanger Castle which dates to the late Medieval or early Tudor period and may have been located by trial trenching as a cobbled track with flanking ditches
 - A group of water features identified through LiDAR, walkover and historical mapping analysis located within the former Westenhanger Castle deer park, close to or within the current racecourse. Four of these are former field boundaries and take the form of the drains within the modern landscape
- 2.3.5 The park pale which would have been the ditch and boundary that defined the extents of the deer park of the Castle are thought to have medieval or early Tudor origins and the location of the pale has been identified through the analysis of historic mapping. The area covered by the park has experienced a number of significant changes in the modern period. North of Westenhanger Castle much of the area that once formed part of the park has been impacted by the construction of the M20 and HS1. South of the Castle much of the area that once formed a proportion of the park has been impacted by Folkestone Racecourse. Despite these changes the park pale can still be detected from LiDAR. The earliest maps e.g. Robert Morden's map of 1695 depicts the pale as a fenced feature. The park was a great park, commensurate with an important country house that, for a period from c.1542 to 1585 was owned by three Tudor monarchs – Henry VIII, Mary I and Elizabeth I (Arcadis 2018).
- 2.3.6 Two 16th century barns, situated 50 m to the west of the moated area of the castle are designated as one Grade 1 Listed building (List Entry 1045888). From the 16th century onwards it seems that the barns would have been associated with the walled garden and terrace on the south side of the moat and they would have been situated in an outer court with various other ancillary buildings. A Ground-plan of Westenhanger House from 1648 (in

the British Library and reproduced in *Archaeologia Cantabrigia* 17, 1887) depicts a north-south building attached to the south side of the east – west barn. This building is now demolished and partly overlain by modern structures (Arcadis 2019). Up until the later 19th century access to the castle was from the south, via a causeway leading from Ashford Road – a medieval route, and the entrance to the castle from the west through the gatehouse. The current eastern entrance was only established following the construction of the racecourse. The southerly approach would have also given access to the building of the outer court, principally the 16th century barns.

- 2.3.7 A number of historical plans depict the structures and layout of Westenhanger Castle. A reconstruction plan of the site as during the late 16th century demonstrates a walled enclosure, trapezoidal in plan surrounded by a moat (ASE 1998). The walled enclosure contains numerous rooms and buildings with a central courtyard devoid of any buildings. At the north-east, north-west, and south-west corners the castle had round towers and, in the south-east, a square tower or bastion. It is apparent from these plans that by the 17th century a good proportion of the castle was demolished and remodelled. The present house on the site, Westenhanger Manor, was constructed from the remains of the 16th century cross-wing of the main hall in the 18th century (English Heritage 2020). A reconstruction of the Castle by Wadmore (1887) based upon British Library drawings depict a quadrangular structure with possible round towers or bastions on the north east, north west and south west corner of the castle. The south-east of the quadrangular castle in Wadmore's reconstruction depicts a square tower misaligned on a NNW – SSE angle from the main quadrangle (Peter Kendall Historic England *pers comm*). An inventory published by Harrington in the Kent Record Series (Kent Archaeological Society 2012) describes the contents of numerous rooms but does not enable identification of which room is based on historical plan or analysis of the remaining structure. However, it does help to identify that in its prime Westenhanger Castle had numerous rooms and that roughly 75 % of the house existed by the end of the 17th century have now been demolished. The ranges around the quadrangular castle appear to once have been three storeys. It is possible that there is a gallery (Rosamund's gallery) existed running along the north side of the tower but how far it extended south into the quad is unknown (Peter Kendall Historic England *pers comm*).
- 2.3.8 A historical and topographical survey was carried out by Hasted in 1797 – 1801 (Hasted, 1797 – 1801). This survey noted that the parish church of Westenhanger was situated outside the entrance to the castle, on the northern side of the approach, between the bridge and the surviving late 16th century barn. It was de-commissioned by the crown in 1542 when the parish was united with neighbouring Stanford (Martin and Martin 2017).

Palaeolithic and Mesolithic

- 2.3.9 The evaluation undertaken in Area 4 over the former racecourse in 1969 retrieved some waste and worked flints of possible Upper Palaeolithic or Mesolithic date (Oxford Archaeology 2018a).

Later Prehistoric

- 2.3.10 Within the study area 17 monuments are listed on the KHER as dating to the prehistoric period. Of these, 7 have been found within the proposed development area, and 10 within 500 m of the site. Most of these assets are find-spots which are listed as flint and pottery finds. Of the remaining assets, six indicate occupation activity within the prehistoric period, including evidence of Bronze Age occupation within the proposed development area. The seventh is a palaeo-channel close to Barrow Hill.
- 2.3.11 1.3 km to the north of the occupation site are two possible Bronze Age barrows which lie close to the East Stour River, at least one of which is marked on the first edition OS map.



Beyond this site the evidence of occupation is limited to some Bronze Age ditches to the north of Westenhanger, 50 m north of the site, which are associated with finds of Neolithic or Bronze Age worked flint and a buried soil-horizon as well as a possible ring-ditch which lies within Sandling Park, 500 m to the east of the site.

- 2.3.12 Three find spots from the Iron Age have been recorded in the proposed development area. Two Iron Age occupation sites have been recorded within the study area to the north of Westenhanger.

Romano-British

- 2.3.13 The KHER records 13 assets as dating from the Iron Age or Romano-British to early medieval period. Nine of these are find spots, two are roads, and two are occupation evidence.
- 2.3.14 Stone Street Roman Road runs north – south from Canterbury to Lympne for 16 miles (Margary 1955) and passes through the north-eastern corner of the proposed development area, through the village of Westenhanger. The route of the road then either follows the line of the boundary of the proposed development area from Newingreen down to Lympne, and the Roman fort beyond, or diverges to head for West Hythe and the Roman port of *Portus Lemanis*.

Early medieval

- 2.3.15 16 assets are listed on the KHER within the study area with 8 of these listed as being within the proposed development area.
- 2.3.16 Within the area there is one asset that is recorded as 'occupation' for the early medieval period. This is based on cropmark evidence and is thought to be an Anglo-Saxon palace within the former Folkestone Racecourse (Area 4). The cropmarks are described as six or seven 'boat-shaped' features which may represent the earliest site of Westenhanger Manor, 200 m to the north-west. However, it remains possible that it instead relates to installations and activity during World War Two.
- 2.3.17 Within the study area early medieval occupation evidence is shown through features to the north of Westenhanger Manor and two burial sites, to the south and south-east of the site. The first of these lies 465 m south-east of the site at the cross-roads of Stone Street and Aldington Road and is a possible Anglo-Saxon cemetery. The second lies 155 m to the south of the site within the land around Port Lympne Park and is recorded as a Flemish inhumation cemetery. Other assets within the study area are isolated find-spots.

Medieval

- 2.3.18 Activity in the medieval landscape is demonstrated on the KHER through six find spots, comprised of coins, a figuring, a brooch, a ring, and a pottery scatter. There are also 14 recorded HER monuments.
- 2.3.19 Seven of the HER monuments are within the proposed development area. Four of these are located within the scheduled monument at Westenhanger Manor. Two are described as the deserted medieval sites of Westenhanger and Easternhanger, however, it is noted that deserted medieval villages (DMV) are virtually unproven in Kent.



- 2.3.20 To the west of Westenhanger are cropmarks of a trackway and field system which may have been associated with the Manor. Close to the manor house at Westenhanger is the site of St Mary's Church which was demolished around AD 1701.

Post-medieval

- 2.3.21 Seven assets are recorded on the KHER within the study area, of which one lies outside the development area. Within the site, there are two find spots described as 'gold jewellery' on the KHER.
- 2.3.22 The majority of the other assets from the post-medieval period are located to the east of the development area close to Stone Street, between Westenhanger and Newingreen. At Newingreen two assets are described as the location of the former Royal Oak Motel and features found during excavations at the hotel. A ditch runs parallel to Stone Street where it passes through Westenhanger and features were discovered on either side of Stone Street during the CTRL construction work, which were assessed to have been of post-medieval date. However, during the excavations a buried soil horizon was also discovered which could have origins in the Roman or Late prehistoric period.
- 2.3.23 Assets from the post-medieval period within the study area are limited which may correlate with cartographic evidence that there has been little change in the area until the modern period.

Modern

- 2.3.24 All assets listed on the KHER within the study area are of a military nature and are probably associated with the former airfield at Lympne. There are 23 assets of this nature within the study area and only 3 of these are outside the boundary of the development area.
- 2.3.25 Lympne airfield covered the area to the north of the Aldington Road between Otterpool Lane and Stone Street with some activity to the west of Otterpool Lane and was an emergency landing ground for home defence aircraft which was established in 1916. The development of the site began with canvas hangers and wooden huts. In 1917 more sheds, workshops and offices were built close to the Aldington Road. In 2018 Headland Archaeology (headland Archaeology 2018) undertook a magnetometry survey of the former Lympne airfield. Broad areas of magnetic disturbance within the same field were identified as the remains of demolished infrastructure associated with RAF Lympne. The results of the geophysical survey were able to detect at least one rectangular structure within the centre of the survey area and a possible secondary structure in the north-west corner of the field. An extant, existing pillbox (TR13 NW140) was also noted in the north-west of the site at the time of survey.
- 2.3.26 Much of the airfield has now been replaced by an industrial estate and to the east only a small portion of the runway has survived. Additional assets which are listed at the site include an auxiliary operational unit base, a battle headquarters, two aircraft dispersal pens, a gas decontamination building, air raid shelters, Picket Hamilton fort, trenches, a former barracks hut, an over blister hanger and trackway, a machine gun testing range, a bulk fuel installation, a concrete base of unknown use, and a gun emplacement.
- 2.3.27 Four military crash sites are recorded in the KHER within the study area, and of these, two are located within the site.



- 2.3.28 The afore mentioned baseline data for the development area has been greatly increased due to the extensive fieldwork that has been carried out between 2017 – 2018. Further information on previously unknown archaeological features are documented below.

2.4 Previous investigations related to the proposed development

Geophysical survey

- 2.4.1 Several phases of detailed gradiometer survey (Headland Archaeology 2018a-b; Sumo 2018a-c; Magnitude 2018) and a geoarchaeological DBA (Oxford Archaeology 2018a) have been undertaken within the wider development site. The geophysical surveys were successful in identifying anomalies of archaeological interest as well as a large number of coherent ferrous responses. Their results are briefly summarised below.
- 2.4.2 Headland Archaeology (2018a & 2018b) undertook detailed gradiometer surveys at five locations within the proposed development area. Prehistoric archaeological features were recorded including a possible barrow and ring-ditch with possible associated field systems. East of Lympne Industrial Park an extensive complex of linear and recti-linear anomalies was detected during this phase of survey. A potential settlement site of unknown date was also identified. Possible demolished infrastructure associated with RAF Lympne and a 19th-century brick clamp was detected. Finally, a former field boundary south of Westenhanger Castle was identified and interpreted as the western pale of the deer park associated with the castle.
- 2.4.3 Approximately 200 ha of detailed gradiometer survey was undertaken over several land parcels within the development site (Sumo 2018a). Four previously recorded ring-ditch features were identified along with three previously unrecorded ring-ditches from this phase of geophysical survey. Numerous ditched enclosures, tracks, and extensive field systems associated with small settlements were identified. The settlements are interpreted as possibly Iron Age or earlier farmsteads. A possible Roman villa was identified in one of the survey areas.
- 2.4.4 A further phase of detailed gradiometer survey was carried out at the former Lympne Airfield in the south of the development area (Sumo 2018b). A number of field systems comprising enclosures and trackways in the south-west of the survey area were identified. These enclosures were interpreted as possibly Iron Age to Romano British although a medieval date could not be ruled out. Areas of magnetic disturbance and numerous ferrous anomalies were detected which correspond with the location of the former airfield.
- 2.4.5 An earth resistance survey was undertaken on land north-east of the Lympne Industrial Park (Sumo 2018c). The survey was targeting possible structural remains, however only a linear ditch-like feature was recorded, along with former quarry pits and other modern features.
- 2.4.6 A GPR survey was carried out within the proposed development site (Magnitude 2018). The GPR survey successfully detected structural remains and occupation evidence pertaining to the Romano-British period. Agricultural trends relating to modern ploughing and a number of uncertain anomalies were also detected during the GPR survey.

Desk-based Geoarchaeological Assessment of Pleistocene and Early Holocene Stratigraphy

- 2.4.7 Oxford Archaeology (2018a) undertook a desk-based geoarchaeological assessment of the Pleistocene and Holocene stratigraphy associated with the development. The assessment was intended to aid in the development of evaluation fieldwork strategies, addressing

primarily the Palaeolithic/Pleistocene potential of the site, but also considering the Holocene alluvial tract associated with the East River Stour.

2.4.8 The assessment identified a number of significant and potential sediment sequences across the site the most pertinent of these conclusions for this geophysical survey have been described here:

- The site straddles several bedrock geologies, which have given rise to highly variable sequence of superficial drift deposits comprising Pleistocene Head/brickearth and Holocene colluvium/ploughwash on the higher ground and slopes, and Late Devensian fluvial river gravels overlain by alluvium associated with the East River Stour in lower-lying locations.
- The previous geophysical surveys (Headland Archaeology 2018a-b; Sumo 2018a-c; Magnitude 2018) revealed a network of linear geological anomalies interpreted as potential bedrock fissures associated with the Hythe Beds in the western part of the site. Previous investigations on similar geologies have shown that such features can act as sediment traps, preserving important assemblages of Palaeolithic artefacts and faunal remains, as well as later archaeological remains at shallower depths.
- Buried soils and stabilisation horizons may occur within or at the base of the colluvium/ploughwash or at the base of late Devensian Head deposits, and these may be associated with *in situ* archaeological remains.
- Holocene alluvium and Late Devensian fluvial gravels are present in low-lying areas associated with the River East Sour. Although investigations for HS1 to the north of the site concluded that the sequences there were of limited paleoenvironmental potential. Waterlogged Holocene floodplains sequences are more likely to exist in the area surrounding the East Stour and have the potential to preserve remains such as (pollen, plant remain and insects). Whereas wetland edge locations, complex deposits may exist whereby colluvial and alluvial sequence interdigitate, preserving stratified *it situ* evidence of human activity (e.g. flint scatters, burnt mounds).

Archaeological Evaluation

2.4.9 An archaeological evaluation was carried out by Oxford Archaeology (2018b) which consisted of 300 trial trenches over 63 ha of the proposed development area. Evaluation of the geophysical anomalies mentioned above confirmed a number of linear and curvi-linear ditched boundaries to be archaeological in nature.

2.4.10 Features in In Field 1 contained 55 sherds of Early Neolithic pottery and a large assemblage of flint stone tools. Several late Neolithic or Early Bronze Age implements were also recovered. The geophysical survey in this area identified a circular enclosure dated as Iron Age but containing Neolithic material. Early Iron Age enclosures, ditches, and pottery were also identified. In the east of this area a series of medieval ditches were found, probably relating to Otterpool Manor.

2.4.11 Fairly large assemblages of struck flint, pertaining to the Mesolithic to Early Bronze Age were identified in Fields 2 and 3. This suggests a significant Mesolithic or Early Neolithic population due to the size of the assemblage and numerous blades recovered. A small barrow in the west of Field 2 produced Middle Bronze Age pottery. A series of enclosures were excavated in these areas dating from Middle Bronze Age to Early Roman.

2.4.12 A single polished axe of Early Neolithic date, along with an assemblage of worked flint tools dating to mainly Late Neolithic or Early Bronze Age and Early Bronze Age pottery were recorded in the north of Area 4. A sub-rectangular enclosure containing Early-Middle Iron



Age pottery was found in the west of the field. In the centre of this area a rectilinear enclosure was identified containing Middle Roman pottery and tile which may indicate a domestic feature.

- 2.4.13 A mound in the southern edge of Area 5 was identified as a Bronze Age barrow cutting a Mesolithic buried soil horizon. In the north of this area trenches targeted a possible Roman Villa identified by geophysical survey. At least one hypocaust, remains of tile pile and fragments of decorative columns were found. Coins, pottery and other finds suggest occupation of this site in the 3rd century AD.
- 2.4.14 The most significant feature in the southern part of Field 6 was a square enclosure with an external ditch and internal pit dated to the middle Bronze Age. A limited amount of late Iron Age to Roman material was recovered in the north-east of this area. A series of medieval field boundaries were discovered in the northern part of the site. Undated ditches potentially pertaining to a middle Bronze Age enclosure were identified in the centre and south of Field 6. However, they could equally relate to the afore mentioned medieval field boundaries. At the northern edge of this area a 19th century brick clamp kiln was found.
- 2.4.15 In Field 7 a possible Roman ditch was identified however there was limited Roman material culture recovered. A Tudor garden associated with Westenhanger Castle (NHLE 1020761) is known to have been present in the north-west of this area. Trenching in this area revealed a possible boundary wall relating to the garden. Brick and tile of late medieval or early post-medieval were recovered from most of the features in these trenches. Post-medieval finds and features were uncovered, possibly relating to the Folkestone Racecourse, which crossed the evaluated area of Field 7 in the 20th century.
- 2.4.16 A possible ploughed out barrow was excavated in the Field 8. However, the finds recovered from it were post-medieval. A relatively large number of worked flints dated to Mesolithic to early Neolithic were recovered in later layers.
- 2.4.17 In Field 9 a large flint assemblage was discovered dated from the Mesolithic to early Bronze Age. A previously known barrow was excavated in the south-east of the area. It was found to have a ring ditch and internal mound, separated from the inner site of the ring ditch by a berm. There was also evidence of a retaining palisade. A significant metalworking area was identified nearby. In the north-west of the area, a further possible barrow identified from LiDAR was excavated but did not reveal any anthropogenic material.
- 2.4.18 Evaluation trenches in Field 10 sampled the dense concentration of archaeological features identified from the geophysical survey in this area. In the north-west of the area a possible small barrow ditch adjacent to a prehistoric enclosure was identified. To the east numerous Roman ditches were confirmed through excavation. In between the ditches a dense scatter of pits was found to be from middle Iron-Age to Roman in date. A ring ditch in the north has been interpreted as a probably Late Iron Age round house. To the north and south of the ditches Roman enclosures were found, with at least one containing a post built Roman building. Medieval activity was also identified in this area. Three ring ditches in the south of Field 10 have been interpreted as barrows due to their dating and morphology. A henge may predate one of the barrows which has a double ditch. In the south-east of this area a single, undated cremation in a ditch was recovered along with the ring ditch of a possible Iron Age roundhouse. Numerous geophysical anomalies were evaluated throughout this area which correspond with geological features.

Watching Brief

- 2.4.19 Wessex Archaeology (2018) undertook an archaeological watching brief within the development site in order to obtain preliminary information on general ground conditions. The watching brief monitored the excavation of 19 machine excavated test pits, one hand dug test pit and four boreholes in order to monitor areas of high geoarchaeological potential. The watching brief identified deposits of Holocene colluvium overlaying Pleistocene head-brickearth across large areas of the site. Within the floodplain of the East Stour River, Holocene alluvial deposits were identified. A flint flake identified as a soft hammer flake was recovered but not chronologically diagnostic. Within a borehole located south of Westenhanger Castle, brick fragments were observed which may be associated with either the walled garden of Westenhanger Castle or related to the construction of Folkestone racecourse.

3 METHODOLOGY

3.1 Introduction

- 3.1.1 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team in two phases. The first phase was between 26 March – 24 April and covered Areas 1 – 8 with magnetometry and EM survey. The second phase was 5 – 7 May and covered Area 6 with GPR survey. Field conditions at the time of the survey were good throughout.
- 3.1.2 The methods and standards employed throughout the geophysical survey conform to that set out in the Written Scheme of Investigation (WSI) (Wessex archaeology 2020), as well as to current best practice, and guidance outlined by the Chartered Institute for Archaeologists' (CIfA 2014) and European Archaeologiae Consilium (Schmidt *et al.* 2015).

3.2 Aims and objectives

- 3.2.1 The aims of the survey comprise the following:
- To determine, as far as is reasonably possible, the nature of the detectable archaeological resource within a specified area using appropriate methods and practices; and
 - To inform either the scope and nature of any further archaeological work that may be required; or the formation of a mitigation strategy (to offset the impact of the development on the archaeological resource); or a management strategy.
- 3.2.2 In order to achieve the above aims, the objectives of the geophysical survey are:
- To conduct a geophysical survey covering as much of the specified area as possible, allowing for on-site obstructions;
 - To clarify the presence/absence of anomalies of archaeological potential; and
 - Where possible, to determine the general nature of any anomalies of archaeological potential.

3.3 Fieldwork methodology

Gradiometer survey

- 3.3.1 The cart-based gradiometer system used a Leica Captivate RTK GNSS instrument, which receives corrections from a network of reference stations operated by the Ordnance Survey (OS) and Leica Geosystems. Such instruments allow positions to be determined with a



precision of 0.02 m in real-time and therefore exceeds European Archaeologiae Consilium recommendations (Schmidt *et al.* 2015).

- 3.3.2 The detailed gradiometer survey was undertaken using four Bartington Grad-01-1000L gradiometers spaced at 1 m intervals and mounted on a non-magnetic cart. Data were collected with an effective sensitivity of 0.03 nT at a rate of 10 Hz, producing intervals of 0.15 m along transects spaced 4 m apart.

Electromagnetic survey

- 3.3.3 The EM survey was conducted using a GF Instruments CMD Explorer. This is a multi-receiver EM conductivity instruments with pairs of coils (one as transmitter and the other as a receiver) at three inter-coil separations (1.48, 2.82 and 4.49 m). This provides measurements from several depths consecutively, up to approximately 6.7 m when collected in the horizontal coplanar (HCP) formation. It has measuring ranges of 1000 mS/m for the apparent conductivity and ± 80 ppt for the magnetic susceptibility.
- 3.3.4 The EM survey works by measuring the conductivity of different subsurface materials by transmitting electrical currents into the ground with a transmitter coil and measuring the secondary induced magnetic field with a separate tuned receiver coil. Readings are simultaneously recorded for the quadrature component (apparent conductivity) and the in-phase component (magnetic susceptibility). High conductivity values can be associated with clays and silts, whilst low conductivity values are likely to relate to deposits of sands and gravels, which have higher electrical resistance. If anomalies of both high magnetic susceptibility and high conductivity are coincident, then it is likely that the feature is metallic and therefore likely to be modern or artificial in origin.
- 3.3.5 The EM data was collected in transects at 0.5 m intervals throughout Area 7 using the zig-zag method. A SBAS GPS system was used in order to facilitate continuous measurement which is precise to ± 0.3 m. The location of these areas was compared against survey data collected using a Leica RTK GNSS GPS instrument, which is precise to approximately 0.02 m, in order to ensure accurate correspondence between the datasets.

Ground Penetrating Radar survey

- 3.3.6 Individual survey grid nodes were established using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02 m and therefore exceeds European Archaeologiae Consilium recommendations (Schmidt *et al.* 2015)
- 3.3.7 The GPR survey was conducted using an Impulse CrossOver4080 System with shielded antennas. This was mounted on a rough terrain cart which is fitted with an odometer to measure horizontal distance along the ground surface. This was deployed across all of the GPR areas with data collected along traverses spaced 0.5 m apart.
- 3.3.8 Data with the 400 MHz antenna were collected every 0.03 m with an effective time window of 100 ns. Data with the 800 MHz antenna were collected every 0.03 m with an effective time window of 50 ns. This was collected in the zigzag method with the exception of a couple of lines where space restrictions required a parallel data collection method. The GPR survey was undertaken in accordance with European Archaeologiae Consilium recommendations (Schmidt *et al.* 2015).

3.4 Data processing

Gradiometer survey

- 3.4.1 Data from the survey were subjected to minimal correction processes. These comprise a 'Destripe' function (± 5 nT thresholds), applied to correct for any variation between the sensors, and an interpolation used to grid the data and discard overlaps where transects have been collected too close together.



3.4.2 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix 1**.

Electromagnetic Induction survey

3.4.3 The EM point data was gridded using Terrasurveyor software in order to produce 2D depth slices of conductivity (mS/m) and magnetic susceptibility (ppt) across the area at varying depths. This was undertaken for each nominal depth using Terrasurveyor software for the quadrature component (apparent conductivity), and in-phase component (magnetic susceptibility).

3.4.4 Data from the EM survey was subject to minimal data correction processes. This comprised a zero-median traverse function (± 2 SD threshold) applied to correct for any variation between the different transect calibrations.

3.4.5 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix 2**.

Ground Penetrating Radar (GPR) survey

3.4.6 Data from the survey were subjected to common radar signal correction processes. These comprise amplitude and wobble correction of the radar profile to correct for variance in temperature and soil moisture content, background and bandpass filtering to remove noise in the data from the surrounding area, and XYZ mean line to correct for mosaic effects from variance in the day-to-day conditions during the survey. These steps were applied to all datasets collected across the Scheme.

3.4.7 The approximate depth conversion for the 400 MHz antenna is shown in **Table 1** below and the 800 MHz antenna is shown in **Table 2**. These have been calculated on the assumption that the GPR pulse through the ground is 0.119 m/ns for the 400 MHz antenna and 0.119 m/ns for the 800 MHz antenna. It is possible to determine more precisely the average velocity of the GPR pulse through the ground is excavated features at a known depth can be identified in the data. Radargrams were analysed for suitable hyperbolic reflections, which can be used to determine the velocity of the GPR pulse through the subsurface deposits.

3.4.8 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix 3**.

Table 1 Relative velocity to depth conversion based on a dielectric constant of 6.36 for the 400 MHz antenna

Time Slice	Time (ns)	Depth (cm)
1	0–2.34	0–0.1
2	2.34–4.68	0.1–0.19
3	4.48–7.02	0.19–0.29
4	7.02–9.36	0.29–0.39
5	9.36–11.7	0.39–0.49
6	11.69–14.04	0.49–0.58
7	14.03–16.38	0.58–0.68
8	16.37–18.72	0.68–0.78
9	18.71–21.05	0.78–0.88
10	21.05–23.39	0.88–0.97
11	23.39–25.73	0.97–1.07
12	25.73–28.07	1.07–1.17
13	28.07–30.41	1.17–1.27



14	30.41-32.75	1.27-1.36
15	32.74-35.09	1.36-1.46
16	35.08-37.43	1.46-1.56
17	37.42-39.77	1.56-1.66
18	39.76-42.1	1.66-1.75
19	42.1-44.44	1.75-1.85
20	44.44-46.78	1.85-1.95

Table 2 Relative velocity to depth conversion based on a dielectric constant of 6.36 for the 800 MHz antenna

Time Slice	Time (ns)	Depth (cm)
1	0.-1.17	0.-0.05
2	1.16-2.33	0.05-0.1
3	2.32-3.5	0.1-0.15
4	3.49-4.66	0.14-0.19
5	4.65-5.82	0.19-0.24
6	5.81-6.98	0.24-0.29
7	6.97-8.14	0.29-0.34
8	8.13-9.31	0.34-0.39
9	9.3-10.47	0.39-0.43
10	10.46-11.63	0.43-0.48
11	11.62-12.79	0.48-0.53
12	12.78-13.96	0.53-0.58
13	13.95-15.12	0.58-0.63
14	15.11-16.28	0.63-0.68
15	16.27-17.44	0.68-0.72
16	17.43-18.6	0.72-0.77
17	18.59-19.77	0.77-0.82
18	19.76-20.93	0.82-0.87
19	20.92-22.09	0.87-0.92
20	22.08-23.25	0.92-0.96
21	23.24-24.41	0.96-1.01
22	24.4-25.58	1.01-1.06
23	25.57-26.74	1.06-1.11
24	26.73-27.9	1.11-1.16
25	27.89-29.06	1.16-1.21

4 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION

4.1 Introduction

4.1.1 The detailed gradiometer survey has identified magnetic anomalies across the site, along with a large number of ferrous anomalies. Results are presented as a series of greyscale plots, and archaeological interpretations for the gradiometer data at a scale of 1:2000 (**Figures 2 – 23**). The data are displayed at -2 nT (white) to +3 nT (black) for the greyscale image.

4.1.2 Results for the EM data are presented as a series of divergent colourscale plots, and interpretations at a scale of 1:1500 (**Figures 24 – 26**). The EM data are displayed at -3



mS/m (blue) to +5 mS/m (red) for the divergent colourscale apparent conductivity images. The magnetic susceptibility images are displayed at -2 ppt (blue) to +1 ppt (red) for the divergent colourscale plots.

- 4.1.3 Results for the GPR data for each area are presented as a series of greyscale timeslices and archaeological interpretations at a scale of 1:600 for Area A and B (**Figures 27 – 28**); 1:650 for Area C (**Figures 29 – 30**) and 1:1000 for Area D (**Figures 31 – 32**). The greyscale plots display black representing high amplitude responses and white relating to low amplitude responses. For ease of interpretation an overall plan has been produced, incorporating information from the entire dataset 1:800 (**Figure 33**).
- 4.1.4 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous responses, burnt or fired objects, and magnetic trends (**Figure 3,5,7,9,11,13,15,17,19, 21,23, 24 – 26 and 28, 30, 32 and 33**). Full definitions of the interpretation terms used in this report are provided in **Appendix 4**.
- 4.1.5 Numerous ferrous anomalies are visible throughout the dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.
- 4.1.6 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be present than have been identified through geophysical survey.
- 4.1.7 Geophysical survey may not detect all services present on site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.

4.2 Area 1 (Figure 2 and 3)

- 4.2.1 The survey area comprises 8 ha of arable land. The site is bisected by Harringe Lane and bound by agricultural land on all sides. Survey conditions at the time of survey consisted of recently cut oilseed rape and an overall coverage of 8 ha was achieved in this area.
- 4.2.2 The survey area is on a slight incline sloping from 59 m above Ordnance Datum (aOD) at the northern edge to 56 m aOD at the southern edge.
- 4.2.3 The solid geology underlying the area comprises mudstone of the Weald Clay Formation in the north and of the Atherfield Clay Formation in the south. There is also a small outcrop of Sandstone and Limestone of the Hythe formation close to the northern edge of the area. No superficial geological deposits recorded for this area (BGS 2020), but it has been suggested that there are superficial deposits of alluvium are located in the centre of the site (Oxford Archaeology 2018).
- 4.2.4 The soils underlying the site are likely to consist of typical stagnogley soils of the 711e (Wickham 1) association (SSEW SE Sheet 6 1983).

Gradiometer survey results and interpretation

- 4.2.5 The geophysical survey has identified several features that may be associated with archaeological remains. These are predominantly located in the north of Area 1 and are thought to relate to linear and curvilinear possible ditch features.
- 4.2.6 In the north of Area 1, there are a series of irregular linear anomalies that have been identified at **4000** and **4001**. These are all represented by weakly positive magnetic values and may be associated with possible ditch features. They are predominantly aligned on an

east – west orientation and have an average width of 1.5 – 3 m. Whilst these anomalies may be archaeological in origin, they are parallel to the River East Stour which bounds the survey area to the north, and they could, therefore, be associated with geomorphological features. It is also possible that they are associated with fissures in the underlying bedrock that have been widely recorded in former gradiometer surveys on slopes of the Hythe formation nearby (Oxford Archaeology 2018a). As such, further investigation would be required to understand the precise origin of these anomalies.

- 4.2.7 Numerous discrete positive anomalies have been detected throughout Area 1 and measure between 1 – 3 m in diameter. These are interpreted as possible archaeology and may be evidence of pit-like features indicating activity such as extraction or refuse pits. However, it is equally likely that these anomalies are natural in origin, pertaining to localised variations in the underlying bedrock.
- 4.2.8 In the north of the area, at **4002**, a linear dipolar anomaly has been identified. It is 88 m long by 3 wide and is aligned north – south. Directly east of this at **4003** a weakly positive anomaly has been identified, measuring 63 m long and 3 m wide on an east – west alignment. Additionally, a dipolar, linear anomaly has been identified in the south-east of the site at **4004**. It is aligned on an NNW – SSE orientation and extends from a drainage ditch noted at the time of survey. This anomaly is 92 m long and 5 m wide. All of these anomalies correspond to the location of former field boundaries identified on First Edition 1888 OS maps.
- 4.2.9 Several irregularly shaped strongly positive and negative anomalies have been identified in the north-east and central portion of this area at **4005**. They are sinuous in form and most likely reflect superficial geological deposits possibly associated with the alluvial deposits of the River East Stour which is located directly north of the site. The variation in the magnetic response is most likely associated with the variable composition of these deposits, which most likely comprise fine-grained silts and clays as well as bands of more coarse sands and gravels. This also corresponds with an area of alluvium highlighted by previous geoarchaeological investigations (Oxford Archaeology 2018a).
- 4.2.10 Numerous parallel positive and negative linear anomalies have been identified throughout Area 1. They are evenly spaced with 15 – 20 m between each anomaly. The majority of these anomalies are orientated east – west however there are several orientated north – south and NNE – SSW. It is probable that these relate to an extensive water management system and represent drains. The clearest example of these is at **4006** where the drain is aligned in the direction of the existing drainage ditch in the centre of the survey area.
- 4.2.11 To the north-west of **4006**, there is a notable area comprising randomly distributed weakly positive and negative magnetic anomalies. This increased magnetic response is most likely associated with variation in the underlying bedrock geology but could be associated with some small scale archaeological activity. However, as this is very poorly defined it is considered most likely that this is natural in origin.
- 4.2.12 The only other anomalies of note in this area relate to modern features. In the centre of the site at **4007** are a series of evenly spaced weakly negative linear anomalies. They are spaced 5 m apart and correspond with the current ploughing regime noted at the time of survey. In the south-east of the survey area at **4008** is a large circular strongly positive magnetic anomaly, this corresponds with the location of an electric pylon.

4.3 Area 2 (Figures 4 and 5)

- 4.3.1 Area 2 comprises 2 ha of arable land subdivided by a small field. The site is bound by residential housing adjacent to Barrow Hill (A20) to the east and agricultural land on all other sides. Survey conditions at the time of survey consisted of arable crop (wheat) and an overall coverage of 2.1 ha was achieved in this area.



- 4.3.2 The survey area is on a slight incline sloping from 69 m aOD at the northern edge to 79 m aOD at the southern edge.
- 4.3.3 The solid geology underlying the area comprises sandstone and limestone of the Hythe Formation in the north and mudstone of the Atherfield Clay Formation in the south with overlying superficial Head deposits of clay and silt (BGS 2020).
- 4.3.4 The soils underlying the site are likely to consist of typical argillic gley soils of the 841e (Park Gate) association (SSEW SE Sheet 6 1983).

Gradiometer survey results and interpretation

- 4.3.5 Two linear anomalies have been identified in the centre of this area at **4009**. They are characterised as weakly positive anomalies. The larger of these anomalies is located to the east, measuring 22 m long on an NNW – SSE alignment and 1.5 m wide. Directly west is a further anomaly, aligned east – west, measuring 11 m long and 1.5 m wide. Both of these anomalies are likely to relate to ditch-cut features of unknown origin.
- 4.3.6 Numerous discrete positive anomalies have been detected throughout Area 2 and measure between 1 – 2 m in diameter. These are interpreted as possible archaeology and may be evidence of pit-like features indicating activity such as extraction or refuse pits. However, it is equally likely that these anomalies are natural in origin, pertaining to localised variations in the magnetic susceptibility of the underlying Head deposits.
- 4.3.7 In the centre of the area there is a dipolar linear anomaly at **4010**. This is aligned east – west, measuring 70 m long and 4 m wide. It is probable that this relates to a former fence line as it corresponds with a field boundary on First Edition 1888 OS maps.
- 4.3.8 The only other anomalies of note in this area relate to modern features. Throughout this survey area at **4011** are a series of evenly spaced weakly negative linear anomalies. They are spaced 5 m apart and correspond with the current ploughing regime noted at the time of survey. Forming the eastern boundary of Area 2 is a concentration of dipolar anomalies which reflect the adjacent housing bounding the site to the east.

4.4 Area 3 (Figures 6 – 9)

- 4.4.1 Area 3 comprises 15 ha of arable land. The site is bound by residential buildings, a lorry park, and Ashford Road (A20) to the south, with agricultural land on all other sides. The course of the River East Stour traverses the northern boundary of the area and intersects the centre of the site on a south-easterly trajectory. Survey conditions at the time of survey consisted of arable crop (wheat) and an overall coverage of 15.9 ha was achieved in this area.
- 4.4.2 The survey area is on a slight incline sloping from 67 m aOD at the northern edge to 72 m aOD at the southern edge. In the centre of the area, there is a slight depression associated with the course of the River East Stour.
- 4.4.3 The solid geology underlying the area comprises sandstone, siltstone, and mudstone of the Sandgate Formation in the centre and east, with sandstone and limestone of the Hythe Formation in the north and west. There are no superficial geological deposits recorded for this area (BGS 2020).
- 4.4.4 The soils underlying the site are likely to consist of typical argillic brown earths of the 571c (Malling) association (SSEW SE Sheet 6 1983).

Gradiometer survey results and interpretation

- 4.4.5 In the eastern part of Area 3, at **4012 – 4014**, several weak anomalies are interpreted as possible archaeological remains. These consist of two linear, negative anomalies at **4012** and **4013** which are aligned NNW – SSE (61 m x 1.8 m) and NNE – SSW (66 m x 1.8 m) respectively, forming an L-shape. To the north are further, weakly negative linear anomalies at **4014**. The clearest of these forms a rectilinear shape measuring 10 m x 10 m, on an NNE – SSW orientation with a gap measuring 7 m wide at the north-east end. Directly east of this are a number of incoherent, weakly negative anomalies. Due to the form of these features and apparent lack of magnetic enhancement it is possible that these anomalies represent either stone-built walls or bank features. The Romano-British villa located 250 m south of Area 2 was investigated through evaluative trenching and comprised stone buildings and limestone wall foundations as well as numerous occupation evidence of a potentially high-status settlement (Oxford Archaeology 2018b). Therefore, the features identified at **4012 – 4014** may be associated with the further Romano-British structural remains.
- 4.4.6 Numerous discrete positive anomalies have been detected throughout Area 3 and measure between 1 – 3 m in diameter. The clearest example of these are located in the north-east of the area at **4015**. These are interpreted as possible archaeology and may be evidence of pit-like features. However, it is also possible that these anomalies are natural in origin, pertaining to localised variations in the underlying bedrock.
- 4.4.7 In the west of the survey area several weakly positive, linear anomalies have been identified at **4016 – 4017**. The largest of these (**4016**) is aligned north – south measuring 177 m long and 4 m wide. At the northern end the visibility of this is impeded by the presence of a band of probable superficial geological deposits for 18 m, but it likely continues at **4017**, diverging into parallel anomalies measuring between 43 – 45 m each. It is probable that these features relate to ditch-like features of unknown origin. They may relate to former land divisions associated with a wider field system surrounding the Romano-British settlement activity to the south-west of the site (Oxford Archaeology 2018b). However, this is speculative and further investigation would be required to confirm this.
- 4.4.8 A further weakly positive linear anomaly has been identified in the south-west of Area 3 at **4018**. They are both aligned NNW – SSE with the larger of the two anomalies measuring 90 m by 2.5 m. Directly south is a smaller linear measuring 15 m by 2.5 m. This may relate to a ditch-like feature, but its weak nature and poor definition make it difficult to provide a more specific interpretation.
- 4.4.9 In the north of the site, aligned on an east – west alignment, a positive curving, linear anomaly has been identified at **4019**. It measures 140 m in length and 2.5 m wide. It follows the alignment of a negative response at the edge of a band of probable superficial deposits, most likely associated with the River East Stour (**4022**). There is no notable topographic variation aside from a gradual decline towards the river, but it may demarcate an area of fine-grained alluvial deposition. The weakly negative response may suggest the presence of more coarse material such as sand or gravel at the edge of this. The positive response at **4019** could relate to further variation within this, but perhaps more likely relates to a ditch-like feature at the edge of these probable valley deposits.
- 4.4.10 A strongly positive curving linear anomaly has been detected in the north-east of Area 3 at **4020**. It measures 21 m and is orientated north – south, turning to the east in the southern extent where it continues for a further 12 m. It is 5 m wide and there are two smaller sub-circular positive anomalies measuring 1 – 3 m in diameter adjacent to its eastern side. These anomalies may represent ditch and pit-like features and, as they are located close to the River East Stour, they may be associated with management of the river or drainage.



- 4.4.11 A broad, weakly positive and negative anomaly has been identified in the west of this area (**4021**) on and NNW – SSE alignment. It measures 138 m long by 8 m wide and corresponds with a former field boundary identified on First Edition 1888 OS maps.
- 4.4.12 A sinuous band of positive and negative anomalies has been identified in the north of the area at **4022**. It is broadly aligned NNW – SSE but extends on a south – west alignment at the southern end. This is likely associated with the aforementioned alluvial material deposited by the nearby River East Stour and could indicate variations in sands, gravel, and clay deposits.
- 4.4.13 A series of evenly spaced, linear positive anomalies have been detected throughout the survey area, aligned in a 'herringbone' arrangement at approximately 45 and 90 degrees from each other. The clearest example of these is in the centre of the site at **4023** with anomalies aligned on an NNE – SSW and NNW – SSE alignment, orientated in the direction of a tributary of the River East Stour which subdivides the survey area. This collection of anomalies relates to a series of ceramic field drains.
- 4.4.14 The only other anomalies of note in this area are weakly positive, parallel anomalies (**4024**) in the centre of the area which relate to the direction of current ploughing regimes noted at the time of the survey. In addition, in the south-east of the site are three distinct dipolar anomalies, measuring 13 m in diameter and are aligned in an east – west alignment (**4025**). These correspond with the location of three electric pylons visible on historical Google Earth images from 1940. These pylons may be related to possible wartime radio or communication masts with similar examples identified from wartime aerial photographs of RAF Lympne which is situated one kilometre south of Area 3. It is possible that these anomalies related to a dispersed site associated with the nearby airfield but would require further investigation to confirm.

4.5 Area 4 (Figures 10 – 17)

- 4.5.1 Area 4 comprises 40 ha of land covering the former Folkestone racecourse as well as agricultural land to the south, which is currently utilised for a mixture of arable and pasture. The site is bound by residential buildings to the east and Ashford Road (A20) to the south, with further agricultural land to the north and west. Survey conditions at the time of survey consisted of arable crop (wheat) in the centre and south of the site, with rough pasture in the area of the former racetrack and in the south-east of the site. An overall coverage of 36.8 ha was achieved in this area, with minor reductions due to drainage ditches, overgrown vegetation, and an existing industrial building in the south-east corner of the site.
- 4.5.2 The survey area is on a slight incline sloping from 73 m aOD at the northern edge to 80 m aOD at the southern edge.
- 4.5.3 The solid geology underlying the area comprises sandstone, siltstone and mudstone of the Sandgate Formation. However, superficial deposits consist of Head (clay and silt) have been widely recorded in the centre and east of the area (BGS 2020; Oxford Archaeology 2018a).
- 4.5.4 The soils underlying the site are likely to consist of typical argillic gley soils of the 841e (Park Gate) association (SSEW SE Sheet 6 1983).

Gradiometer survey results and interpretation

- 4.5.5 A sinuous, curving linear anomaly has been detected in the south of the area at **4026**. It is characterised as weakly positive response, forming an L-shape, orientated north-south – east-west. At the south-eastern corner the anomaly curves towards the north. It covers a 61 m by 66 m area and is between 2.5 – 3 m wide. It is most likely a ditch-like feature and

may represent a small enclosure. Directly north-west of this are three further positive linear and curvi-linear anomalies at **4027**. They are predominantly aligned NNE – SSW aligned and measure between 16 – 30 m long and 1.5 m wide. These also indicate ditch features and may be associated with the possible enclosure at **4026**. These features could relate to wider settlement patterns and land divisions associated with the continued occupation at Westenhanger Castle (NHLE 1020761), which is situated 750 m to the north. However further investigation would be required to confirm this as an earlier origin cannot be ruled out.

- 4.5.6 Further examples of possible land divisions and ditch-like features have been detected in the centre of Area 4 at **4028** and **4029**. At **4028** an east – west aligned, positive linear anomaly, measuring 61 m has been identified. At the eastern end of is this a further positive linear anomaly that is perpendicular to this on a north – south alignment. This is 46 m long and possibly continues to the south of a gravel track, which subdivides the survey areas for a further 41 m. Both of these anomalies at **4028** measure 2.5 m wide. To the north-east are two further curving ditch-cut features at **4029**. They are broadly aligned north – south and measure 25 m and 55 m in length by 2 m wide, respectively. Whilst it is likely these are ditches it is unclear from the geophysical results alone whether they represent former land divisions as they lack coherent form.
- 4.5.7 Two further linear anomalies have been identified in the south-east of the area at **4030** and the north of the site at **4031**. The positive anomaly at **4030** measures 16 m x 1 m on an east – west alignment. The curvi-linear anomaly at **4031** measures 10 m in diameter and 1 m wide. These may both be associated with activity at Westenhanger Castle (NHLE 1020761), but due to their isolated nature, it is difficult to assign a precise interpretation. Moreover, the circular form of the anomaly at **4031**, could relate to the partial remains of a ring-ditch feature, but this is not clear from these results alone.
- 4.5.8 A positive and negative linear anomaly has been identified in the south-east corner of Area 4 at **4032**. It measures 98 m long on an east – west orientation and is 4.5 m wide. Directly west of this, at **4033**, is a broad, dipolar linear anomaly which is aligned NNE – SSW. This measures 235 m long and 10 m wide. These both correspond with a former field boundary and drainage ditch evident on Second Edition 1937-61 OS maps.
- 4.5.9 A number of dipolar linear anomalies have been detected in the south-east and south of the area at **4034 – 4040**. They are all 20 – 30 m long by 2 m wide and indicate former steeplechase jumps relating to the former Folkestone racecourse.
- 4.5.10 Several broad, sinuous positive and negative magnetic anomalies have been detected in the south-east and centre of the site at **4041 – 4043**. These anomalies indicate superficial deposits related to the underlying Head deposits, likely comprising variations of silt, sand, and gravel. The example in the south-eastern corner (**4041**) has a more coherent linear form and is aligned NNW – SSE, covering a distance of 105 m and could indicate a possible dry-river or colluvial deposits, due to its defined shape and location within a notable valley in the LiDAR data.
- 4.5.11 Numerous, closely spaced positive and negative linear anomalies have been identified throughout the survey area with the clearest examples of these at **4044** and **4045** in the south-east and south-west of Area 4. It is more than likely that these anomalies relate to water management and indicate an extensive network of drains. Evidence of former ploughing has also been detected in the south of the site, aligned in the direction of the former racetrack at **4046**. These anomalies consist of weakly positive, linear anomalies evenly spaced at 5 m apart on an east – west alignment.
- 4.5.12 In the north of the site at **4047 – 4048** a series of interconnecting, dipolar linear anomalies have been revealed. They most likely indicate numerous, modern services associated with

the disused racecourse buildings directly to the north. A further, curving linear dipolar anomaly (**4049**) is aligned east – west and corresponds with a former road visible on Google Earth images from 1960. There are dense concentrations of dipolar anomalies throughout Area 4 and these anomalies likely indicate modern ferrous material associated with the previous use as a racecourse.

- 4.5.13 In the south-east corner of the area there is an area of increased magnetic response at **4050**. This most likely relates to magnetically enhanced material associated with the construction of the adjacent industrial building to the east.

4.6 Area 5 (Figures 18 and 19)

- 4.6.1 Area 5 is located 400 m south of Area 4 and comprises 7 ha of agricultural land currently utilised for pasture. The site is bounded by residential buildings at the village of Lympe and agricultural land to the north, west, and east. Survey conditions at the time of survey consisted of pasture and an overall coverage of 7 ha was achieved in this area. It was not possible to survey small portions of the site to the north due to waterlogged ground.
- 4.6.2 The survey area is on a slight incline sloping from 76 m aOD at the northern edge to 90 m aOD at the southern edge, towards the course of the River East Stour.
- 4.6.3 The solid geology comprises sandstone and limestone of the Hythe Formation with overlying superficial geological deposits of Head (clay and silt) in the north of the site, aligned on a north-west to south-east axis (BGS 2020). There may also be a small amount of alluvium located adjacent to the river (Oxford Archaeology 2018a)
- 4.6.4 The soils underlying the site are likely to consist of typical argillic brown earths of the 571c (Malling) association (SSEW SE Sheet 6 1983).

Gradiometer survey results and interpretation

- 4.6.5 In the centre of the site two well-defined, strongly positive anomalies have been detected at **4051** and **4052**. Both measure 6 m in diameter. These anomalies likely represent extraction or quarry pits. These anomalies are similar in dimensions to a number of quarry pits identified during a geophysical survey in 2018 (Headland Archaeology 2018), 300 m to the west of the site. The geophysical survey of 2018 identified a probable Roman settlement site, with a field system, trackways and small-scale quarrying. Therefore, these pits may be further evidence of wider occupation activity from this settlement.
- 4.6.6 A number of amorphous anomalies have been identified at **4053** – **4055** in the centre and north-east of the site. They are characterised by a weakly positive response and likely indicate areas of superficial material, most likely relating to variable Head deposits. However, those located closer to the river (e.g. close to **4056**) may relate to alluvial deposition.
- 4.6.7 The only other anomalies of interest in this area have been detected in the north. These consist of a series of strongly positive parallel anomalies aligned NNW – SSE and NNE – SSW at **4056**. These are indicative of land drains, laid out in a herringbone fashion.
- 4.6.8 In the north-east corner of the site several strong dipolar, linear anomalies have been detected at **4057** – **4058** and are surrounded by an area of dipolar anomalies. They are aligned approximately north – south and east – west and are indicative of services.

4.7 Area 6 Gradiometer Survey (Figures 20 and 21)

- 4.7.1 Area 6 comprises 5.5 ha of agricultural land currently utilised for pasture and gardens lying almost entirely within the scheduled area of Westenhanger Castle (NHLE 1020761). The Folkestone to Ashford railway line bounds the area to the north, with a former racecourse

to the south, and agricultural land to the west and east. Conditions at the time of survey consisted of rough pasture and maintained grassed areas. An overall coverage of 4.8 ha was achieved. It was not possible to survey small portions of the site to the north due to buildings, vehicles, overgrown vegetation, and waterways.

- 4.7.2 The survey area is on a slight incline sloping from 71 m aOD at the northern edge to 74 m aOD at the southern edge.
- 4.7.3 The solid geology underlying the area comprises sandstone of the Folkestone Formation in the north with a band of sandstone, siltstone and mudstone of the Sandgate Formation in the south aligned on a NNE – SSW axis. In the north of the site the overlying superficial geological deposits consist of Head (clay and silt). In the south of the site there is a band of Alluvium aligned on a NNE – SSW axis (BGS 2020).
- 4.7.4 The soils underlying the site are likely to consist of typical argillic gley soils of the 841e (Park Gate) association (SSEW SE Sheet 6 1983).

Gradiometer survey results and interpretation

- 4.7.5 The detailed gradiometer survey has been successful in detecting a small number of anomalies of possible archaeological origin. These have mainly been identified in the north-west of the area and are likely associated with the monument at Westenhanger Castle (NHLE 1020761). For example, at **4059** a positive rectilinear anomaly has been detected in the north-west of the area. It is aligned north – south, measuring 19 m in length, before turning to an east – west alignment for a further 22 m. It is 2.5 m wide and relates to a ditch-like feature of unclear function.
- 4.7.6 A broad, dipolar linear anomaly has been identified in the north-west of the site at **4060**. It is orientated on an NNW – SSW alignment, measuring 122 m long. At the northern end it curves slightly west and continues for a further 20 m, on a north – south alignment. The feature corresponds with a former footpath as noted on First Edition 1888 OS maps. This anomaly is magnetically enhanced suggesting there is a lot of ferrous material present in this area. This may indicate the feature is a drain, as the anomaly leads towards the River East Stour at its southern end.
- 4.7.7 Several linear, strongly positive and dipolar anomalies have been identified in the north-west of the site at **4061 – 4063**. They are aligned NNW – SSW and north – south with all anomalies orientated towards the River East Stour, which flows directly north of the castle. These anomalies indicate land drains.
- 4.7.8 A broad, irregular-shaped area has been identified in the east of the area at **4064**, which comprises several poorly defined positive and negative responses. These straddle the East River Stour and are likely associated with the variable composition of alluvial material.
- 4.7.9 The only other anomalies of note are dipolar, linear anomalies located in the south-west and south-east of the area at **4065** and **4066**. These anomalies are both aligned, broadly east – west and likely relate to services. To the north of the service at **4065** a linear alignment of increased magnetic response has been detected at **4066**. It is unclear from the geophysical results alone, but this may also relate to a service. The only other anomalies are concentrations of dipolar anomalies that probably relate to ferrous or burnt material. Some of this may relate to buildings and infrastructure surrounding Westenhanger Castle, but this is not well-defined by this particular geophysical technique.

4.8 Area 6 GPR Survey (Figures 27 - 33)

- 4.8.1 The GPR survey was undertaken by Wessex Archaeology's in house team between 5 – 7 May 2020. Field conditions at the time of survey were good throughout with sunny weather.

Four survey areas were completed, and an overall coverage of 0.6 ha was achieved. The ground cover consisted of short grass and gravel in Area A and B, hard standing in Area C, and long grass in Area D. Parts of Area A remained unsurveyed due to a marquee and lawn furniture, while part of Area C remained unsurveyed due to numerous obstructions.

- 4.8.2 The 400 MHz used in this survey has the potential of detecting features to a depth of 2.1 m in optimal conditions, however the total depth varies on depending on the specific conditions of each area.
- 4.8.3 For ease of interpretation, the most representative timeslices have been selected for presentation with the interpretation image detailed the salient results from each relevant slice of 0.11 m thickness.
- 4.8.4 The results of Area A – D are presented and interpreted separately. The results for each area are presented as a series of greyscale timeslices and archaeological interpretations at a scale of 1:600 for Area A and B (**Figures 27 – 28**); 1:650 for Area C (**Figures 29 – 30**) and 1:1000 for Area D (**Figures 31 – 32**). The greyscale plots display black representing high amplitude responses and white relating to low amplitude responses.
- 4.8.5 All features are described in terms of their geophysical character. It is important to stipulate that all the depths referred to in this report are approximate levels below the current ground surface. The interpretation of the GPR data highlights the presence of potential archaeological features, possible archaeological features and high amplitude responses (**Figures 28, 30, 32, 33**).
- 4.8.6 It should be noted that small features and waterlogged features may produce responses that are below the detection threshold of the GPR antenna. Excessive disturbance can also impede the ability of geophysical techniques to detected archaeology. It may therefore be the case that more archaeological features are present that have been identified through the geophysical survey.

GPR survey results and interpretation

Area A – Results and Interpretation

- 4.8.7 The survey has identified a complex of rectilinear anomalies in the north of the central quad within the existing walls of Westenhanger Castle at **5000**. This comprises discrete and complex responses that are present in Timeslices 9 – 20 (0.78 – 1.95 m deep). Whilst these are shown as individual anomalies in (**Figures 26 and 27**), for ease of interpretation an overall plan has been produced, incorporating information from the entire dataset (**Figure 33**).
- 4.8.8 A range of square and rectilinear anomalies have been identified at **A**. These are formed of discrete responses and are indicative of wall features. It appears that they form one building, subdivided into four rooms by internal walls. The building covers an area of 12 m north – east and 11 m east – west. The four possible rooms measure 4 x 4 m with the internal walls being 0.75 m wide. The outer walls of the building are 1 m wide. In the south-east corner of the south-east room, a square shaped anomaly has been identified at **B**. This is 2.2 x 2.2 m and present in Timeslices 9 – 20 (0.78 0 1.95 m deep) and appears to have less compacted material at the centre of the anomaly. It is not clear exactly to what this anomaly relates, although the discrete response likely indicates a structural feature within the room. Potential interpretations could be an oven, fireplace or even staircase. A number of discrete irregular anomalies have been identified at **C** in the centre of the building. These are 1 – 3 m in diameter and visible in Timeslices 13 – 15 (1.17 – 1.46 m). It is not clear from GPR results alone what these indicate, although it is likely they relate to archaeological features, such as better preserved sections of wall.



- 4.8.9 To the south-east of the building at **A**, a linear anomaly has been identified at **D**. The anomaly is present in Timeslices 9 – 20 (0.78 – 1.95 m deep). It measures 16 m on an east – west axis and 0.8 m wide. It is indicative of a wall feature and appears to be contiguous with the southern wall of the building at **A**. At the eastern end of this, the wall appears to turn to the south extending for a further 4 m. However, these anomalies are not as well defined, suggesting they are less well preserved. The anomaly also continues to the north but is only present on Timeslices 17 – 20 (1.56 – 1.95 m). It is 14 m long by 1.3 m wide and relates to wall remains. An area of high amplitude anomalies is visible directly east of this section of wall adjacent to the existing Westenhanger Manor. It is not clear from the GPR results alone to what these anomalies relate to. However, they may indicate further archaeological remains associated with the structure at **D** or the construction of Westenhanger Manor.
- 4.8.10 Further linear anomalies (**E** and **F**) have been detected to the north and south of the building at **A**. They are present in Timeslices 13 – 18 (1.17 – 1.75). They are positioned in the centre of the northern and southern walls of the building. Both extend for 5 m on a north – south axis and are 1 m wide. The discrete responses forming these anomalies are indicative of walls and may reflect a continuation of the main building. To the west of the main building a further linear anomaly formed of discrete responses has been identified at **G** and is similarly aligned to the walls located at **E** and **F**. It is present in Timeslices 11 – 16 (0.97 – 1.96). It measures 8.6 m north – south with a 3.5 m gap and then continues for a further 3 m. The anomalies are 1.5 m wide and most likely remains of walls. The full extent of these anomalies has not been identified and likely continue to the north beyond the edge of the surveyed area.
- 4.8.11 A number of less clear, linear anomalies have been identified south and north of the building at **H** – **K**. They are present in Timeslices 9 – 15 (0.79 – 1.46 m). Anomaly **H** is located south-west of the structure at **A**. It measures 9 m on a NNE – SSW axis, where it continues in the north for a further 8 m on a north – south alignment. Several north – south aligned linear anomalies (**J**) have been identified to the south, projecting from the southern wall of the building at **A**. They likely are a continuation of the building as they share a similar alignment but are more diffuse in plan. They measure between 3 – 5 m long. Directly south and north of wall **D** are a number of linear anomalies (**I** – **K**). They are aligned east – west and north – south but are not well defined. All of these anomalies may indicate walls. They are similarly aligned and whilst appear disjointed from the structure they could relate to less well preserved structural remains. However due to their lack of clarity this interpretation is tentative.
- 4.8.12 The walls and building at **5000** do not correspond with any features on the late 16th century reconstruction plan (ASE 1998). However, they do correspond with the approximate location of the site of a service building and raised gallery. However, these are recorded as size unknown. It is possible that the wall at **D** is a continuation of the northern, internal wall of the quadrangular enclosure and may be associated with the wall at **5001**. Although this would require further investigation to confirm.
- 4.8.1 In the south-east of Area, A, a complex of linear anomalies has been identified at **5001**. They are visible in Timeslices 3 – 20 (0.19 – 1.95 m). They are primarily formed of a linear anomaly (**L**) aligned north – south extending from the southern boundary of the existing Westenhanger Manor. The anomaly is 14 m long, with a central gap of 2.5 m where it continues for a further 13 m to the south. At the southern end the anomaly abruptly turns west at a right angle for a further 9 m. It likely continues beyond the edge of the surveyed area. A rectilinear anomaly (**M**) measuring 6 m x 3 m has also been identified at this point. This linear alignment of anomalies relates to structural remains and most likely indicates walls with internal room divisions. At the centre of the anomaly (where the gap is visible), parallel linear anomalies (**N**) have been identified, projecting eastward for 8 m. These are

indications of further walls indicating a building or room measuring 9 x 6 m. It is feasible that the structures identified at **5001 L - N** correspond with the south-east corner of the inner walled enclosure as depicted on the reconstruction plan of the site during the late 16th century (ASE 1998). The parallel walls at **N** likely indicates the room noted on the reconstruction plan as the parlour (chapel over) with anomaly **M** part of the chamber next to the parlour.

- 4.8.2 A rectilinear anomaly has been located in the centre of Area B at **5002**. It measures 6 m x 4 m on an east – west orientation and is present on Timeslices 3 – 7 (0.19 – 0.68 m). Directly south of this is a further linear anomaly present in Timeslices 8 – 10 (0.34 – 0.48 m). It measures 5 m on an east – west orientation and 1.1 m wide. These anomalies are located in what was the northern gatehouse. The reconstruction plan of the site as during the late 16th century (ASE 1998) depicts that this gatehouse was part of the western side of the enclosed quadrangular castle, subdivided into several rooms with internal division on an east – west alignment. It is therefore likely that these anomalies at **5002** are the remains of walls that formed these internal divisions with some interpretative plans of Westenhanger Castle suggesting the room immediately north of the entrance passage was the porter's lodge.
- 4.8.3 In the north-west corner of Area A, a curving, linear anomaly has been identified at **5003**. It is present on Timeslices 2 – 6 (0.1 – 0.58 m) and measures 15 m on an east – west axis. At the eastern end of the anomaly it curves towards the north-east for a further 7 m. Overall the anomaly measures 0.7 m wide. This has been interpreted as a possible wall due to its shape and the near-surface response. However, it equally could relate to a drain as it does not correspond with any features noted on historical plans of the site.
- 4.8.4 The only other features identified are thought to be modern in provenance. In the east of Area A, a linear, high amplitude anomaly has been identified at **5004**. It is present in Timeslices 2 – 10 (0.1 – 0.97 m). It is aligned on a north – south axis and corresponds with the location of an existing gravel pathway noted at the time of survey. A further linear anomaly has been detected in the south of Area B at **5005** present on Timeslices 1 – 3 (0 – 0.29 m). It is orientated on an east – west axis and also corresponds with the location of an existing gravel pathway. In the centre of Area, A, a low amplitude linear anomaly has been detected at **5006**. It is present on Timeslices 2 – 6 (0.1 – 0.58 m) and is orientated on a NNW – SSW axis. Towards its northern end it curves towards the south to continue in an east – west alignment towards the north of Westenhanger Manor. This anomaly indicates a modern service. A broadly circular area of high amplitude has been identified in the south-east of this area at **5007** present on Timeslices 7 – 20 (0.58 – 1.95 m) It measures 11 m in diameter and its location corresponds with a semi-circular stone footing surrounding a tree noted at the time of survey.

Area C – Results and Interpretation

- 4.8.5 The survey has identified two distinct rectilinear anomalies in the centre of this area in the courtyard directly east of the 16th century barn. These anomalies comprise linear and rectilinear anomalies that are present in Timeslices 5 – 20 (0.39 - 1.95 m deep). Whilst these are shown as individual anomalies in (**Figures 29 – 30**), for ease of interpretation an overall plan has been produced, incorporating information from the entire dataset (**Figure 33**).
- 4.8.6 A rectilinear anomaly has been identified in the centre of this area at **5008**. It is present in Timeslices 5 – 17 (0.39 – 1.66 m). The anomaly covers an area of 14.5 m x 9.7 m and is predominately aligned on a NNE – SSW. Overall, the anomalies measure 1.2 m wide. The anomaly likely extends to the east beyond the edge of the surveyed area. These discrete responses are indicative of wall features relating to the remains of a rectangular structure. At the centre of this structure are a number of irregular anomalies of higher amplitude

present on Timeslices 5 – 8 (0.39 – 0.78 m). They are 1 – 3 m in diameter and have been interpreted as archaeology due to their location in the centre of the structure. However, the results are not clear enough to discern a more accurate interpretation. Given the location, dimensions, and east – west orientation of these anomalies, it is likely they relate to the remains of the parish church of Westenhanger.

- 4.8.7 Directly north of this is a square anomaly at **5009**. It is visible on Timeslices 5 – 20 (0.39 – 1.95 m). It comprises a series of discrete responses forming a square shaped anomaly covering an area of 8 m x 8 m in a north – south / east – west alignment. At the centre are four linear anomalies measuring 1.7 m which appear to form radial partitions on a orthogonal alignment. The linear anomalies measure 1.3 m wide throughout the feature. These are indicative of wall features, indicating the remains of a structure; however, there are no records of a building in this location. Possible interpretations for this structure could be the base of a square tower with the internal radial partitions functioning as buttressing for the stability of the tower. Plans of the earlier moated manor enclosure depicts four towers built into the curtain wall, with the south-east tower square in shape (Martin and Martin 2017). However, this structure is not attached to the main enclosed castle. Another interpretation could be of an agricultural or service building due to its proximity of the late 16th century barn which is directly west of it. Parallel, linear anomalies have been identified directly south of the structure in Timeslices 2 – 7 (0.1 – 0.68 m). They project south from the structure at **5009**, measuring 4 m long and 0.5 m wide. They have been interpreted as possible walls likely associated with the square building. However, their function is not clear from the geophysical results alone.
- 4.8.8 A broad, diffuse, linear anomaly has been identified at **5010** in the centre of this area. It is broadly aligned east – west and is visible in Timeslices 2 – 20 (0.1 – 1.95 m). It measures 22 m in length and 2.7 m wide. This has been interpreted as a possible pathway due to its broad nature and alignment to the inner curtain wall of the enclosed quadrangular castle identified in Area A. However, it could equally be the remains of a former stable block which was present in this area. Three rectangular stables are visible on aerial photographs from 1965 (Google Earth 2020) with the most northerly of these corresponding with the location of the feature at **5010**. Further evaluation would be required to confirm this.
- 4.8.9 A broad, irregular area of high amplitude is visible at **5011** adjacent to the eastern edge of the late 16th century barn. It is visible in Timeslices 2 – 20 (0.1 – 1.95 m). It is aligned almost north – south measuring 26 m x 8 m. It is difficult to discern any features however at Timeslices 5 (0.58 – 0.68 m) it is possible to identify a discrete, narrow linear anomaly defining the eastern and southern boundary of this area. This area of complex responses indicates demolition material or a compacted surface with the linear anomaly being the remains of a possible wall. Further areas of high amplitude are detected throughout this area from Timeslices 5 – 20 (0.39 – 1.95 m) which may indicate further buried building material.

Area D – Results and Interpretation

- 4.8.10 The survey has identified two irregular shaped anomalies interpreted as possible archaeological features in the centre of this area. These anomalies comprise discrete responses (**5012 – 5013**) that are present in Timeslices 7 – 9 (0.58 – 0.88 m deep). Whilst these are shown as individual anomalies in (**Figures 31 – 32**), for ease of interpretation an overall plan has been produced, incorporating information from the entire dataset (**Figure 33**).
- 4.8.11 In the centre of Area D at **5012** an irregular shaped anomaly is present in Timeslices 7 – 9 (0.58 – 0.88 m deep). It measures 5 m on a north – south alignment but varies in width between 0.5 – 1.5 m. Directly north-west of this a further irregular shaped anomaly has been identified at **5013** present in the same Timeslices. This anomaly is more defined and is

aligned NNW – SSE measuring an area of 3 m x 2 m. Both of these anomalies have been interpreted as possible archaeology due to their shape in plan. However, it is not possible to determine a more coherent explanation for these features. The location of feature (**5012**) broadly corresponds with some possible temporary buildings as seen on 1962 Google Earth imagery. However, the image is unclear, and it is difficult to draw further conclusions from this.

- 4.8.12 A linear anomaly formed of discrete responses has been identified towards the north of the area at **5014** and is present on Timeslices 3 – 20 (0.19 – 1.95 m deep). It measures 37 m on a NNE – SSW alignment curving slightly to the north-west at the northern end. The feature corresponds with a former footpath as noted on First Edition 1888 OS maps. This feature continues to the north-east and was identified by the gradiometer survey at **4060** (**Figure 21**).
- 4.8.13 The only other features of note in this area relate to more recent activity in the area. Two possible east – west aligned trackways have been detected at **5015** and **5016** in the north and centre of the area. They are both characterised discrete responses forming parallel, curving anomalies with **5015** present on Timeslices 2 – 20 (0.19 – 1.95 m deep) and **5016** present on Timeslices 6 – 10 (0.49 – 0.97 m deep). In the centre of the site at **5017** a low amplitude, linear anomaly aligned NNW – SSE has been detected. This is present on Timeslices 4 – 8 (0.19 – 0.78 m). A similar low amplitude anomaly has been detected north of this at **5018**, present in Timeslices 3 – 5 (0.19 – 0.49 m deep). These anomalies indicate modern services. In the south of the site at **5019** a broad, sinuous anomaly has been identified in Timeslices 3 – 20 (0.19 – 1.95 m deep). This feature corresponds with the existing road noted at the time of survey. At **5020** a circular area of high amplitude has been detected in the south of Area D. The location of this feature corresponds with a tree and is likely natural.

4.9 Area 7 (Figures 24 – 26)

- 4.9.1 Area 7 comprises 1.6 ha of arable agricultural land bisected centrally by a hedgerow of trees aligned on a north – south axis. The site is bound by Ashford Road (A20) to the north with agricultural land on all other sides. This area was chosen for EM survey due to the discovery of a Roman villa during a previous phase of gradiometer survey (SUMO 2018a) directly west of the site. Evaluative trenching of the villa (Oxford 2018a) identified good levels of preservation with numerous structures and remains of the hypocaust surviving at a depth below the threshold of the magnetometers. It is hoped, therefore, that an EM survey may identify any significant archaeological remains located below any alluvial deposits.
- 4.9.2 An overall coverage of 1.5 ha was achieved across the site. It was not possible to survey the centre of the site due to an existing north – south aligned field boundary that was heavily overgrown at the time of survey.
- 4.9.3 The survey area is relatively flat with a slight incline sloping from 71 m aOD at the northern edge to 74 m aOD at the southern edge.
- 4.9.4 The solid geology underlying the area comprises sandstone and limestone of the Hythe Formation in the east with no superficial geological deposits recorded. The solid geology in the centre of the area consists of sandstone, siltstone and mudstone of the Sandgate Formation with overlying superficial geological deposits of Alluvium (clay, silt, sand, and gravel). The solid geology in the east consists of sandstone, siltstone and mudstone of the Sandgate Formation with overlying superficial geological deposits of Head (clay and silt) as well as probable alluvial deposition closer to the river (BGS 2020).



- 4.9.5 The soils underlying the north of the site are likely to consist of typical argillic brown earths of the 571c (Malling) association. The soils underlying the south of the site are likely to consist of Typical Argillic Gley soils of the 841e (Park Gate) association (SSEW SE Sheet 6 1983).

Electromagnetic survey results and interpretation

- 4.9.6 The EM survey has highlighted areas of high/low apparent conductivity and magnetic susceptibility and the majority of this is attributable to variation in superficial geological deposits. However, the dataset does not contain any clearly identifiable areas relating to archaeological features. In general, the magnetic susceptibility values are very low with little variation, which may suggest that there is limited archaeological activity at the depths recorded by this survey.
- 4.9.7 For the first coil separation (approximately 2.2 m depth), there are several areas of high conductivity in the north-east and north-west (**4067** and **4068**). These are persistent throughout the subsequent depth-slices (approximately 4.2 and 6.7 m below the ground surface). These may be associated with areas characterised by siltier or more clayey material, most likely associated with alluvial deposition by the River East Stour or perhaps colluvial hillwash towards deposited in the lower lying area at the river's edge. However, it is not possible to discern the precise nature of this deposition from this data alone.
- 4.9.8 The anomaly at **4068** corresponds with a slightly increased magnetic susceptibility in the at 6.7 m deep. It is possible that this probable siltier/more clayey deposit contains isolated archaeological material, but the response is considered too weak to be associated with burnt or fired archaeological features.
- 4.9.9 There are several broader areas of low conductivity that have been detected in the north and south of Area 7 at **4069** – **4072**. These are also persistent throughout all of the depth-slices but are better resolved in the 2.82 and 4.49 m coil separation images. It is probable that these are associated with areas composed of more electrically resistant material such as gravels or bedrock (Hythe Formation) geology. This is also consistent with the magnetic susceptibility data where slightly lower values are recorded.
- 4.9.10 The only other anomalies of interest are modern. Two areas of high conductivity and high magnetic susceptibility have been located in the north at **4073** and **4074**. These correspond with the adjacent A20 road and may indicate construction material. In addition, a further area of high conductivity and high magnetic susceptibility has been detected at the east of the site at **4075**, which corresponds with a house in this area. Directly west of this at **4076** a manhole cover is identifiable as a high magnetic susceptibility anomaly.

4.10 Area 8 (Figures 22 and 23)

- 4.10.1 Area 8 comprises 8 ha of agricultural land currently utilised for arable crop and located directly west of the scheduled area of Westenhanger Castle (NHLE 1020761). The Folkestone to Ashford railway line bounds the area to the north, with a former racecourse to the south-east, and agricultural land to the west and south. Conditions at the time of survey consisted of rough immature wheat crop. An overall coverage of 7.9 ha was achieved. It was not possible to survey small portions to the north due to overgrown vegetation. This survey is an addition to the western side of the field which was previously surveyed by handheld gradiometer (SUMO 2018a).
- 4.10.2 The survey area is on a slight incline sloping from 71 m aOD at the northern edge to 74 m aOD at the southern edge.



4.10.3 The solid geology underlying the area comprises siltstone and mudstone of the Sandgate Formation in the south of the site superficial geological deposits consist of Head (clay and silt). In small area the north-east of the site the solid geology comprises sandstone of the Folkestone Formation overlying superficial geological deposits consist of Head (clay and silt), (BGS 2020).

4.10.4 The soils underlying the site are likely to consist of typical argillic gley soils of the 841e (Park Gate) association (SSEW SE Sheet 6 1983).

Gradiometer survey results and interpretation

4.10.5 At **4077** a series of interconnecting linear anomalies have been identified in an orthogonal arrangement broadly aligned on a NNE – SSW orientation. These anomalies cover an area of 82 m x 42 m and each linear anomaly is 2.5 m wide. Some of these appear to continue south-west into the area previously surveyed (Sumo Services 2018). They are characterised by a weak negative response that may relate to structural remains, most likely associated with stone walls. At the centre of this group of anomalies is a positive, irregular shaped anomaly (**4078**) measuring 5 m in diameter. This is likely a pit-like feature and its size and form may indicate an extraction pit. However, it may have a more specific function relating to the structure at **4077**. The proximity to the Early Medieval settlement at Westenhanger Castle directly east of the site suggests that it is associated with this period. However, the recti-linear form may also indicate Romano-British origin and it is also located 800 m north of the Roman villa site (SUMO 2018a; Oxford Archaeology 2018b).

4.10.6 Parallel, weakly positive anomalies have been detected in the north-east of Area 8 at **4079**. These are fragmentary but are broadly aligned NNW – SSE measuring 165 m long with a gap of 18 m between them. There are some smaller linear anomalies aligned NNE – SSW to the east and west of the main alignment. These likely signify ditch or drainage features. At the centre and south of these ditches are two discrete, strongly positive anomalies (**4080** – **4081**) measuring 6 – 8 m in diameter. These may relate to large pit-like features associated with extraction or the nearby Westenhanger Castle.

4.10.7 To the west at **4082** are several weakly, positive linear anomalies. At **4082** there is an L-shaped anomaly broadly aligned NNW – SSE and NNE – SSW, measuring 38 m long and 1 m wide but is fragmented at the centre by a dipolar anomaly. At the northern and southern end are two further linear anomalies aligned NNW – SSE (36 m long) and NNE – SSW (17 m long) respectively. They both measure 1.5 m wide and are thought to relate to ditch or drainage features possibly associated with those at **4079** – **4081**.

4.10.8 At **4083** is a weakly positive rectilinear anomaly. It measures 13 m x 13 m and is 2 m wide. The northern end of this anomaly is fragmented with a further linear anomaly measuring 8 m long and 1.5 m wide. This may relate to a small ditched enclosure due to its shape, but the weak and limited scale of the anomaly makes it difficult to provide a more detailed interpretation.

4.10.9 A weakly, negative circular anomaly has been identified in the south of the area at **4084** and measures 20 m in diameter. Due to the lack of magnetic enhancement this anomaly may be made of either stone or a bank of material. This anomaly has been interpreted as possible archaeology due to its discernible anthropogenic form. Circular features of this size could relate to a prehistoric feature such as a barrow or henge, but it is too poorly defined within this survey to state this with any certainty.

4.10.10 In the north-east corner of the site, a weakly positive and dipolar linear anomaly has been identified at **4085**. It is broadly aligned NNW – SSE and measures 87 m in length. This anomaly corresponds with a former field boundary and footpath visible on First Edition 1892 OS maps.



- 4.10.11 Three, irregularly shaped anomalies (**4086 – 4088**) have been identified in the north-east of the area. They are characterized as weakly positive and negative anomalies and likely denote natural variations in the underlying superficial Head deposits.
- 4.10.12 The only other anomalies of note in this area are two, weakly positive linear anomalies in the south at **4089**. They are orientated on a north-west to south-east axis and indicate drains. Strong dipolar anomalies on the northern edge of Area 8 correspond with the adjacent railway line which bounds the area.

5 DISCUSSION

- 5.1.1 The detailed gradiometer survey has been successful in detecting anomalies of archaeological origin in Areas 1 – 6 and 8. This includes numerous ditch-like features, some of which may form a series of land divisions and enclosures potentially associated with settlement activity at the nearby Westenhanger Castle. Those located further away are perhaps more likely associated with Romano-British settlement in the area, which is likely centred around the villa and located in areas covered by previous phases of investigations undertaken as part of this scheme.
- 5.1.2 A small number of possible structural features have also been located (e.g. in Area 8 and Area 3), but the interpretation for these features is less clear. They could be related to Romano-British occupation as limestone structures were identified at the site of a Roman villa 800 m south of Area 8, but may relate to an alternative phase of activity.
- 5.1.3 Numerous large pit-like features have been interpreted across the site, many of which likely relate to former quarry or extraction activity (Area 5 and 8). It is not apparent, however, whether this relates Romano-British or later periods. However, some of these pits could be associated with more widespread quarrying activity identified in 2018 at a site 400 m west of Area 5 (Headland 2018a).
- 5.1.4 Numerous anomalies have been located across the site that relate to variations in the bedrock or superficial geological deposits. This includes possible periglacial fissures on areas underlain by the Hythe formation (Area 1) and features relating to the differential composition of both Head and alluvial deposits within the vicinity of the River East Stour, as well as in the bases of valleys. It is not possible from these results alone to comment on the precise character and extent of this deposition, but some of these may contain or overlie further paleoenvironmental or archaeological remains than has been presented here.
- 5.1.5 The EM survey undertaken in Area 7 aimed to investigate whether any significant archaeological remains were located below alluvial material adjacent to the River East Stour that might be an attributable activity associated with the Romano-British Villa. Although areas of lower conductivity and higher magnetic susceptibility were detected, it is not possible to ascribe this to evidence for archaeological activity. Given the small scale of the survey, it is more likely that these relate to localised variations in the underlying superficial and bedrock geology. However, it is equally difficult to define the character of the deposits in this area based on this data alone.
- 5.1.6 More modern features such as former field boundaries, drainage, ploughing and services have been identified in Area 1 – 6 and 8. Three pylons visible on historic Google Earth images potentially relate to radio or communication masts possibly associated with Second World War infrastructure have been identified in Area 3. Former footpaths and roads have been located in Area 6 and 8 and the location of footings for former steeplechase jumps have been identified in the south-east of Area 4.
- 5.1.7 Lastly the GPR survey of the areas surrounding Westenhanger Castle revealed a variety of probable structural remains, some of which likely relate to more widespread 14th – 16th century activity than has been previously noted. This includes evidence for small buildings



and the remains of the internal curtain wall of the enclosed quadrangular castle. A rectangular building thought to be the original Westenhanger Parish church has also been identified west of the castle adjacent to the existing late 16th century barn. In close proximity to the possible church, foundations of a square tower or agricultural building have also been distinguished. Numerous modern features such as pathways, roads and services have also been identified throughout the GPR survey areas.



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APPENDICES

Appendix 1: Gradiometer Survey Equipment and Data Processing

The magnetic data for this project were acquired using a Bartington 601-2 dual magnetic gradiometer system. This instrument has two sensor assemblies fixed horizontally 1 m apart allowing two traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 1 m separation and measures the difference between the vertical components of the total magnetic field within each sensor array. This arrangement of magnetometers suppresses any diurnal or low frequency effects.

The gradiometers have an effective resolution of 0.03 nT over a ± 100 nT range, and measurements from each sensor are logged at intervals of 0.25 m. All data are stored on an integrated data logger for subsequent post-processing and analysis.

Wessex Archaeology undertakes two types of magnetic surveys: scanning and detail. Both types depend upon the establishment of an accurate 20 m or 30 m site grid, which is achieved using a Leica Viva RTK GNSS instrument and then extended using tapes. The Leica Viva system receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems, allowing positions to be determined with a precision of 0.02 m in real-time and therefore exceed the level of accuracy recommended by European Archaeologiae Consilium (Schmidt *et al.* 2015) for geophysical surveys.

Scanning surveys consist of recording data at 0.25 m intervals along transects spaced 10 m apart, acquiring a minimum of 80 data points per transect. Due to the relatively coarse transect interval, scanning surveys should only be expected to detect extended regions of archaeological anomalies, when there is a greater likelihood of distinguishing such responses from the background magnetic field.

The detailed surveys consist of 20 m x 20 m or 30 m x 30 m grids, and data are collected at 0.25 m intervals along traverses spaced 1m apart. These strategies give 1600 or 3600 measurements per 20 m or 30 m grid respectively and are the recommended methodologies for archaeological surveys of this type (Schmidt *et al.* 2015).

Data may be collected with a higher sample density where complex archaeological anomalies are encountered, to aid the detection and characterisation of small and ephemeral features. Data may be collected at up to 0.125 m intervals along traverses spaced up to 0.25 m apart, resulting in a maximum of 28800 readings per 30 m grid, exceeding that recommended by European Archaeologiae Consilium recommendations (Schmidt *et al.* 2015) for characterisation surveys.

Post-processing

The magnetic data collected during the detail survey are downloaded from the Bartington system for processing and analysis using both commercial and in-house software. This software allows for both the data and the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.

As the scanning data are not as closely distributed as with detailed survey, they are georeferenced using the GPS information and interpolated to highlight similar anomalies in adjacent transects. Directional trends may be removed before interpolation to produce more easily understood images.

Typical data and image processing steps may include:



- Destripe – Applying a zero-mean traverse in order to remove differences caused by directional effects inherent in the magnetometer;
- Destagger – Shifting each traverse longitudinally by a number of readings. This corrects for operator errors and is used to enhance linear features;
- Despike – Filtering isolated data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings (generally only used for earth resistance data)

Typical displays of the data used during processing and analysis:

- Greyscale – Presents the data in plan view using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data.
- XY Plot – Presents the data as a trace or graph line for each traverse. Each traverse is displaced down the image to produce a stacked profile effect. This type of image is useful as it shows the full range of individual anomalies.



Appendix 2: Electromagnetic Survey Equipment and Data Processing

The electromagnetic data sets for the project were acquired using a Geonics EM31-MK2 low frequency electromagnetic instrument. Its total length is 4m while the distance between the transmitter coil and receiver coil is 3.66m. The operating frequency is 9.8kHz which sets it well within the Low Frequency Electromagnetic (LFEM or EM) instruments category which operate under 300kHz.

This is an active instrument that generates a low frequency electromagnetic field from the transmitter coil, the electromagnetic field generates eddy currents due to the effect of soil moisture, conductive features and earth materials present in the subsoil and these, in turn, generate another electromagnetic which is out of phase compared to the first one and is measured by the receiver coil.

The EM31-MK2, like other LFEM instruments, measures an in-phase component (or magnetic susceptibility) which represents the ratio between the primary and secondary magnetic fields in parts (ppt) and a quadrature (or apparent conductivity) component which represents an average of the conductivities of all components of the subsoil in the measured volume. The unit used for the quadrature component is mili-Siemens per metre (mS/m). The depth of investigation depends on the orientation of the two coils (transmitter and receiver). The horizontal magnetic dipole (HMD) deployment detects up to 3 metres deep while vertical magnetic dipole (VMD) has a depth of investigation up to 6 metres.

The measuring ranges are 10,100 and 1000 mS/m for apparent conductivity and ± 20 ppt for magnetic susceptibility. The data was collected along 1m traverses with 2 readings per metre. The survey relies on GPS system (Trackmarker 31) to accurately locate each reading taken by the data logger (Juniper Archer). The sampling interval of 0.5x1m (reading/traverse) offers higher data density than the 'Evaluation' strategy recommended by European Archaeologiae Consilium (Schmidt *et al.* 2015) and is consistent with their 'Characterization' survey strategy of 0.5x1m.

Post-processing

The electromagnetic data collected during the detail survey are downloaded from the Geonics EM31-MK2 data logger for processing and analysis using specific software (DAT31W is used for processing the data, while analysis is done in ARC GIS and Autocad). This software allows for both the data and the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.

Typical data and image processing steps may include:

- Destripe – Applying a smooth function in order to remove differences caused by directional effects inherent in the magnetometer;
- Despiking – Filtering isolated data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings (generally only used for earth resistance data)

Typical displays of the data used during processing and analysis:



- XY Plot – Presents the data as a trace or graph line for each traverse. Each traverse is displaced down the image to produce a stacked profile effect. This type of image is useful as it shows the full range of individual anomalies.
- Greyscale – Presents the data in plan view using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data.



Appendix 3: Ground Penetrating Radar Survey Equipment and Data Processing

The ground penetrating radar (GPR) data will be collected using a cart-mounted shielded antenna with central frequency suitable for the types of target being investigated. Lower frequency antennae are able to acquire data from deeper below the surface, whereas higher frequencies allow high resolution imaging of near-surface targets at the expense of deep penetration. The exact make and model of equipment varies.

The depth of penetration of GPR systems is determined by the central frequency of the antenna and the relative dielectric permittivity (RDP) of the material through which the GPR signal passes. In general, soils in floodplain settings may have a wide range of RDPs, although around 8 may be considered average, resulting in a maximum depth of penetration of approximately 2.5 m with the GPR signal having a velocity of approximately 0.1 m/ns.

The GPR beam is conical in shape, however, and whilst most of the energy is concentrated in the centre of the cone, the GPR signal illuminates a horizontal footprint, which becomes wider with increasing depth. At the maximum depth of the antenna, it becomes impossible to resolve any feature smaller than the horizontal footprint for the corresponding depth. The size of the footprint is dependent upon central frequency, and its size increases as the central frequency decreases.

The vertical resolution is similarly dependent upon the central frequency; for a 400 MHz antenna, features of the order of 0.05 m may be resolved vertically. Antennae with lower frequencies can therefore penetrate more deeply but are less resolute in both horizontal and vertical directions. Choice of antenna frequency is guided largely by the anticipated depth to the target and the required resolution.

GPR data for detailed surveys are collected along traverses of varying length separated by 0.5 m with cross lines collected running perpendicular to these traverses at wider separations. The data sampling resolution is governed by the data logger and a minimum separation of 0.05 m between traces is collected for all surveys, in accordance with European Archaeologiae Consilium recommendations (Schmidt *et al.* 2015).

Post-Processing

The radar data collected during the detail survey are downloaded from the GPR system for processing and analysis using commercial software (GPR Slice). This software allows for both the data and the images to be processed to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.

Typical data and image processing steps may include:

- Gain – Amplifies GPR data based upon its position in the profile, which boosts the contrast between anomalies and background. A wobble correction is also applied during this step;
- Background Filter - is used to remove banding noises that are seen across the radargrams
- Bandpass – Removes GPR data lying outside a specified range, which removes high- and low-frequency noise.



Typical displays of the data used during processing and analysis:

- Timeslice – Presents the data as a series of successive plan views of the variation of reflector energy from the surface to the deepest recorded response. The variation in amplitude is represented using a greyscale with black indicating high amplitude and white indicating low amplitude responses.
- Radargram – Presents each radar profile in a vertical view with distance along the profile expressed along the x axis and depth along the y axis. The amplitude variation is expressed using a greyscale.



Appendix 4: Geophysical Interpretation

The interpretation methodology used by Wessex Archaeology separates the anomalies into four main categories: archaeological, modern, agricultural, and uncertain origin/geological.

The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided into three groups, implying a decreasing level of confidence:

- Archaeology – used when there is a clear geophysical response and anthropogenic pattern.
- Possible archaeology – used for features which give a response, but which form no discernible pattern or trend.

The modern category is used for anomalies that are presumed to be relatively modern in date:

- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin.
- Modern service – used for responses considered relating to cables and pipes; most are composed of ferrous/ceramic material although services made from non-magnetic material can sometimes be observed.

The agricultural category is used for the following:

- Former field boundaries – used for ditch sections that correspond to the position of boundaries marked on earlier mapping.
- Ridge and furrow – used for broad and diffuse linear anomalies that are considered to indicate areas of former ridge and furrow.
- Ploughing – used for well-defined narrow linear responses, usually aligned parallel to existing field boundaries.
- Drainage – used to define the course of ceramic field drains that are visible in the data as a series of repeating bipolar (black and white) responses.

The uncertain origin/geological category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:

- Increased magnetic response – used for areas dominated by indistinct anomalies which may have some archaeological potential.
- Trend – used for low amplitude or indistinct linear anomalies.
- Superficial geology – used for diffuse edged spreads considered to relate to shallow geological deposits. They can be distinguished as areas of positive, negative, or broad bipolar (positive and negative) anomalies.

For the EMI survey several additional categories that relate to the character of the subsurface material are also provided;

- Higher / Lower Conductivity – Higher conductivity features are likely to be associated with clays and silts, whilst low conductivity values are likely to relate to deposits of sands and gravels, which have higher electrical resistance.



- Higher / Lower magnetic susceptibility - Volume specific areas magnetic susceptibility (dimensionless) relate to the extent that subsurface materials become magnetised in an applied magnetic field. Burnt/ fired material has an enhanced magnetic susceptibility, and areas of human activity with its accompanying rubbish / cultural material can also leave a permanent magnetic imprint on the soil. By contrast, natural material or bedrock geology has a lower magnetic susceptibility.
- If anomalies of both high magnetic susceptibility and high conductivity are coincident, then it is likely that the feature is metallic and therefore likely to be modern or artificial in origin.

For the interpretation of GPR datasets two further categories are also employed:

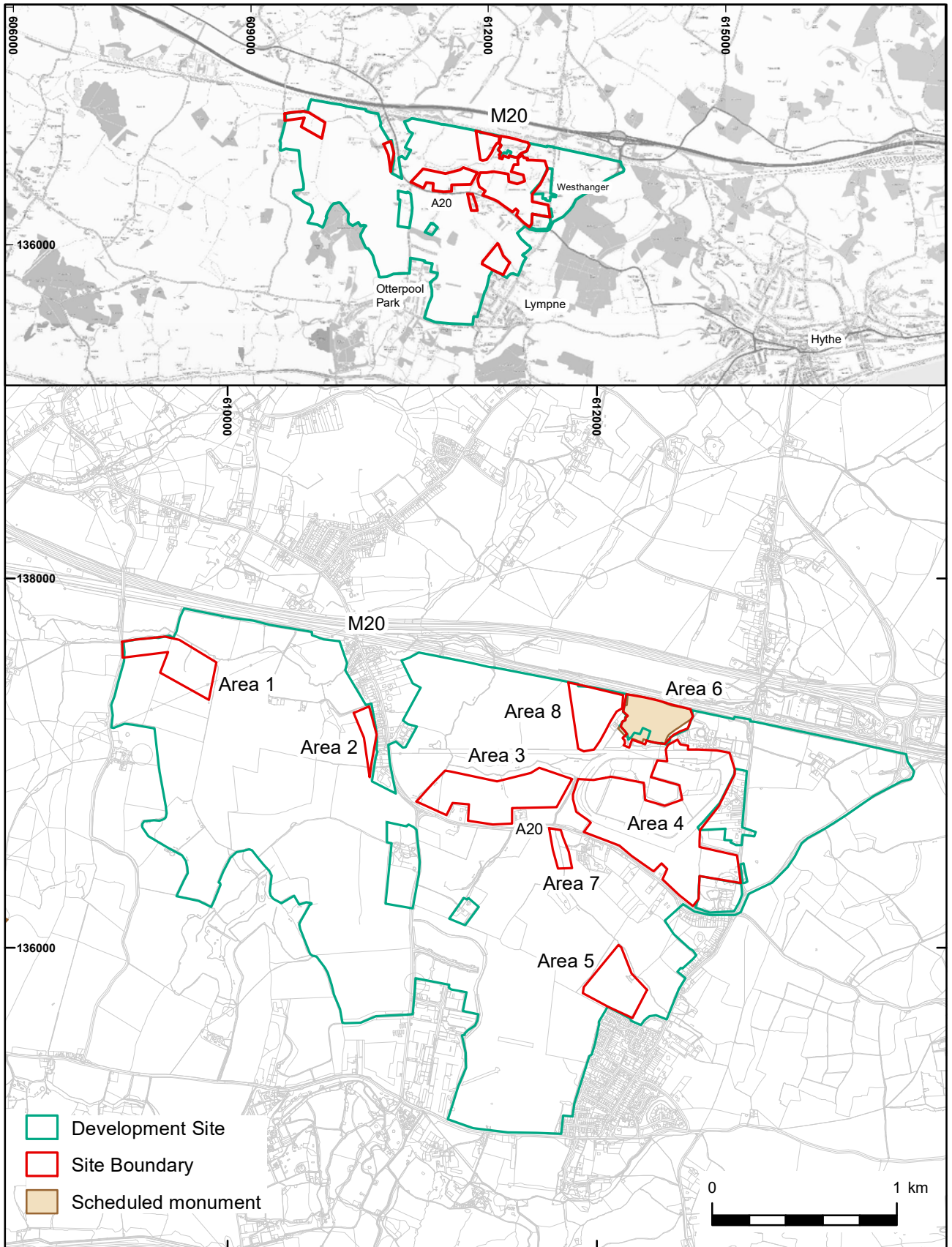
- High Amplitude – used for features which give a notably high amplitude response but display no discernible pattern.
- Low Amplitude – used for features which give a notably low amplitude response but display no discernible pattern.



Appendix 5: OASIS form

Project Details:

Project name		Otterpool Park, Folkestone & Hythe, Kent			
Type of project		Detailed Gradiometer, Ground Penetrating Radar and Electromagnetic Survey Report			
Project description		A detailed gradiometer survey, ground penetrating radar (GPR) and electromagnetic (EM) survey was conducted over land at Otterpool Park, Folkestone & Hythe, Kent. The survey covered eight areas to the south of the M20, west of the Village of Westenhanger in south-east Kent. The project was commissioned by Arcadis LLP with the aim of establishing the presence, of detectable archaeological features in support of a planning application for the development of 585 ha of land. The site comprises a mixture of pasture and arable fields and was undertaken between 27/03/20 to 07/05/20. The site comprises 80 ha of detailed gradiometer survey in Areas 1 – 5 and 8, detailed gradiometer survey of up to 5.5 ha and 1 ha of GPR in Area 6, and 1.6 ha of EM in Area 7. The detailed gradiometer survey has been successful in detecting anomalies of archaeological origin in Area 1 – 6 and 8. This includes numerous ditch-like features, some of which may form a series of land divisions and enclosures potentially associated with settlement activity at the nearby Westenhanger Castle. Those located further away are perhaps more likely associated with Romano-British settlement. The EM survey undertaken in Area 7 aimed to investigate whether any significant archaeological remains were located below alluvial material adjacent to the River East Stour that might be an attributable activity associated with the Romano-British Villa. Lastly the GPR survey of the areas surrounding Westenhanger Castle revealed a variety of probable structural remains, some of which likely relate to more widespread 14th - 16th century activity. This includes evidence for small buildings and the remains of the internal curtain wall of the enclosed quadrangular castle. A rectangular building thought to be the original Westenhanger Parish church has also been identified west of the castle adjacent to the existing late 16th century barn. In close proximity to the possible church, foundations of a square tower or agricultural building have also been distinguished.			
Project dates		Start: 27/03/20		End: 07/05/20	
Previous work		DBA, EIA, Geophysical survey, Evaluative Trenching			
Future work		Trial trenching/excavation			
Project Code:	227401	HER event no.	If relevant	OASIS form ID:	wessexar1- 396235
		NMR no.	N/A		
		SM no.	NHLE 1020761		
Planning Application Ref.		Y19/0257/FH			
Site Status		None Area 1 -5, 7 and 8, Scheduled Monument (SM) Area 6			
Land use		Arable			
Monument type		Castle	Period	Medieval (1066 to 1540)	
Project Location:					
Site Address	Otterpool Park, Stanford, Folkestone and Hythe			Postcode	CT21 4JD
County	Kent	District	Ashford	Parish	Aldington
Study Area	88.1 ha	Height OD	58 – 88 m aOD	NGR	Area 1: 609662 137571 (TR 09662 37571); Area 2: 610757 137204 (TR 10757 37204); Area 3: 611507 136822 (TR 11507 36822); Area 4: 612298 136824 (TR 12298 36824); Area 5: 612064 135788 (TR 12064 35788); Area 6: 612269 137255 (TR 12269 37255); Area 7: 611784 136564 (TR 11784 36564); Area 8: 612009 137285 (TR 12009 37285)
Project Creators:					
Name of Organisation		Wessex Archaeology			
Project brief originator		Arcadis LLP	Project design originator		Wessex Archaeology
Project Manager		Tom Richardson	Project Supervisor		Patricia Voke
Sponsor or funding body		Arcadis LLP	Type of Sponsor		Developer
Project Archive and Bibliography:					
Physical archive	N/A	Digital Archive	Geophysical survey and report	Paper Archive	N/A
Report title				Date	2020
Otterpool Park, Folkestone & Hythe, Kent. Detailed Gradiometer, Ground Penetrating Radar, and Electromagnetic Survey Report					
Author	Wessex Archaeology	Description	Unpublished report	Report ref.	227401.03



Coordinate system:
OSGB36 (OSTN15/OSGM15)

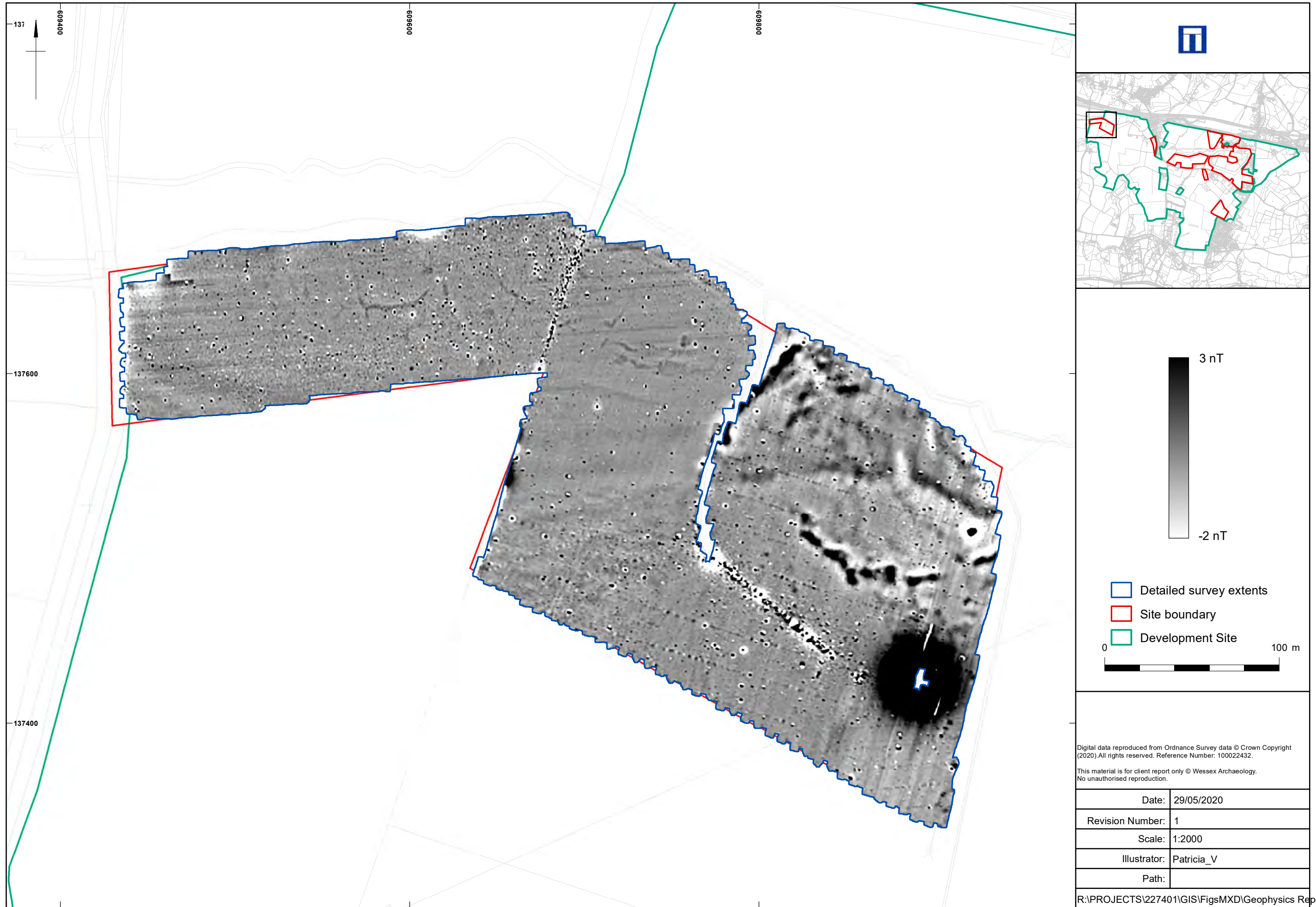


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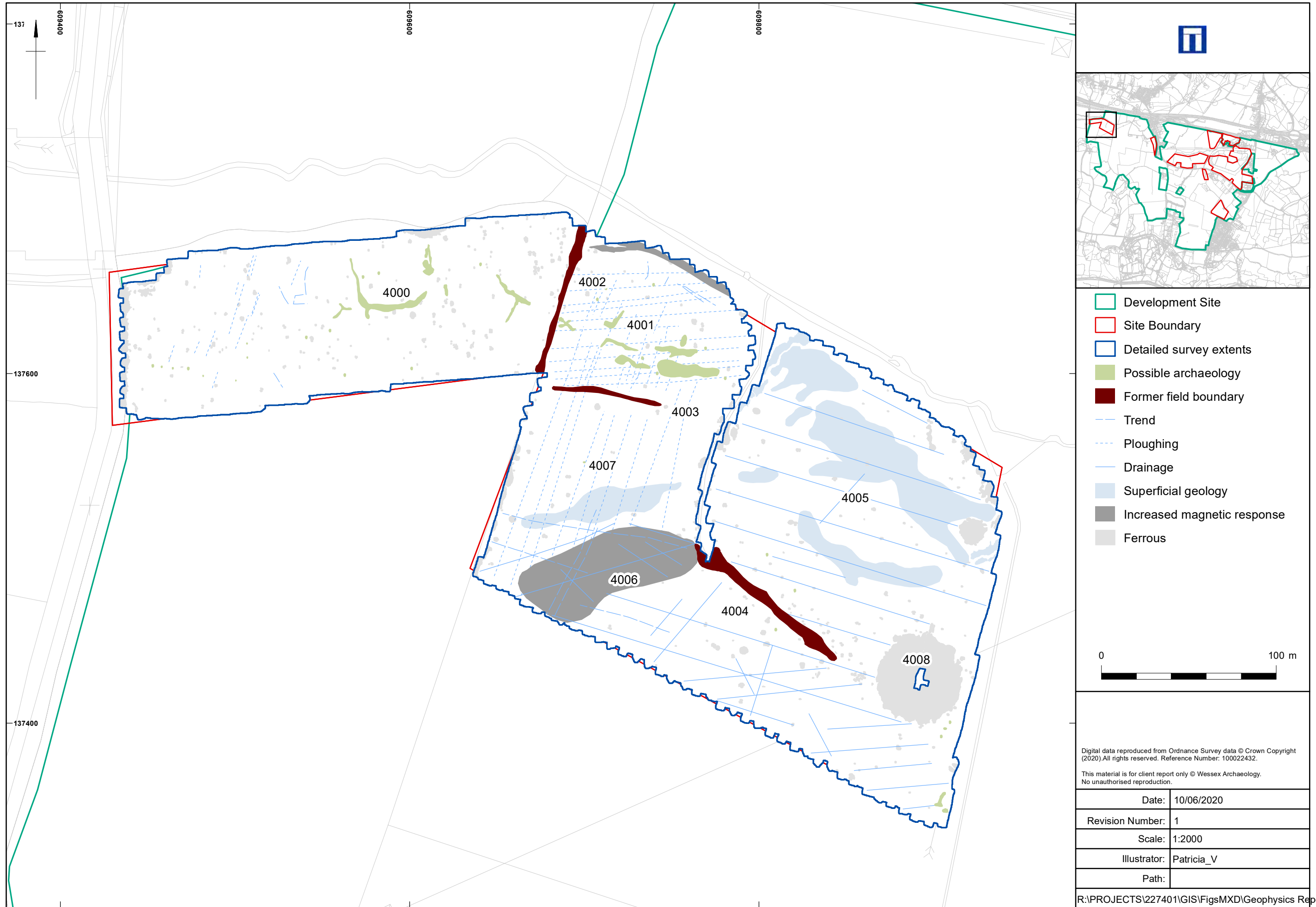
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Site location and survey extents

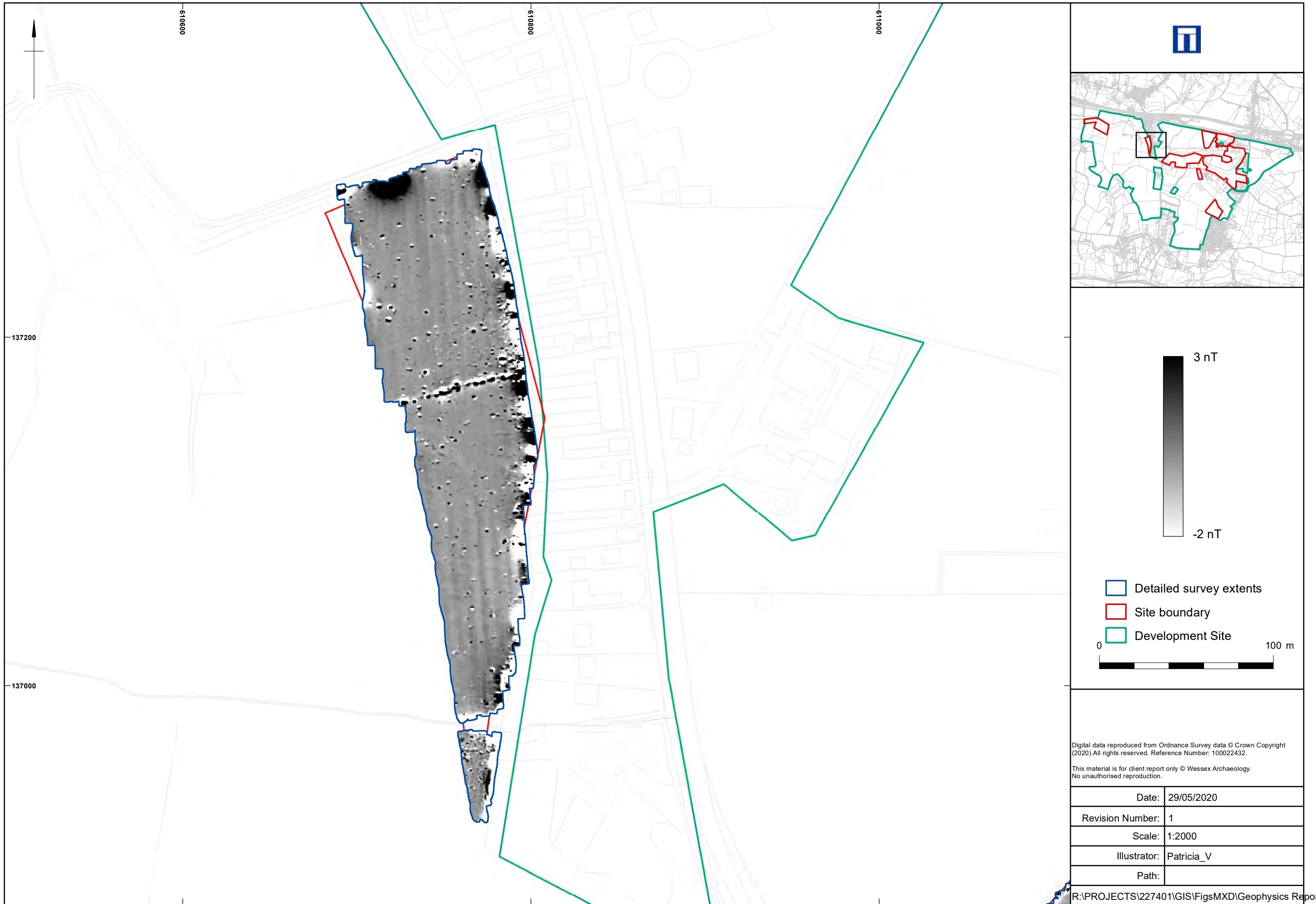
Figure 1



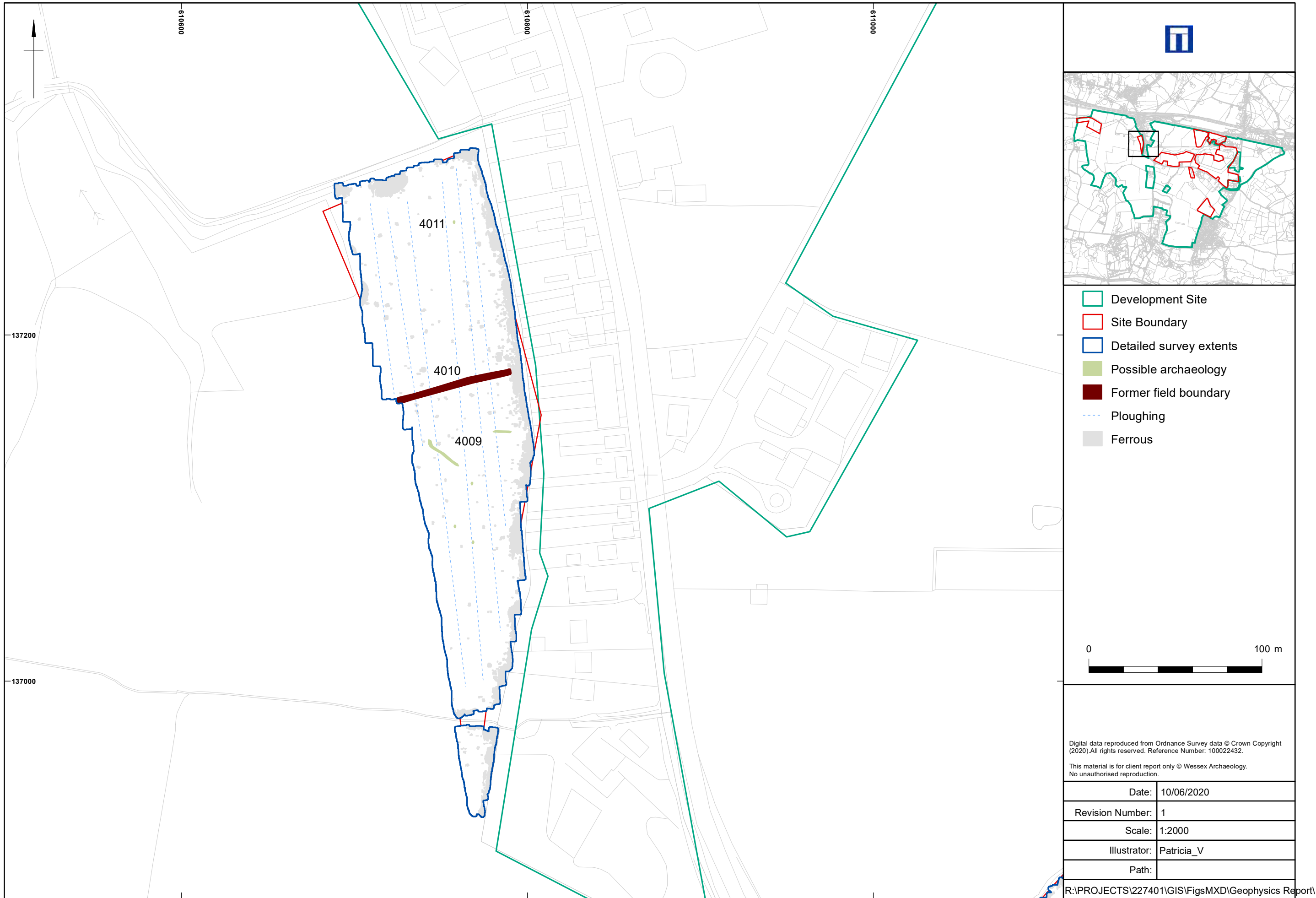
Detailed gradiometer survey results: Greyscale plot Area 1



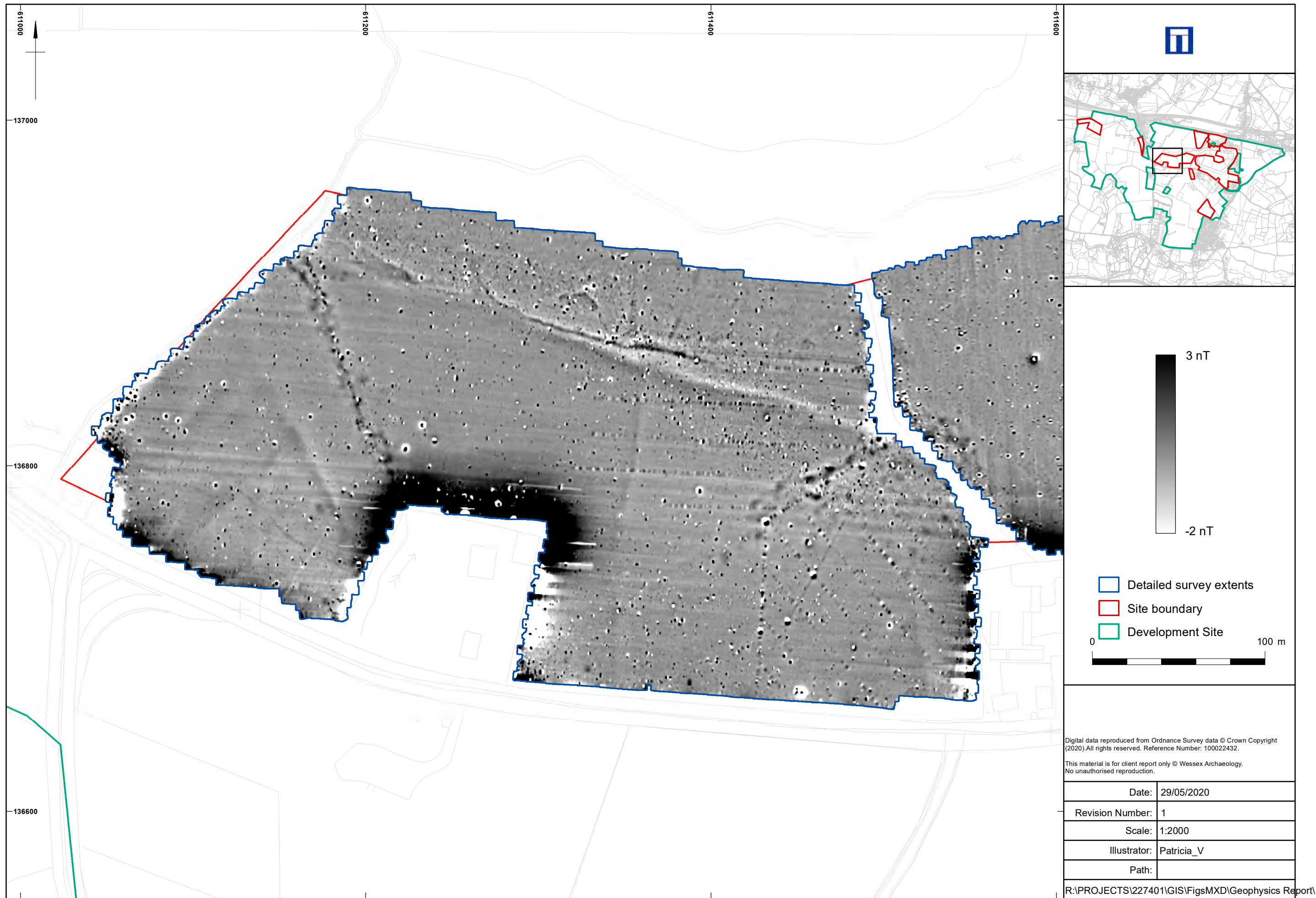
Detailed gradiometer survey results: Interpretation Area 1



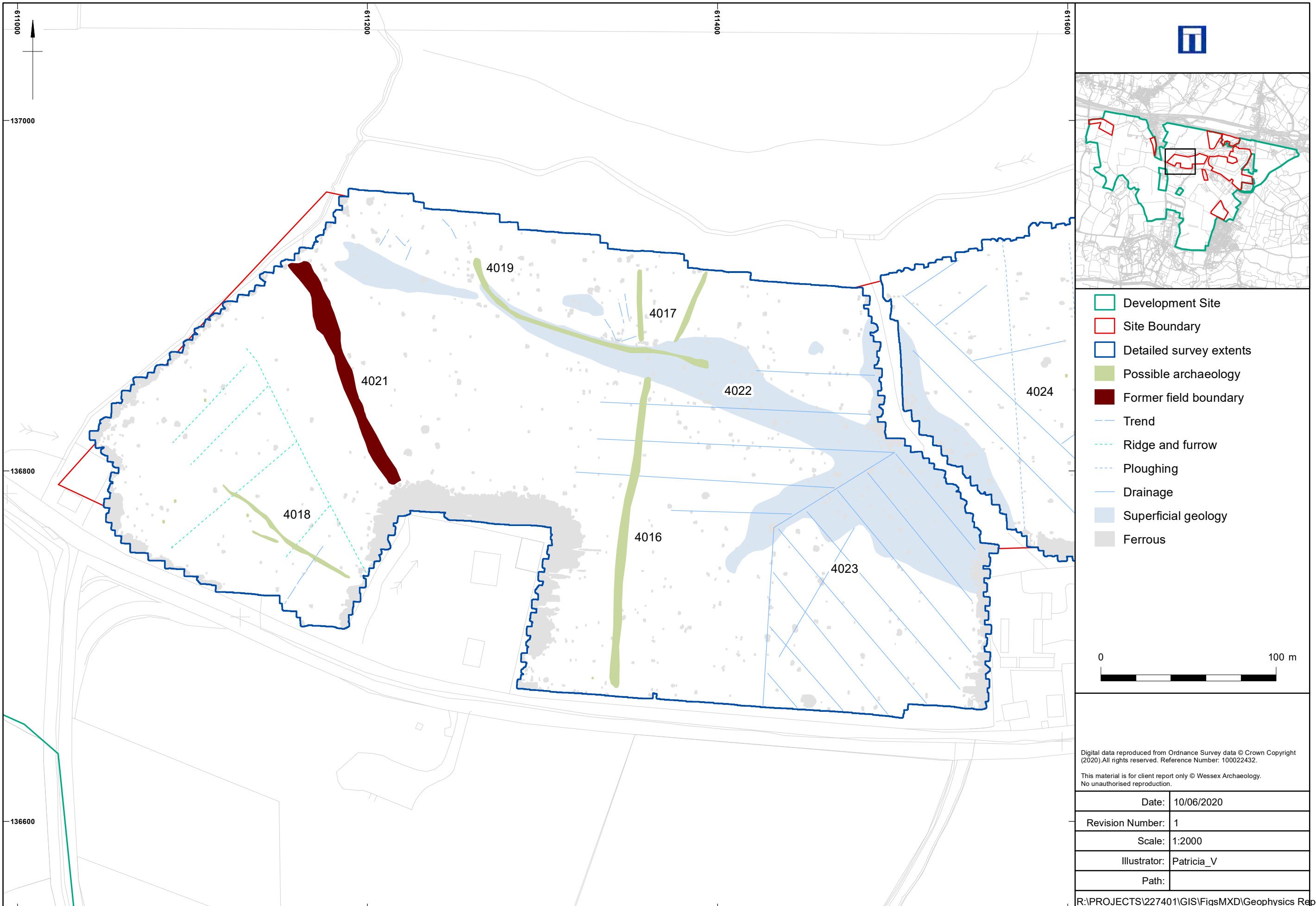
Detailed gradiometer survey results: Greyscale plot Area 2



Detailed gradiometer survey results: Interpretation Area 2



Detailed gradiometer survey results: Greyscale plot Area 3 West

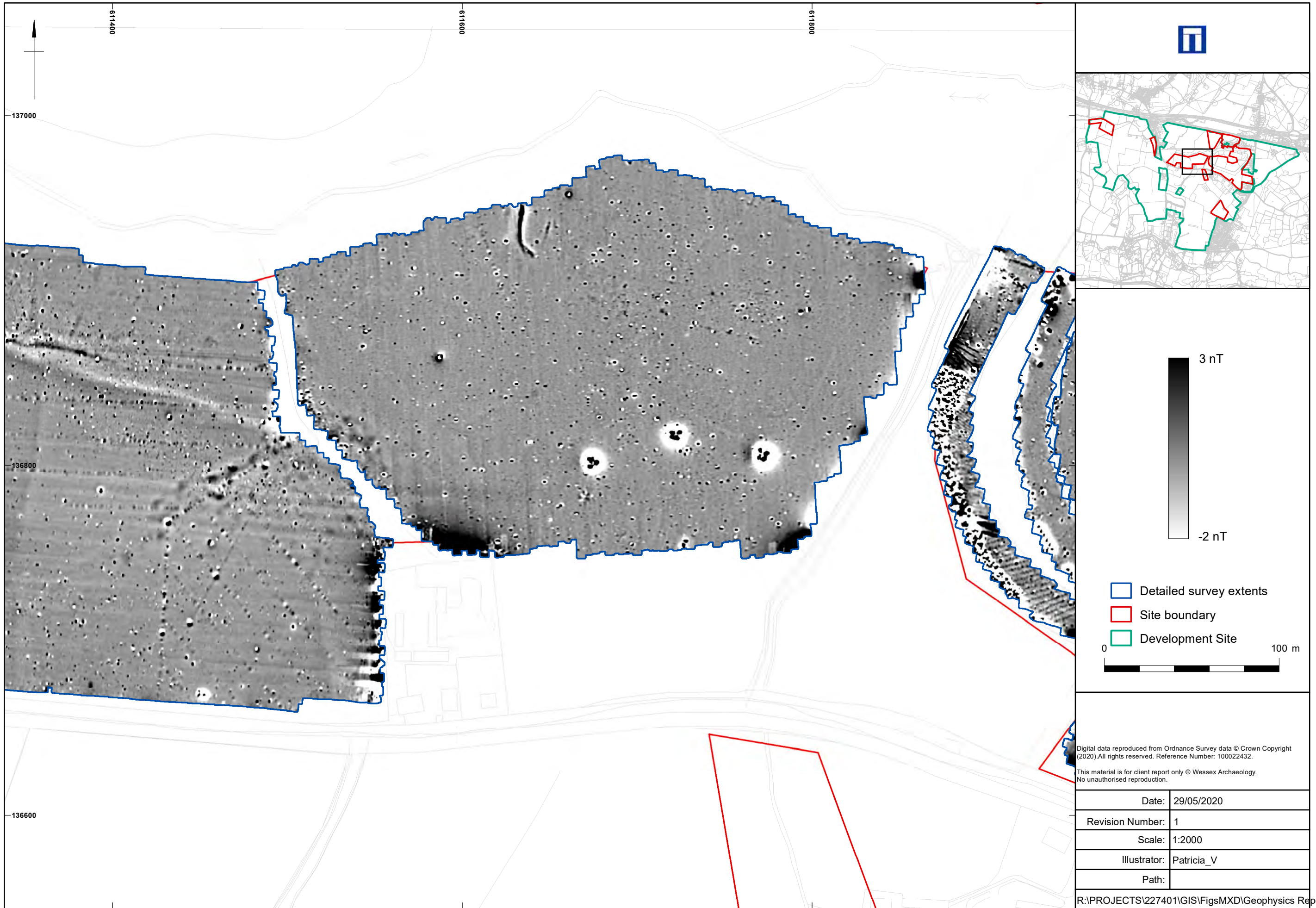


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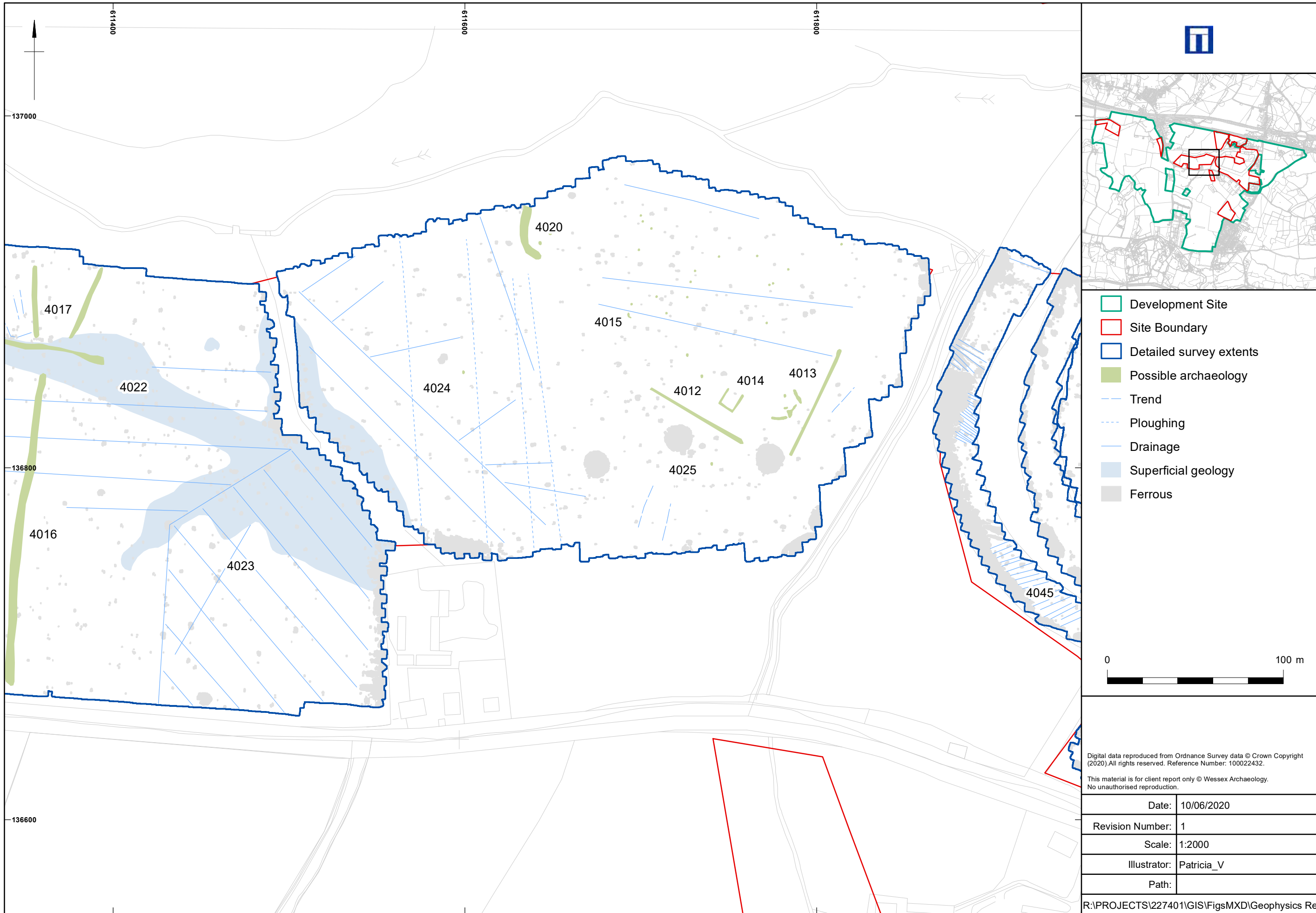
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Detailed gradiometer survey results: Interpretation Area 3 West



Detailed gradiometer survey results: Greyscale plot Area 3 East

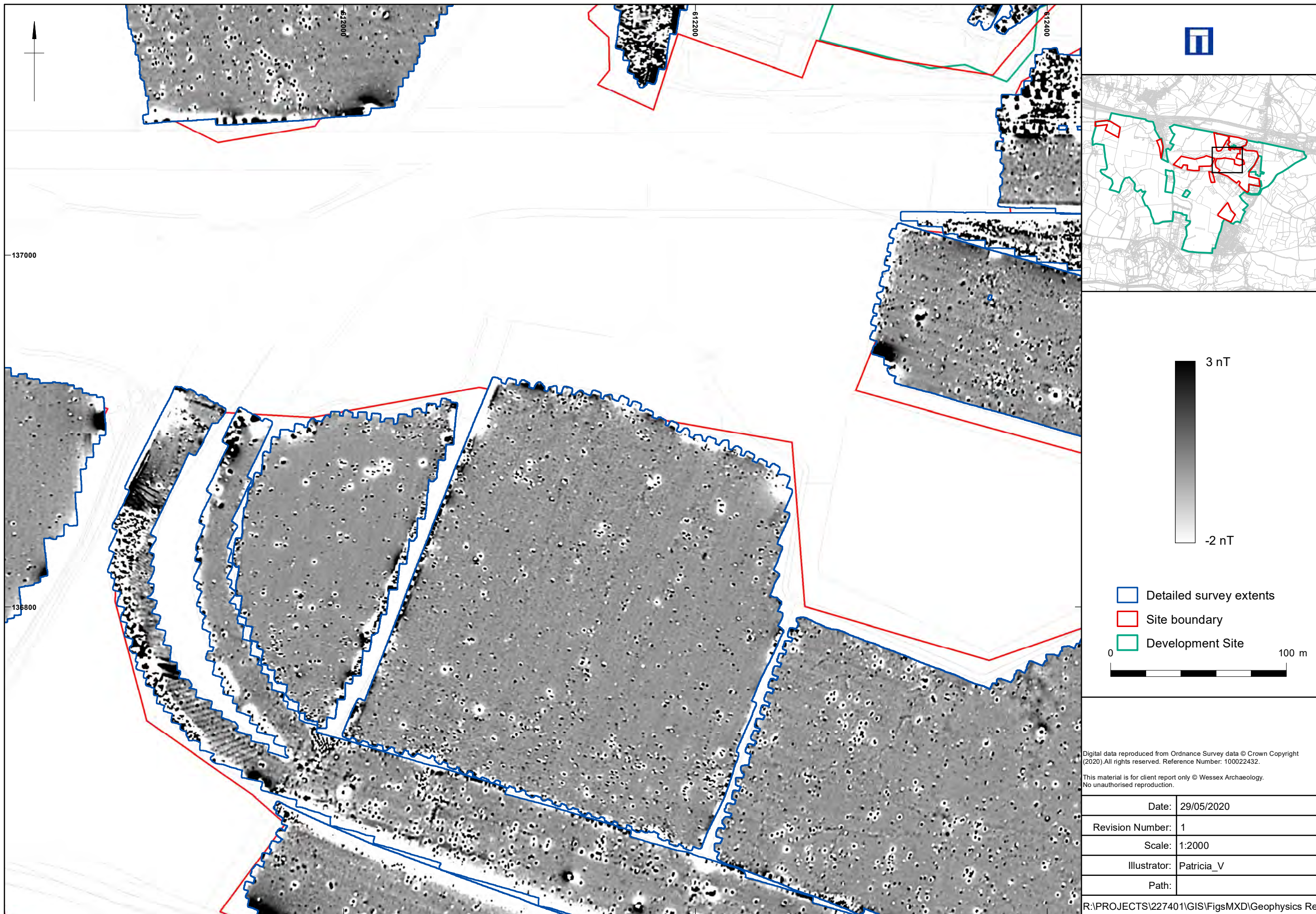


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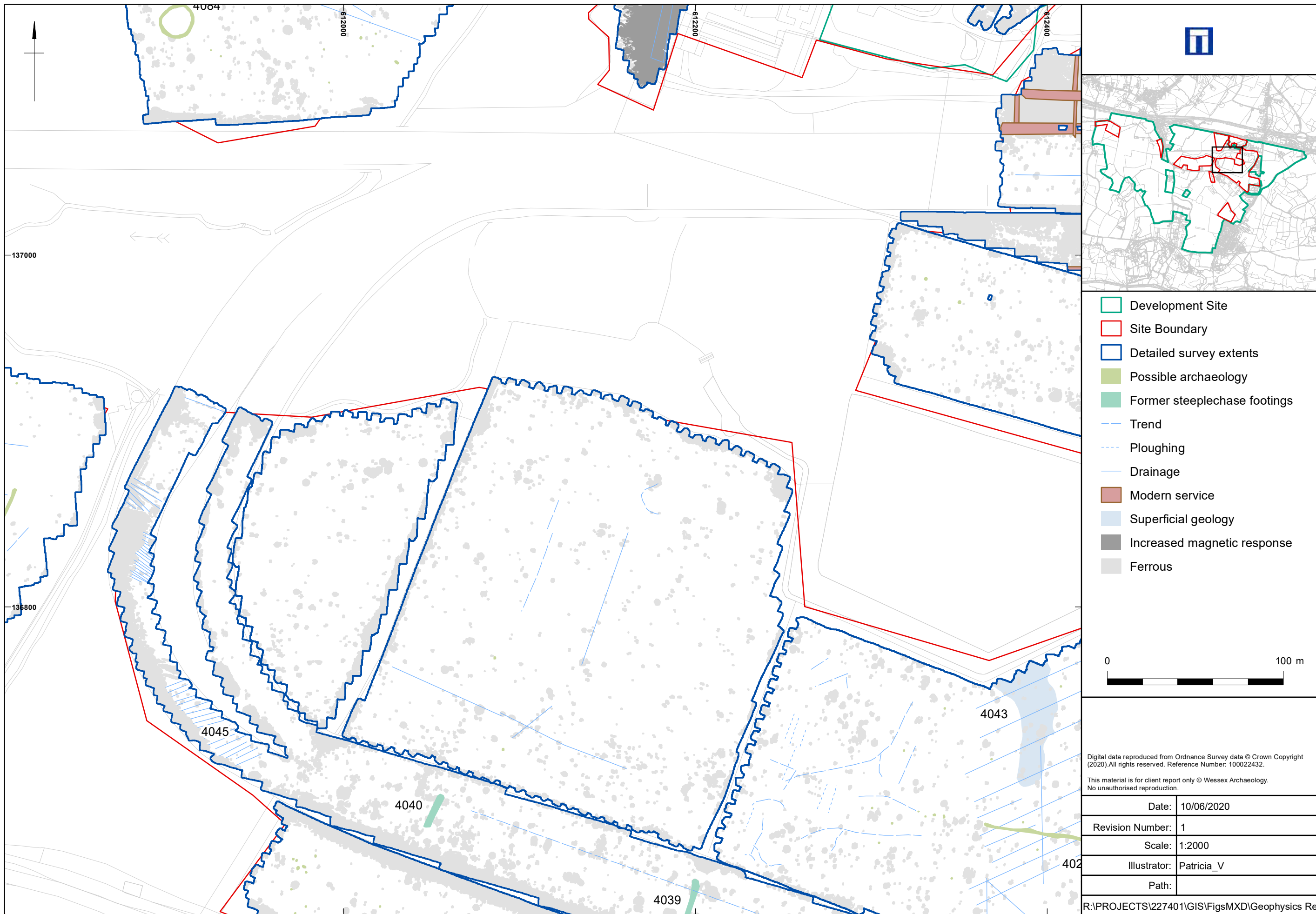
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Detailed gradiometer survey results: Interpretation Area 3 East



Detailed gradiometer survey results: Greyscale plot Area 4 North - west



- Development Site
- Site Boundary
- Detailed survey extents
- Possible archaeology
- Former steepplechase footings
- Trend
- Ploughing
- Drainage
- Modern service
- Superficial geology
- Increased magnetic response
- Ferrous

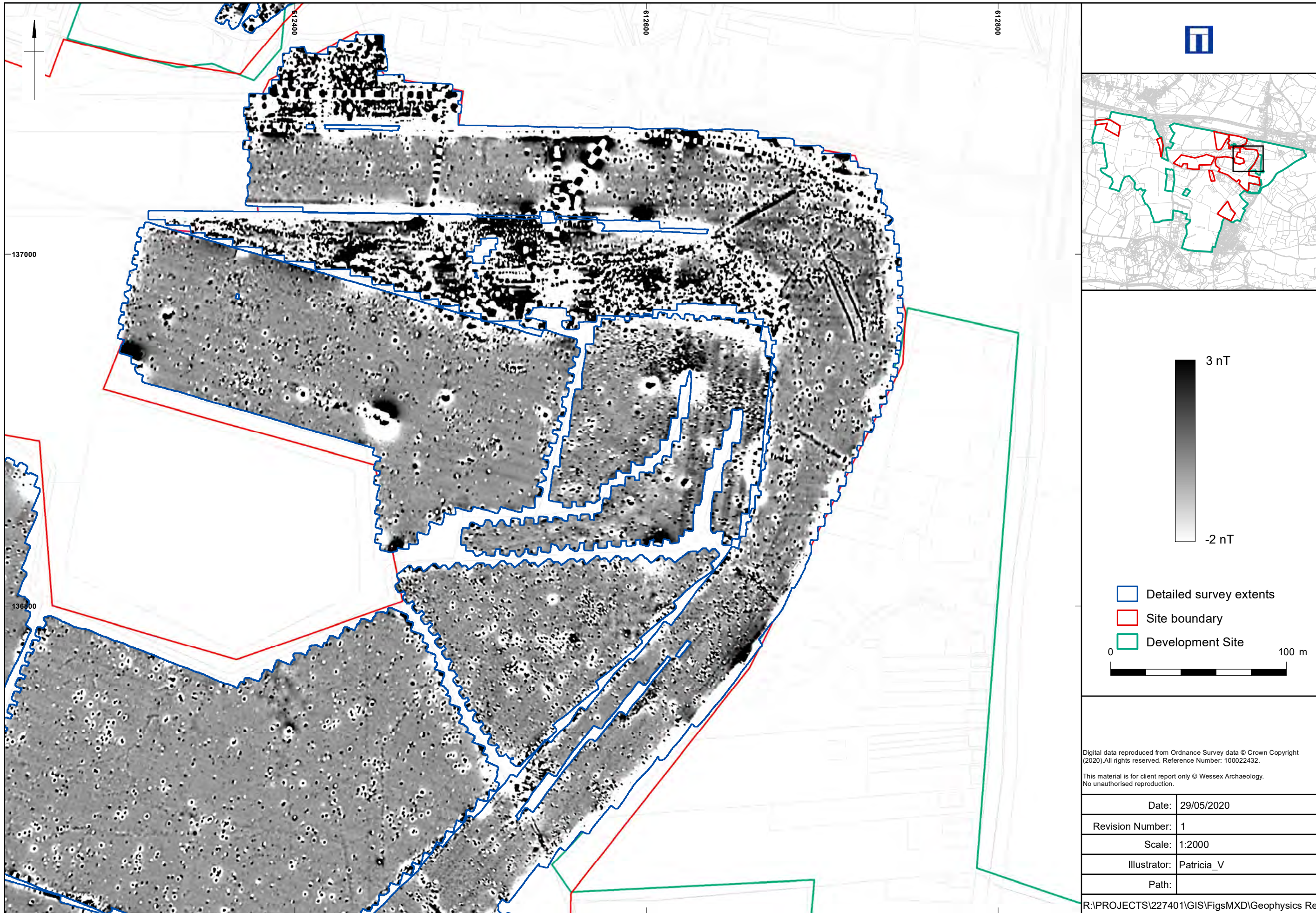


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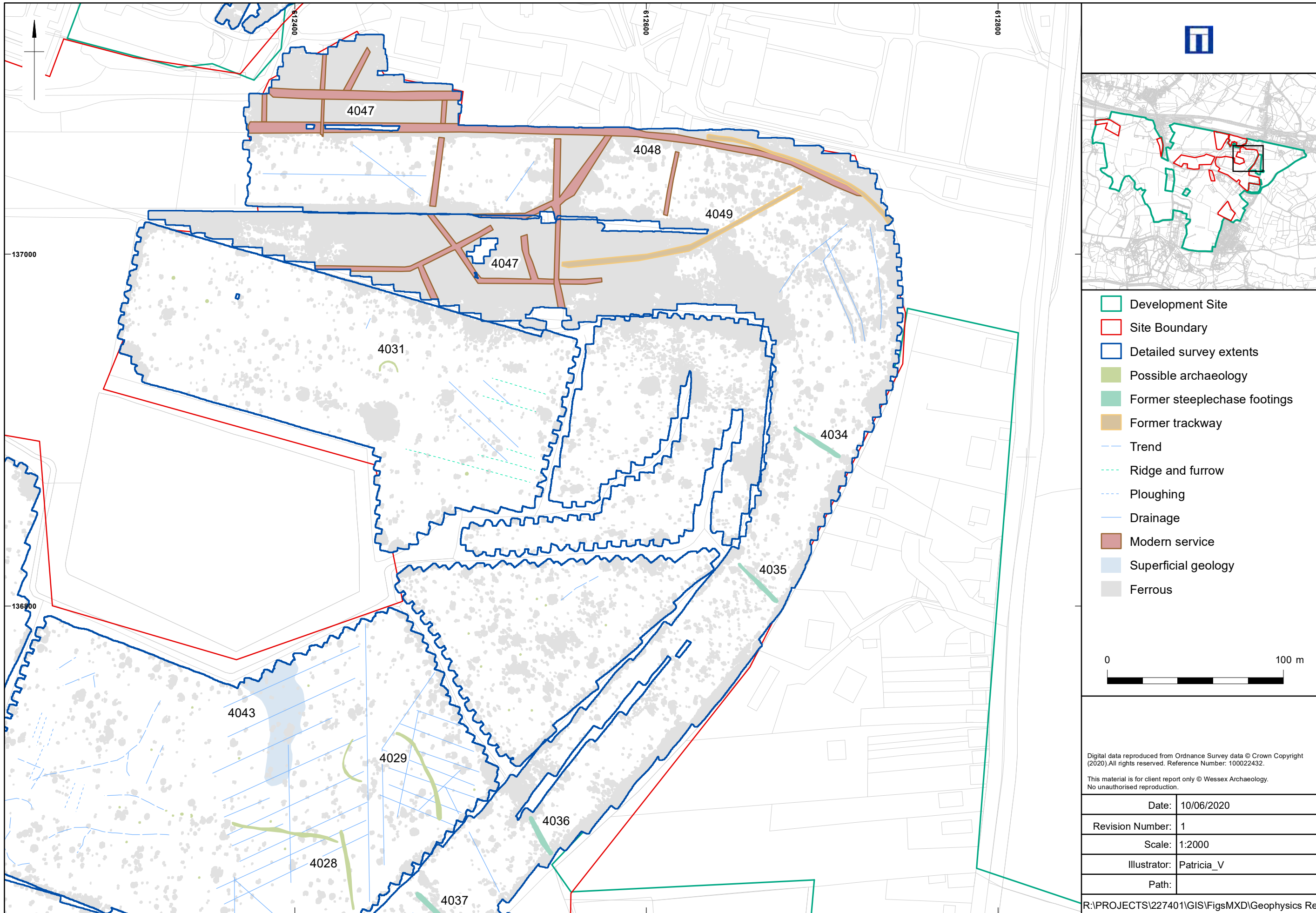
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Detailed gradiometer survey results: Interpretation Area 4 North - west



Detailed gradiometer survey results: Greyscale plot Area 4 North - east

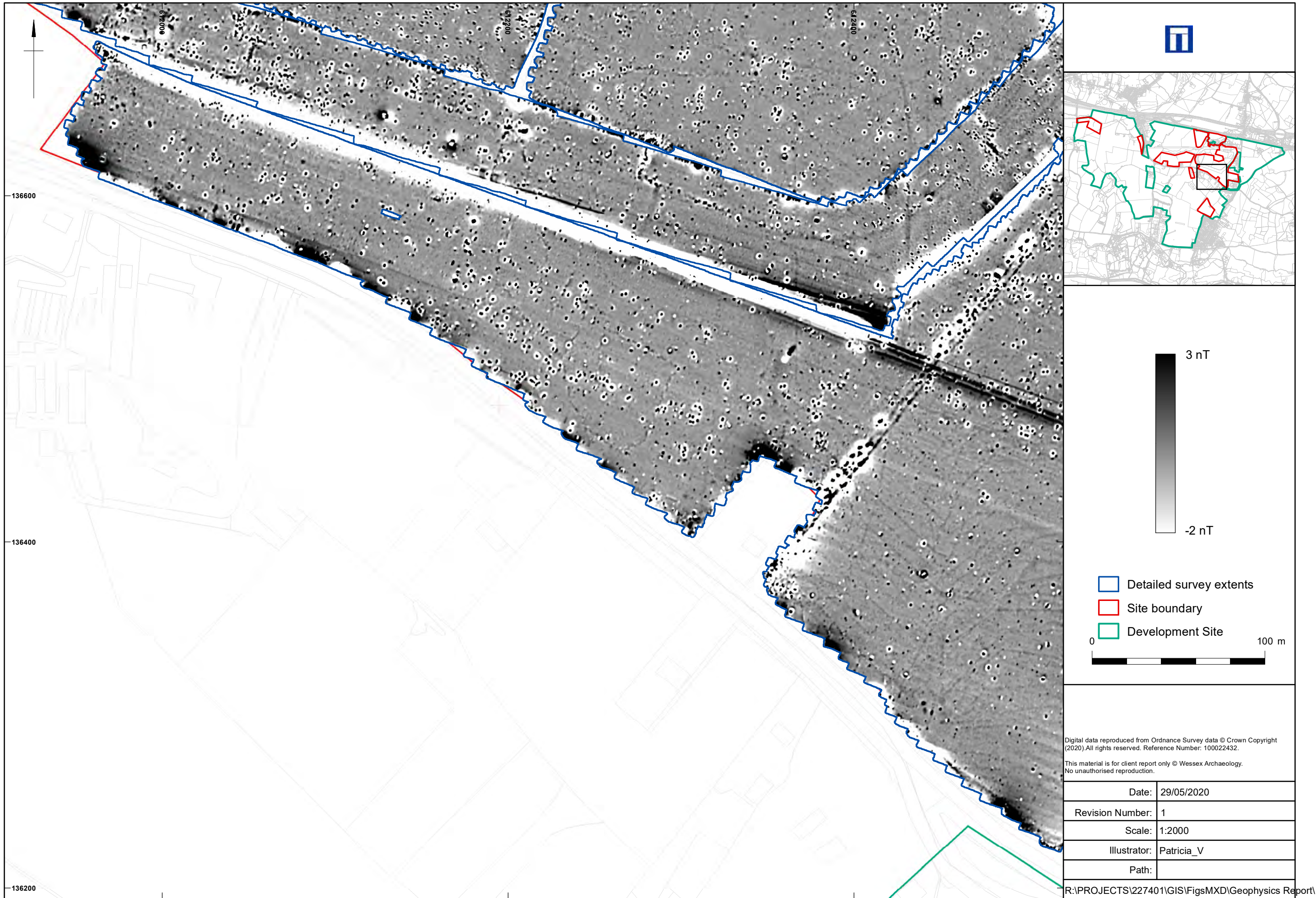


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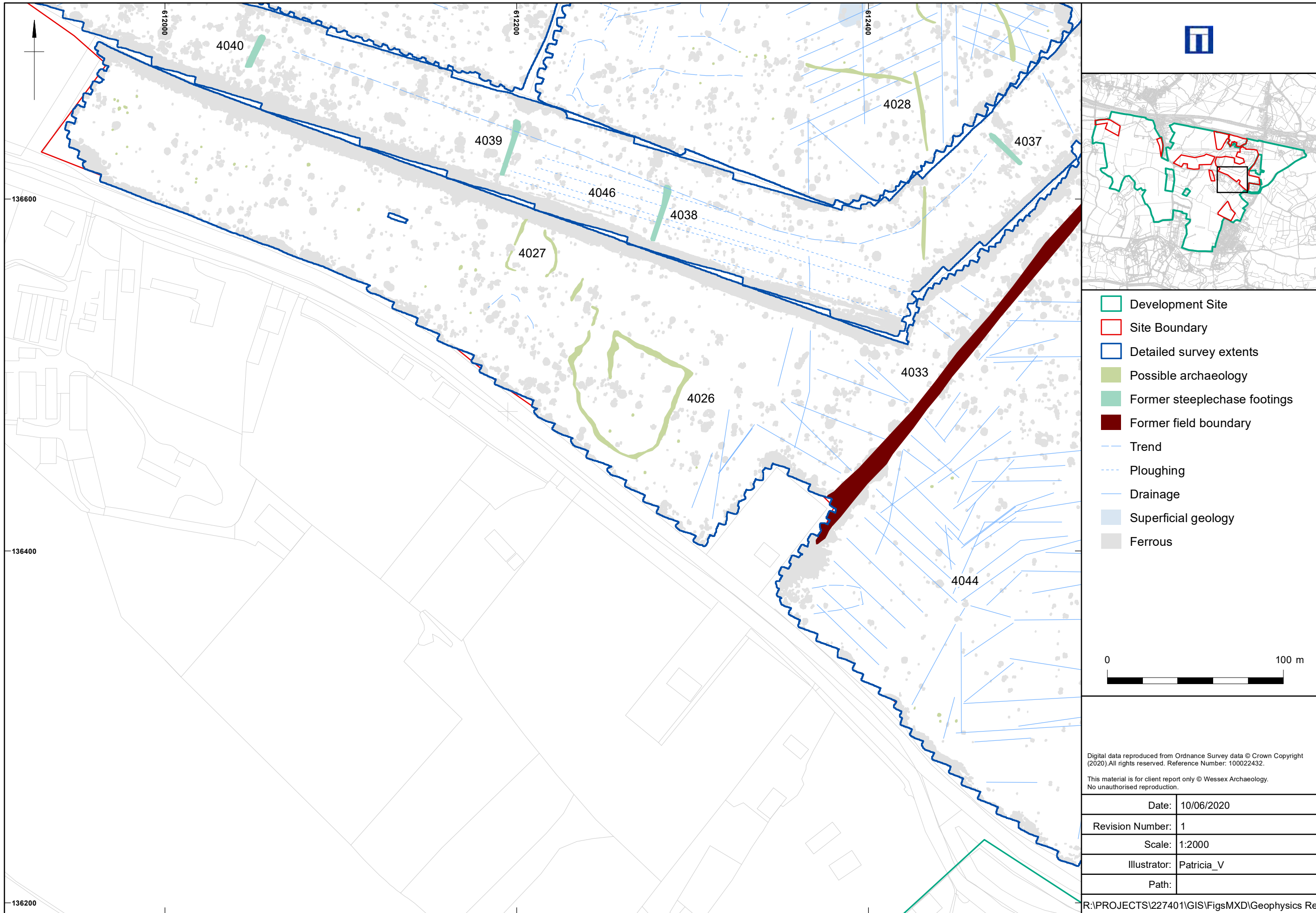
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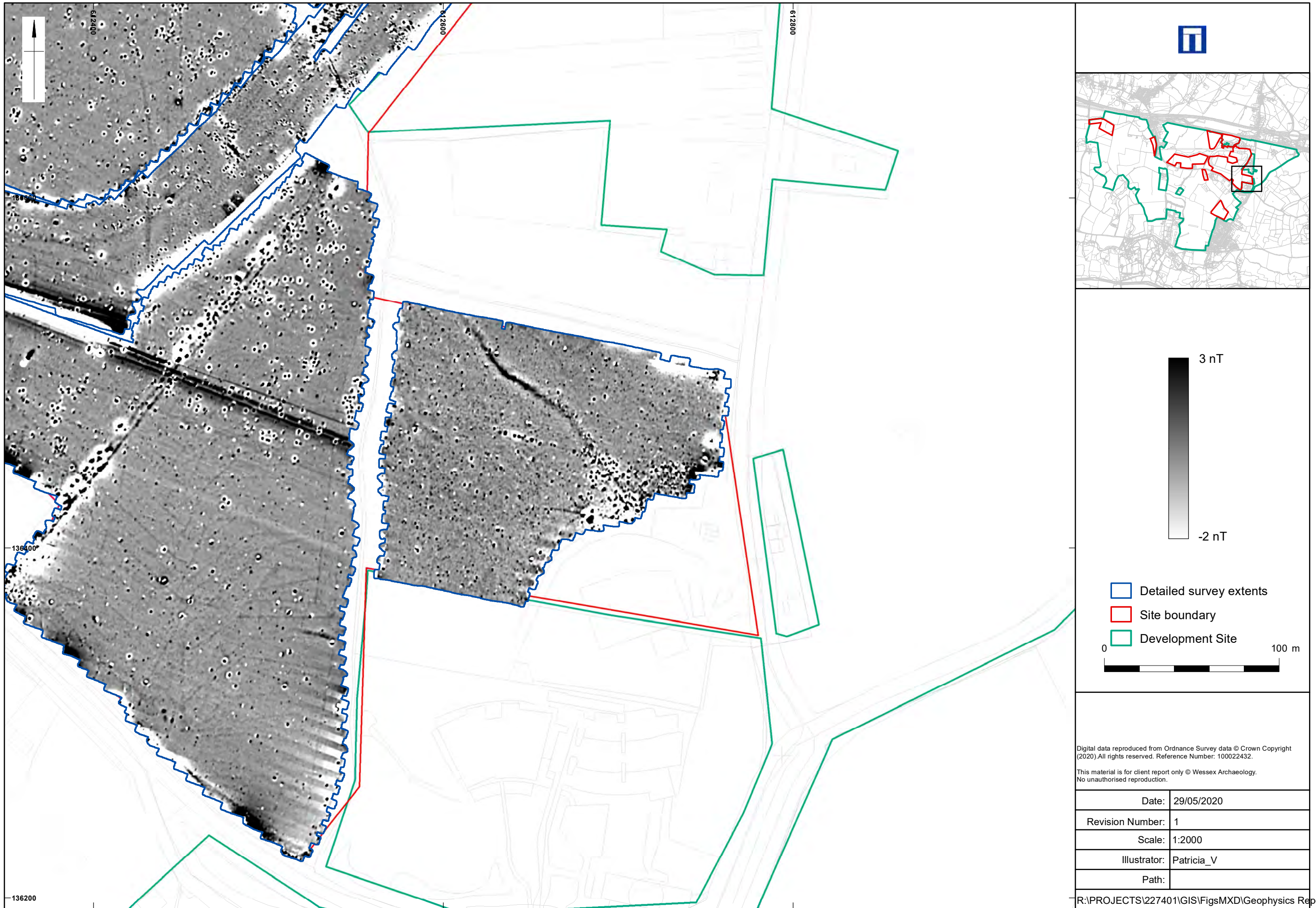
Detailed gradiometer survey results: Interpretation Area 4 North - east



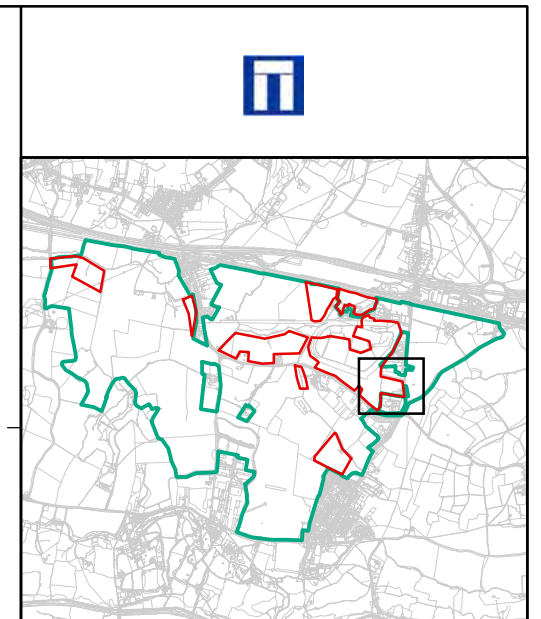
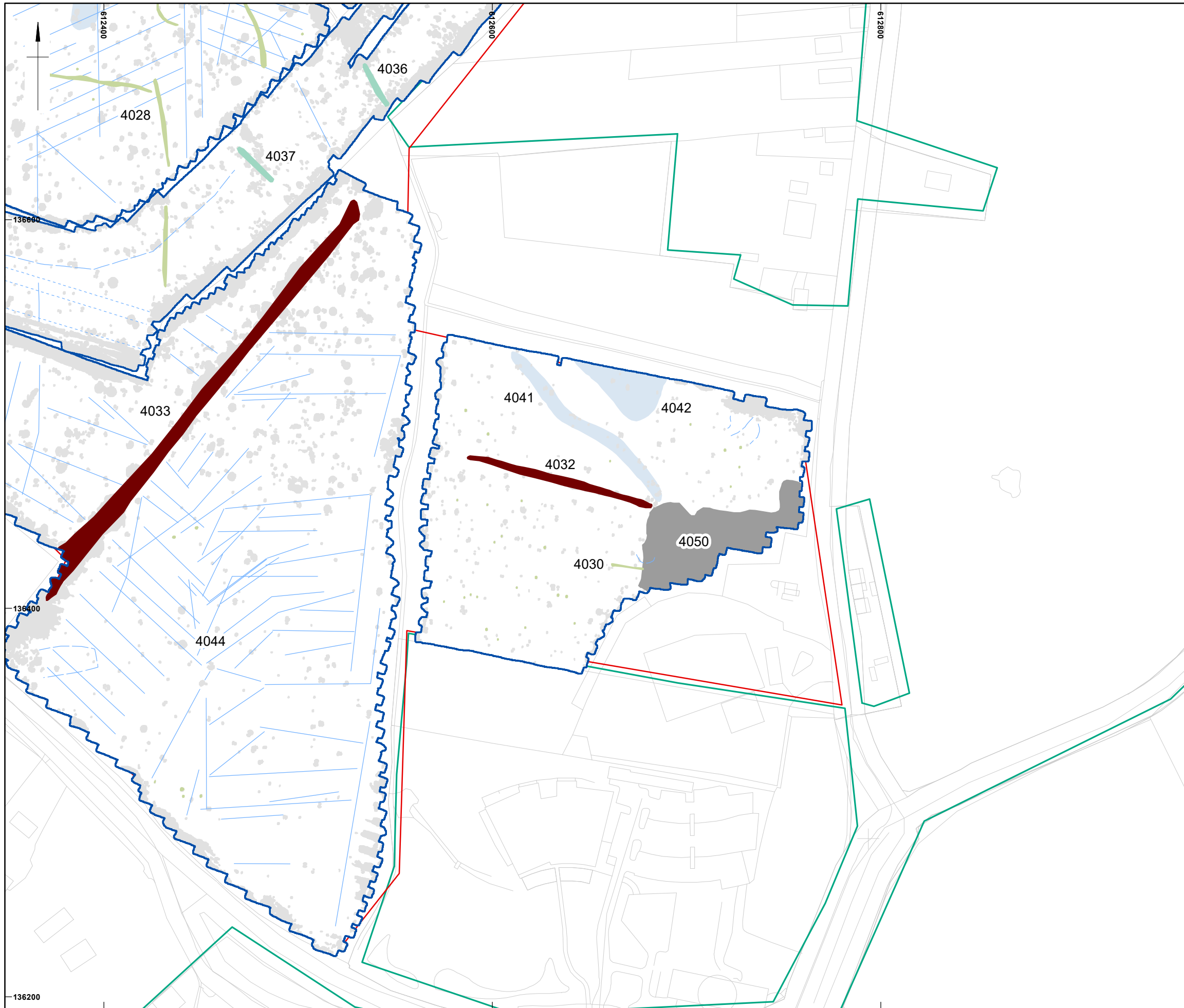
Detailed gradiometer survey results: Greyscale plot Area 4 South - west



Detailed gradiometer survey results: Interpretation Area 4 South - west



Detailed gradiometer survey results: Greyscale plot Area 4 South - east



- Development Site
- Site Boundary
- Detailed survey extents
- Possible archaeology
- Former steeplechase footings
- Former field boundary
- Trend
- Ploughing
- Drainage
- Superficial geology
- Increased magnetic response
- Ferrous



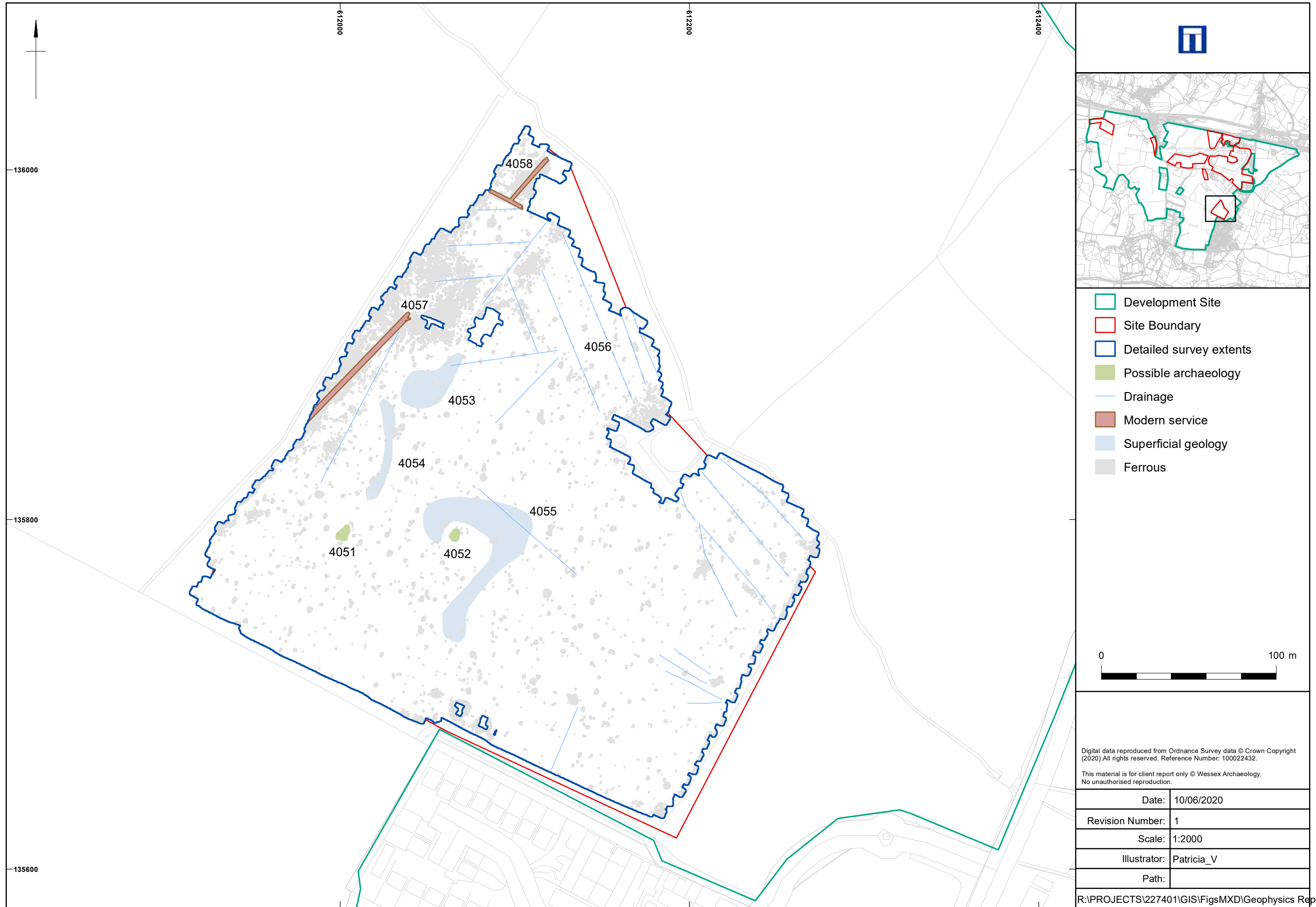
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Detailed gradiometer survey results: Interpretation Area 4 South - east



Detailed gradiometer survey results: Greyscale plot Area 5

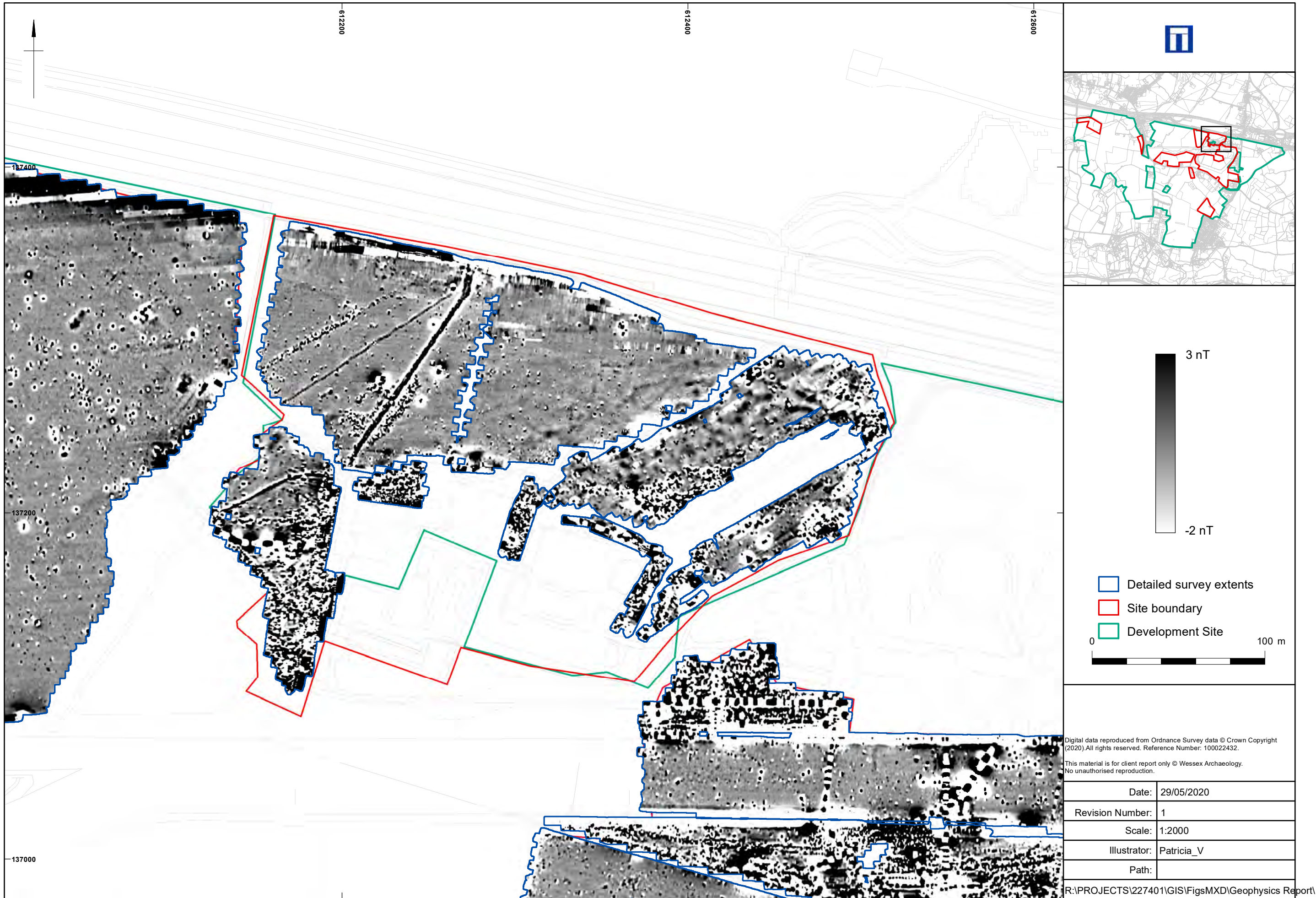


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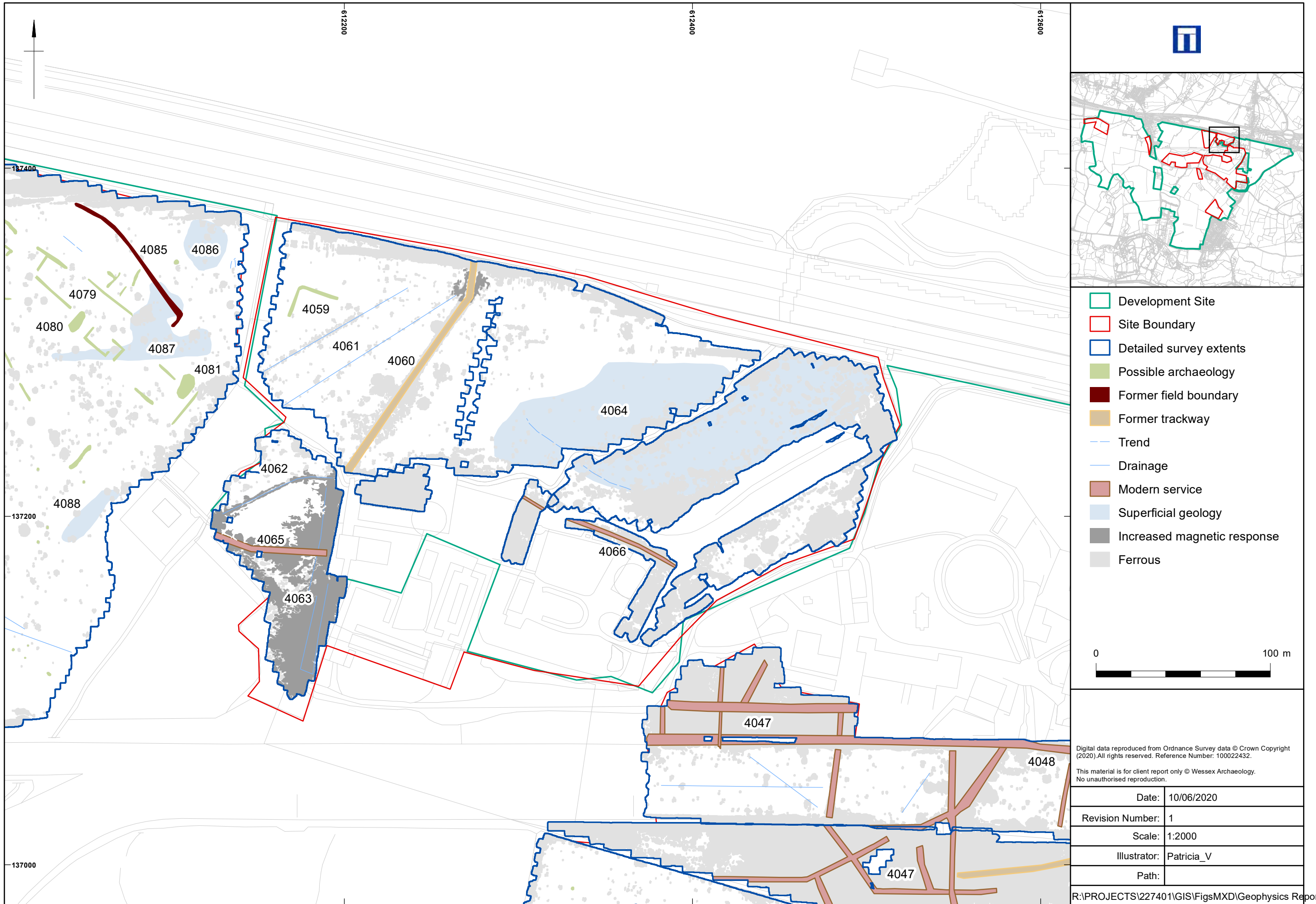
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Detailed gradiometer survey results: Interpretation Area 5



Detailed gradiometer survey results: Greyscale plot Area 6

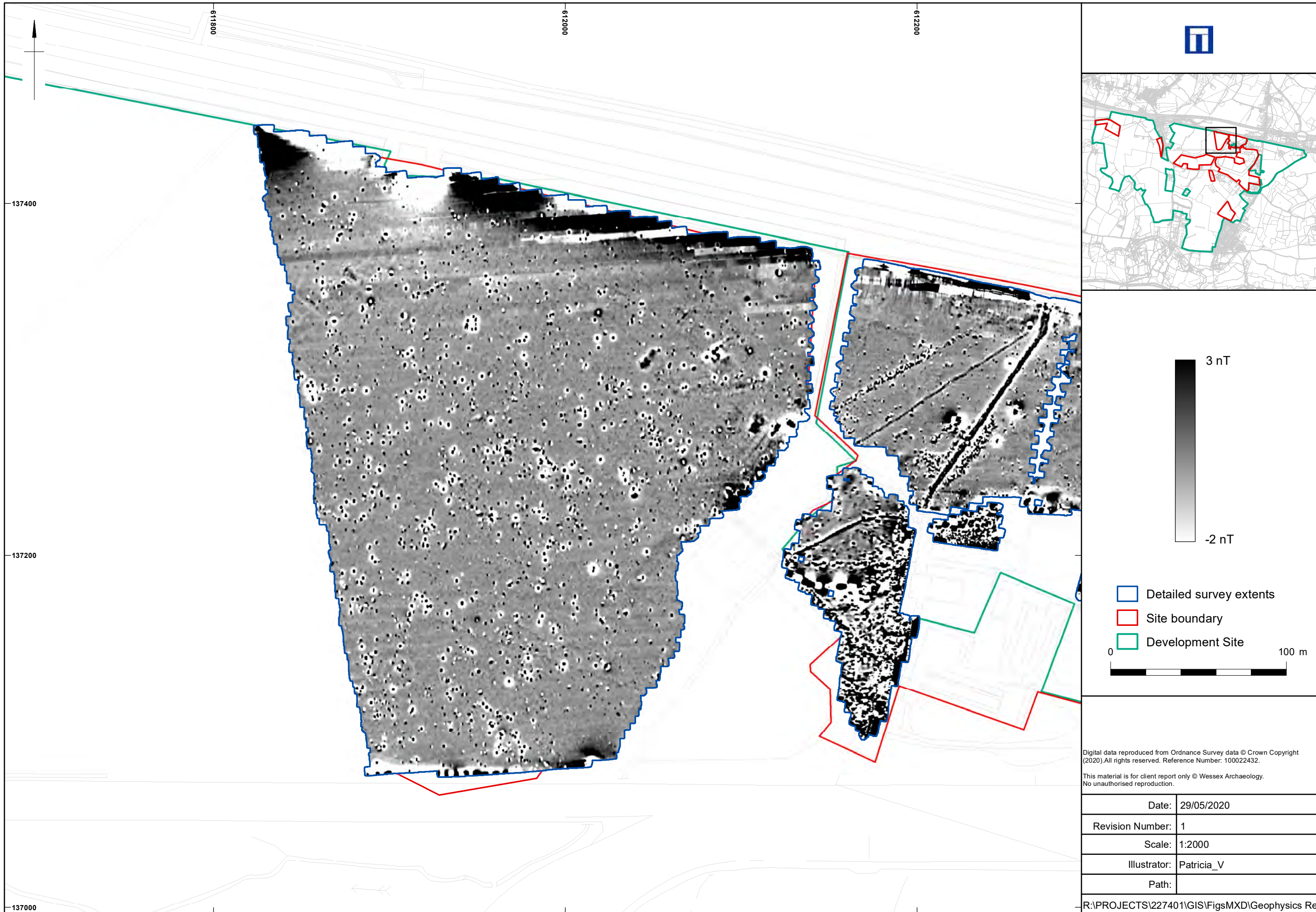


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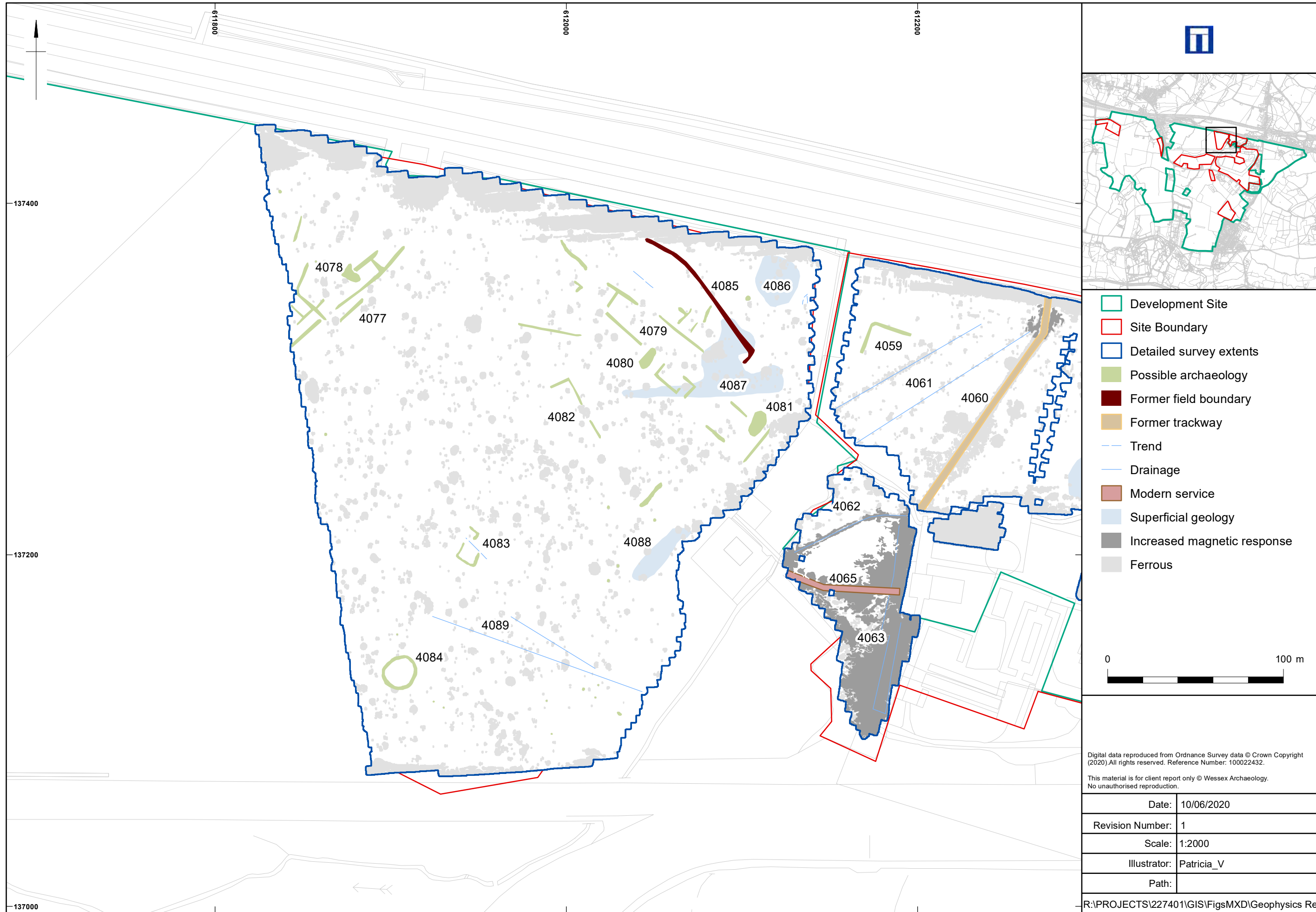
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Detailed gradiometer survey results: Interpretation Area 6

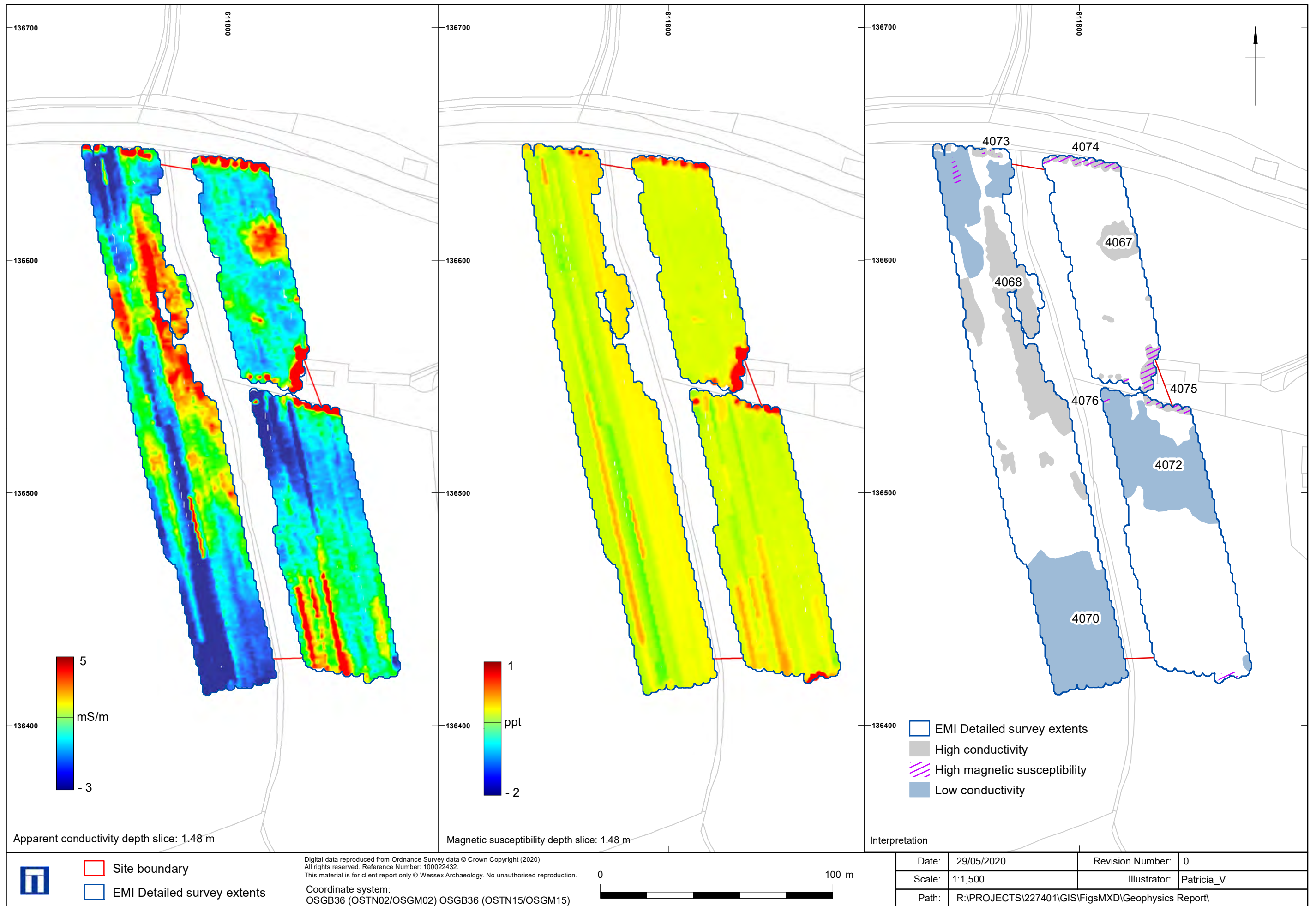


Detailed gradiometer survey results: Greyscale plot Area 8



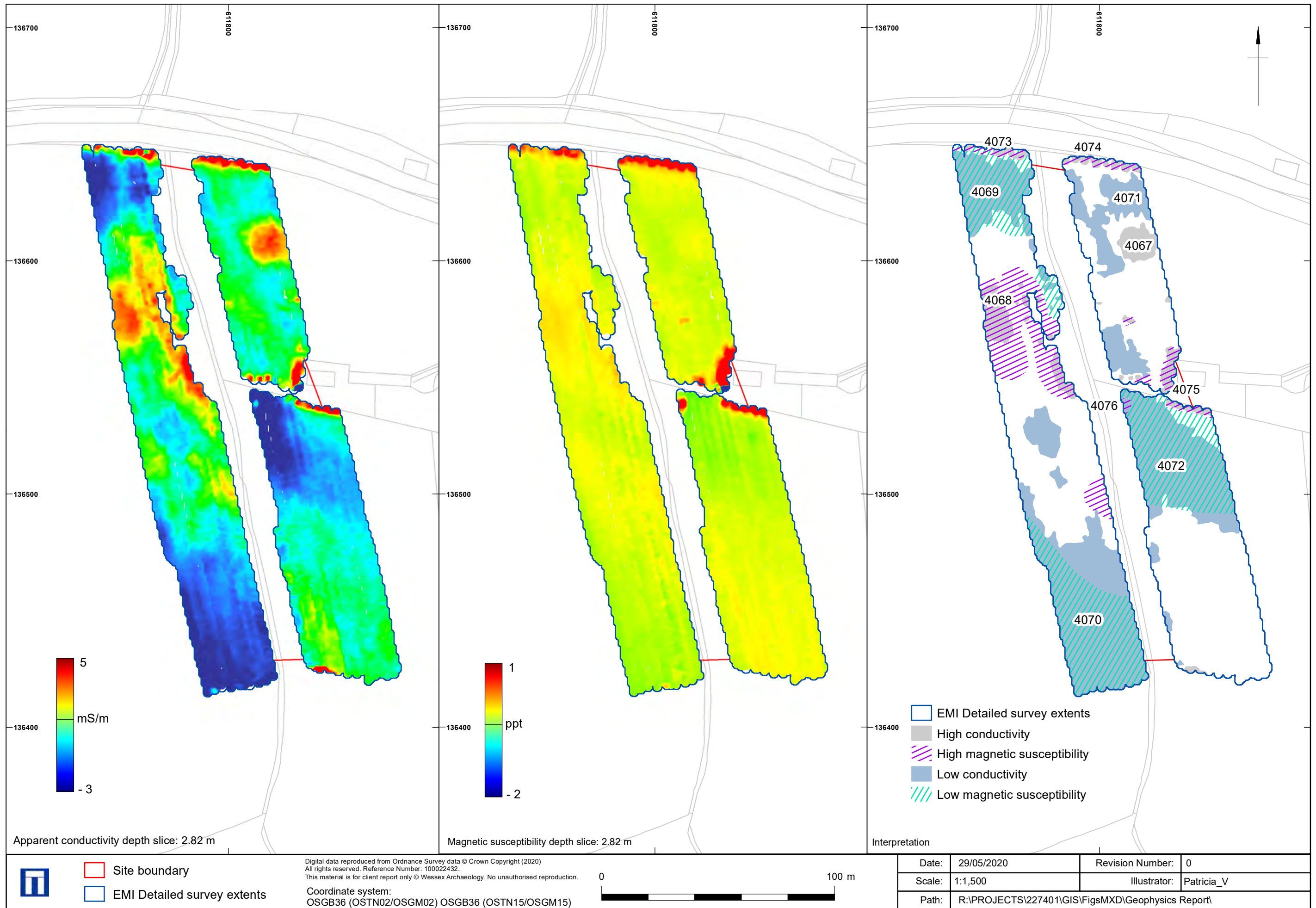
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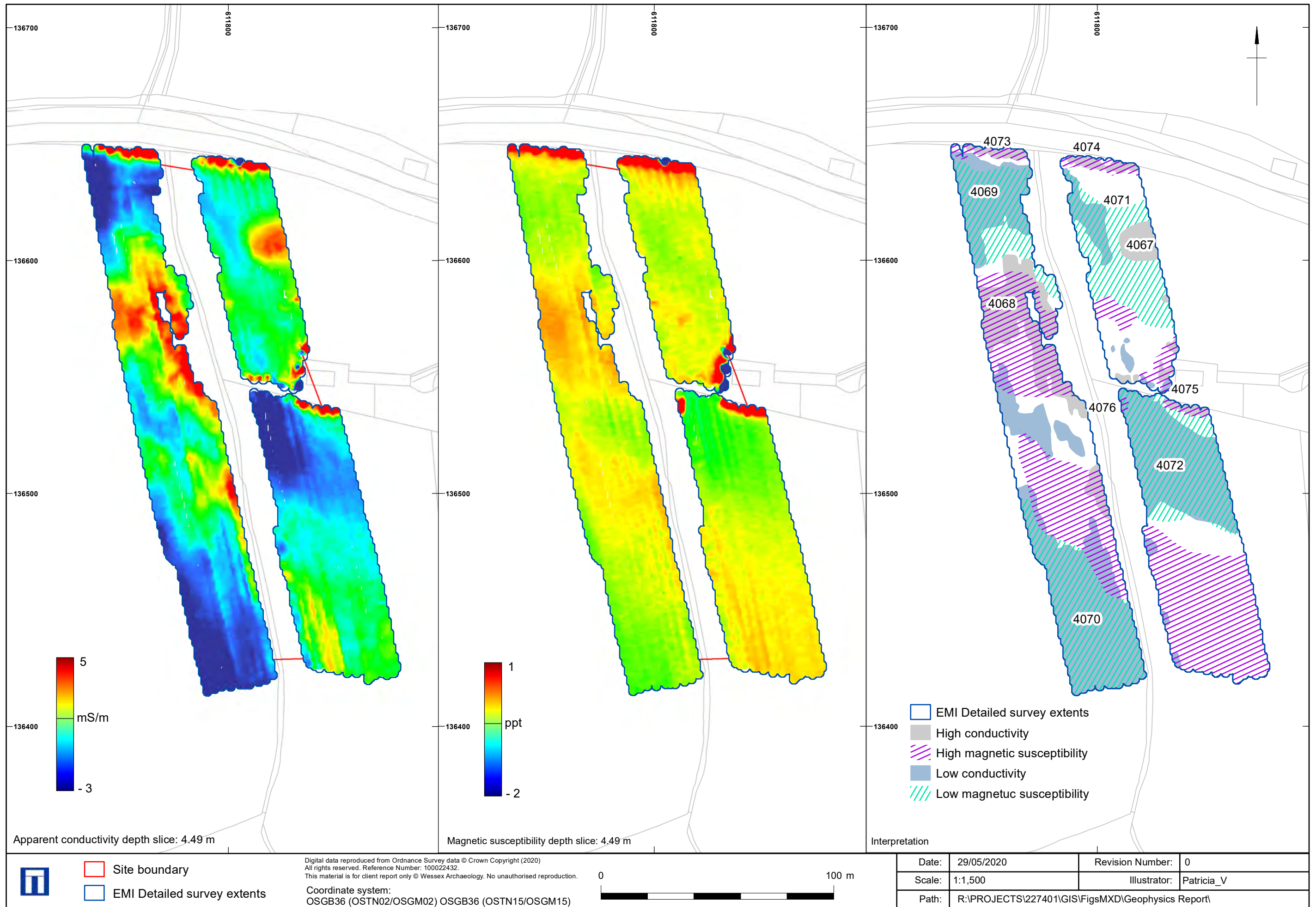
EMI survey results and interpretation: 1.48 m coil separation

Figure 24



EMI survey results and interpretation: 2.82 m coil separation

Figure 25



Apparent conductivity depth slice: 4.49 m

Magnetic susceptibility depth slice: 4.49 m

Interpretation



- Site boundary
- EMI Detailed survey extents

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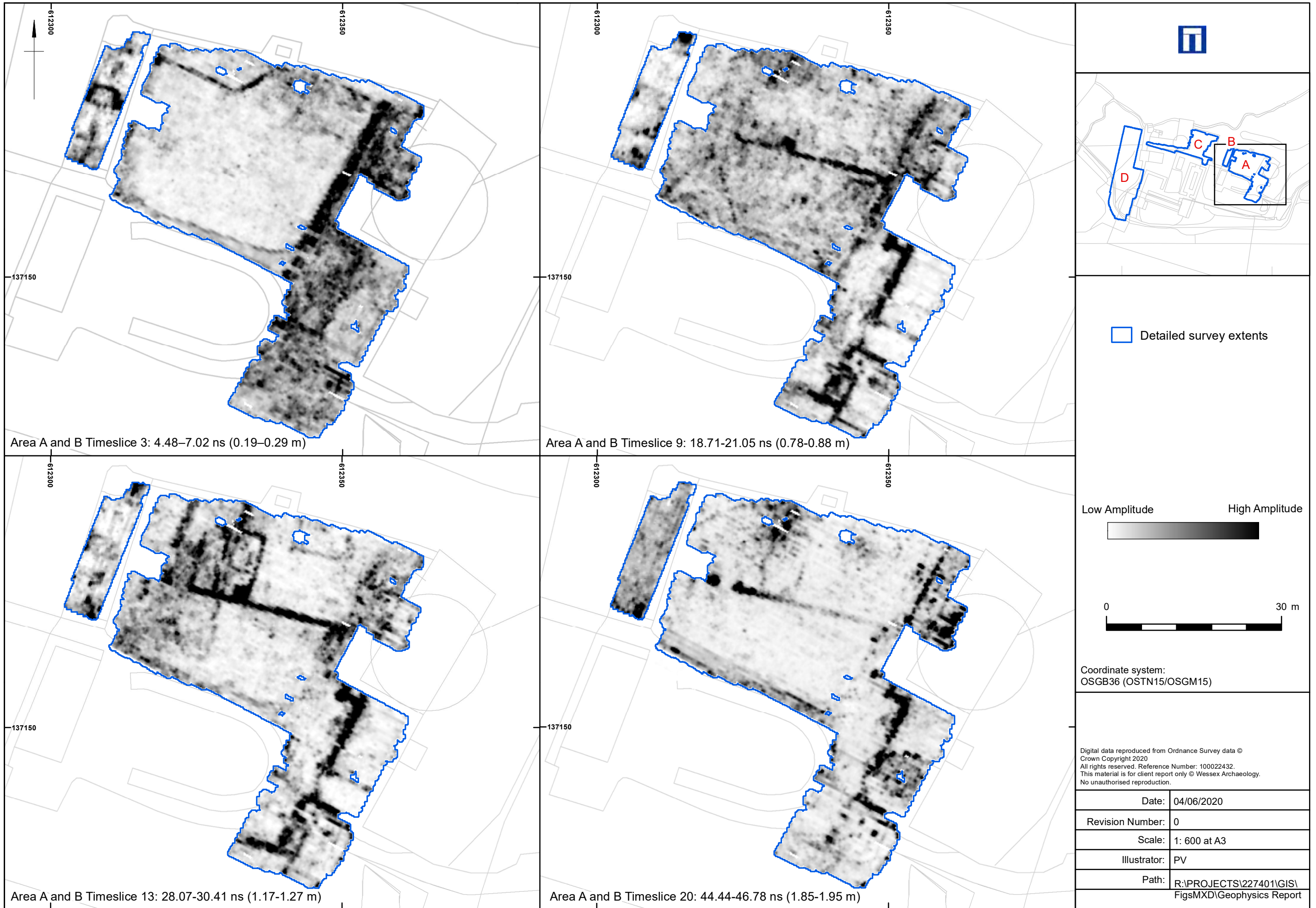
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EMI survey results and interpretation: 4.49 m coil separation

Figure 26



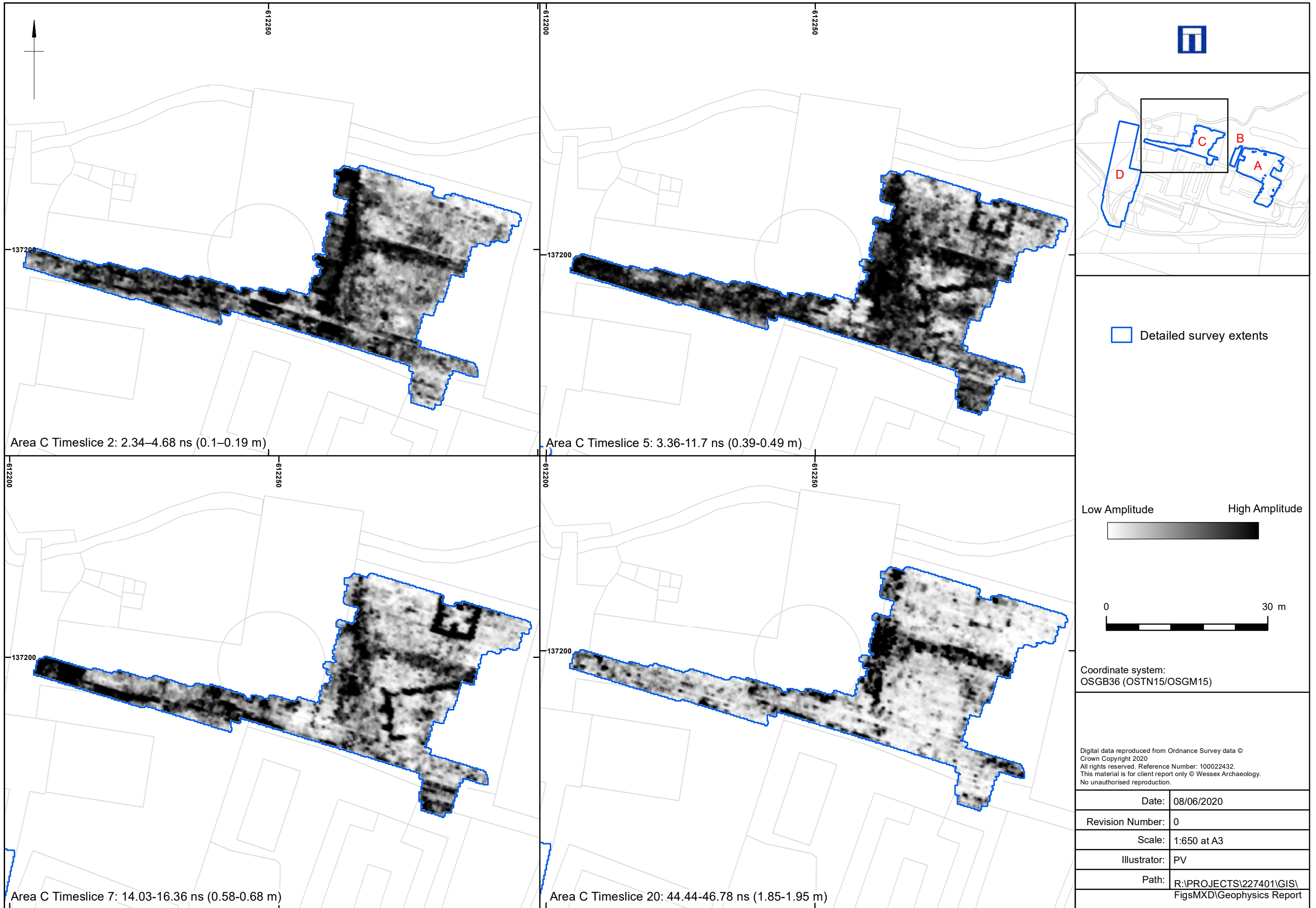
GPR survey Area A and B Timeslice 3, 9, 11 and 20 - Westenhanger Castle

Figure 27



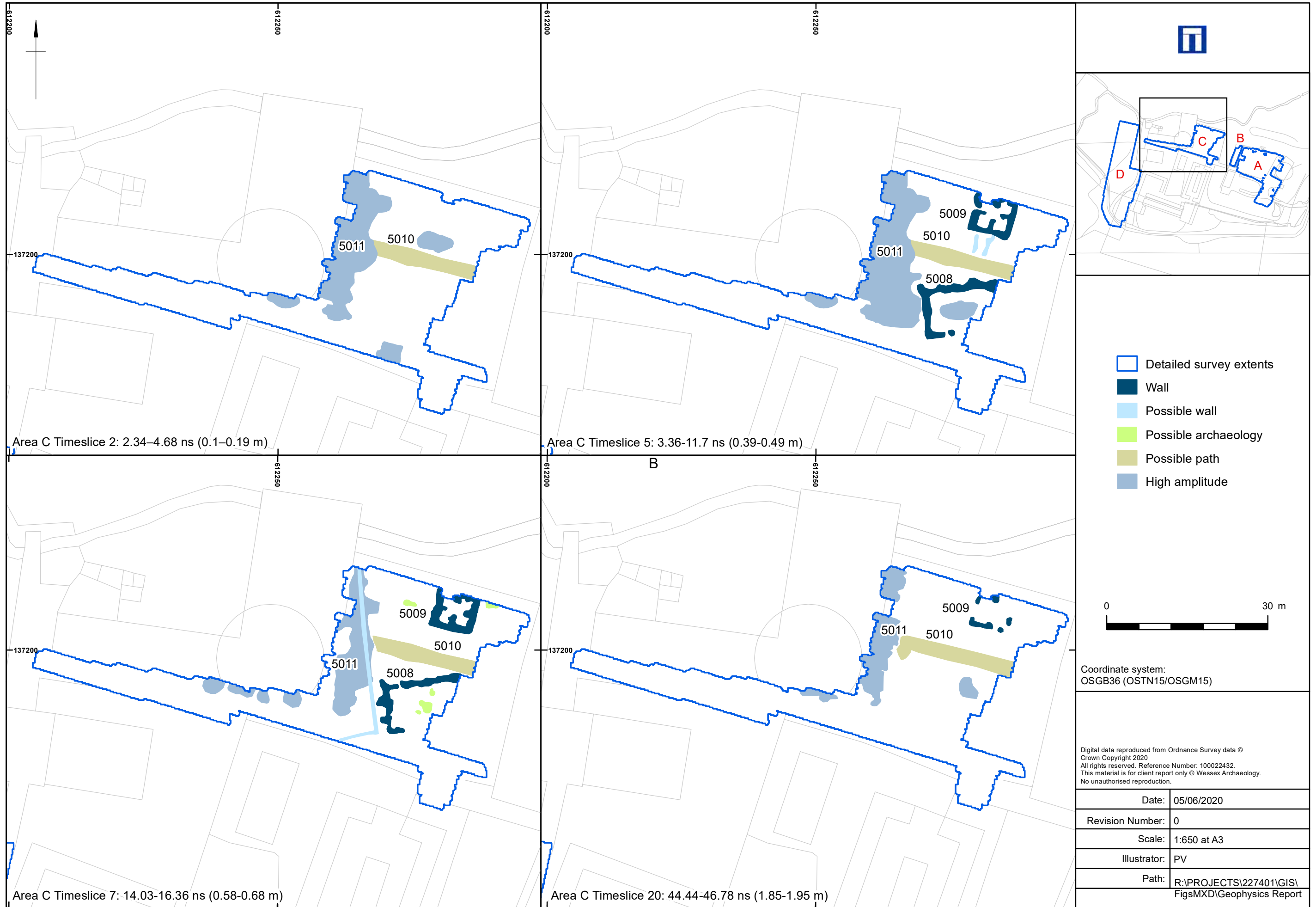
GPR survey Area A and B Timeslice 3, 9, 11 and 20 Interpretation- Westenhanger Castle

Figure 28

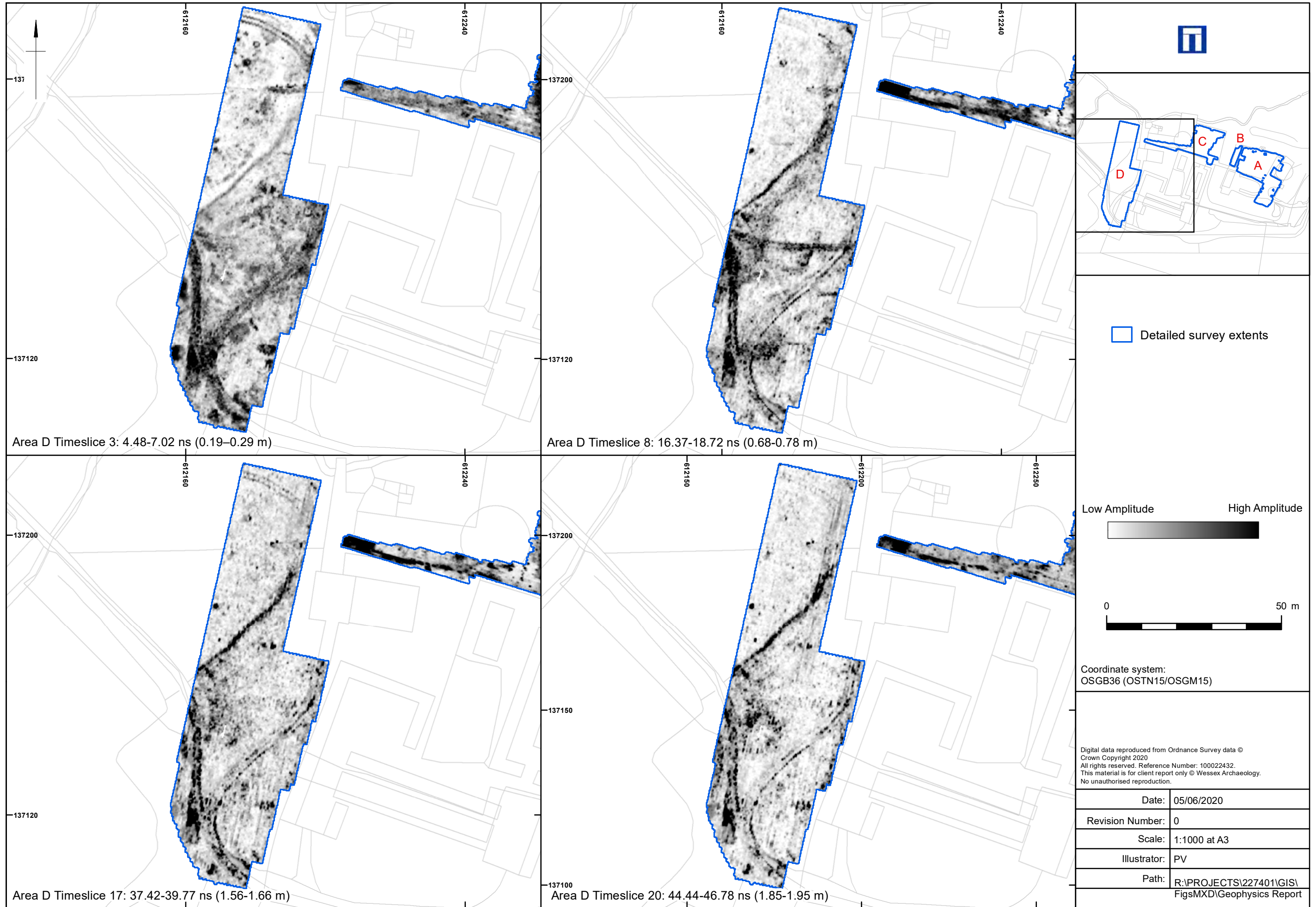


GPR survey Area C Timeslice 5, 10, 17 and 20 - Westenhanger Castle

Figure 29



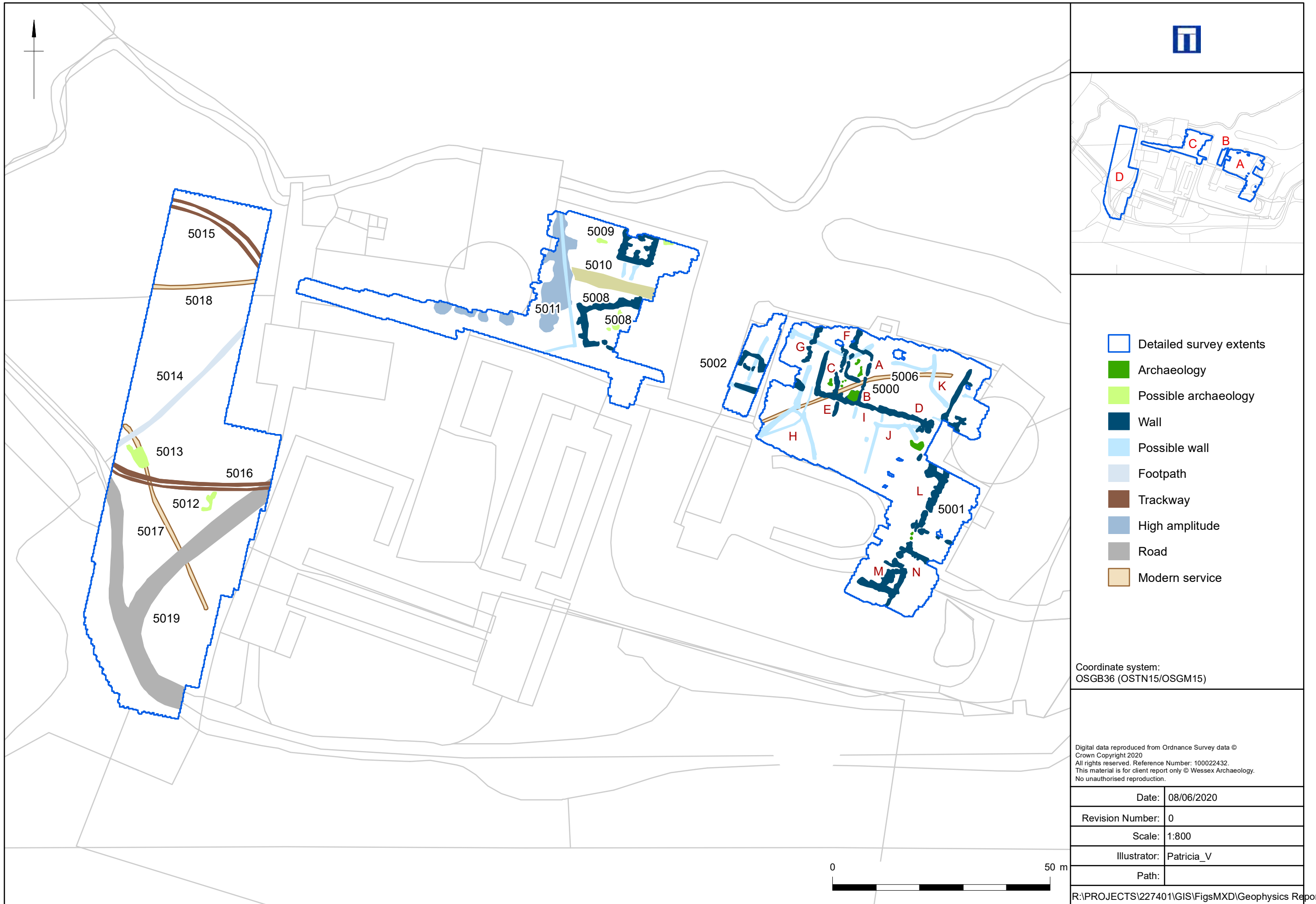
GPR survey Area C Timeslice 5, 10, 17 and 20 Interpretation - Westenhanger Castle



GPR survey Area D Timeslice 3, 8, 17 and 20 - Westenhanger Castle



GPR survey Area D Timeslice 3, 8, 17 and 20 - Westenhanger Castle



GPR Survey Area A - D Combined Interpretation - Westenhanger Castle

Figure 33



Wessex Archaeology Ltd registered office Portway House, Old Sarum Park, Salisbury, Wiltshire SP4 6EB
Tel: 01722 326867 Fax: 01722 337562 info@wessexarch.co.uk www.wessexarch.co.uk

