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Beer Wall – Phase 2 Othery, Somerset

Ground Penetrating Radar Report



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**Beer Wall - Phase 2
Othery, Somerset**

Ground Penetrating Radar Survey Report

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Beer Wall - Phase 2 Othery, Somerset

Ground Penetrating Radar Survey Report

Contents

Summary	iii
Acknowledgements.....	iv
1 INTRODUCTION.....	1
1.1 Project background	1
1.2 Site location and topography	1
1.3 Soils and geology	1
1.4 Archaeological background	2
2 METHODOLOGY.....	4
2.1 Introduction	4
2.2 Method.....	4
3 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION.....	6
3.1 Introduction	6
3.2 Ground Penetrating Radar survey results and interpretation	6
3.3 Modern Services	7
4 CONCLUSION	8
5 REFERENCES.....	9
5.1 Bibliography	9
5.2 Cartographic and documentary sources.....	9
5.3 Online resources	9
APPENDIX 1: SURVEY EQUIPMENT AND DATA PROCESSING.....	10
Survey Methods and Equipment	10
Post-Processing.....	10
APPENDIX 2: GEOPHYSICAL INTERPRETATION.....	12



Figures

- Figure 1 Site location and survey extents
- Figure 2 GPR Profile and Borehole Locations
- Figure 3 GPR Results Southern Field
- Figure 4 GPR Results Southern Field – Interpretation
- Figure 5 GPR Results Northern Field
- Figure 6 GPR Results Northern Field – Interpretation

Tables

- Table 1 - Relative velocity to depth conversion based on a dielectric constant of 61.38..... 5



Beer Wall - Phase 2 Othery, Somerset

Detailed Gradiometer Survey Report

Summary

A ground penetrating radar survey was conducted over land at Beer Wall, Othery, Somerset (centred on NGR 339293 131515). The project was commissioned by the Environment Agency with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features ahead of redevelopment of the land to reduce flooding.

The site comprises arable fields located to the north and south of the A372 Beer road, covering an area of 0.7ha. The geophysical survey was undertaken on 13th-14th July 2015. The ground penetrating radar survey has demonstrated the presence of a number of anomalies of potential archaeological interest in both the north and south fields.

The primary features identified from the radar survey are drainage and agricultural features that are likely to be from the medieval, post-medieval and modern periods. The potential depth penetration of the radar pulse was negatively affected by the geology with a maximum depth of 1.9m being achieved.



Beer Wall - Phase 2, Othery, Somerset

Ground Penetrating Radar Survey Report

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Wessex Archaeology would like to thank the Environment Agency for commissioning the geophysical survey and Skanska for accommodating the field team. The assistance of Liane Persaud is gratefully acknowledged in this regard.

The fieldwork was undertaken by Elizabeth Richley and Jennifer Smith. Elizabeth Richley processed and interpreted the geophysical data and wrote the report. The geophysical work was quality controlled by Dr Paul Baggaley. Illustrations were prepared by Elizabeth Richley. The project was managed on behalf of Wessex Archaeology by Lucy Learmonth.



Beer Wall - Phase 2 Othery, Somerset

Ground Penetrating Radar Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology (WA) was commissioned by The Environment Agency to carry out a geophysical survey at Beer Wall, Othery, Somerset (hereafter “the Site”, centred on NGR 339293 131515) (**Figure 1**). The survey forms part of an ongoing programme of archaeological works being undertaken in support of a redevelopment of the road and flood control at Site.

1.1.2 The aim of the geophysical survey was to establish the presence/absence, extent and character of detectable archaeological remains within the survey area.

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

1.2 Site location and topography

1.2.1 The Site is located to the east of the village of Othery and 5.5km northwest of Langport, in the county of Somerset.

1.2.2 The Site occupies an area of c. 0.7ha of agricultural land, currently utilised for pasture. The Site consists of two areas with two agricultural fields with survey delimited by the survey extents and the Langacre Rhyne floor relief channel. The Beer Road runs between the two survey areas (**Figure 1**)

1.2.3 The Site lies on a very slight incline sloping from 3m aOD at the northern edge to approximately 4m aOD at the southern edge.

1.3 Soils and geology

1.3.1 The solid geology comprises Mudstone of the Merica Mudstone Group with overlying superficial geological deposits of alluvium (BGS 2015).

1.3.2 The soils underlying the Site are likely to consist of deep peat soils of the 1022a (Altcar 1) association (SSEW SE Sheet 5 1983). The presence of peat and alluvium has been confirmed through earlier work undertaken by WA. A series of boreholes were taken in a north-south transect line across the site with the results showing top soil and sub soil forming the first c. 0.6m and then layers of peat from c. 0.5-5 m and estuarine alluvium from c. 5m-10m (WA2014a).

1.3.3 Soils derived from such geological parent material can potentially mask archaeological features from being detected, with the depth and water content of the soils being of particular importance to the success and/or failure of the geophysical survey.



1.4 Archaeological background

- 1.4.1 Prior to this work being undertaken by Wessex Archaeology, an archaeological evaluation and borehole transect programme was undertaken by Wessex Archaeology in 2014. As a part of the archaeological evaluation the Site and its immediate environs were examined for the potential for the survival of buried archaeological remains. A brief summary of this, alongside the results of the archaeological evaluation and the borehole transect programme work is presented below and will be referred to when appropriate in the geophysics results discussion.
- 1.4.2 A limited number of findspots have been recorded 2-4km to the south of the Site, including a Lower Palaeolithic handaxe from the gravels at Oath Hill and a stone axe hammer of Bronze Age date from fields to the west of Aller. Two adjacent ring ditches, possibly the remains of two Bronze Age round barrows, were noted from aerial photographs of Aller Moor. A prehistoric flint scatter and sickle of Iron Age or Romano-British date, and human remains, were also found on Aller Moor. Romano-British remains have been reported from Burrowbridge, approximately 3km to the south-west, including a large number of coins and several sherds of late Romano-British pottery.
- 1.4.3 Further afield, extensive waterlogged remains of international importance have been excavated c. 11-13km to the north east of the Site. These comprise a Neolithic trackway known as the Sweet Track, and the Iron Age Lake Villages at Glastonbury and Meare.
- 1.4.4 An Anglo-Saxon causeway, known as Burrow Wall, is located between Burrowbridge and Othery. Burrow Mump, an outcrop of Keuper Marl and site of St Michael's Church, is also located at Burrowbridge. Initially constructed during the 13th century, with additions in the 14th–16th centuries, the church was extensively restored in the middle of the 19th century.
- 1.4.5 Beer Wall is recorded on the HER for Somerset as Site No. 32364, and is located across the parishes of Othery and Aller. Built in the 13th century, it was designed to protect Aller Moors from flooding. A watching brief carried out in 2013 identified that the wall had been built along the line of an alluvial-filled channel. Stakes discovered in the upper silts of the channel were thought to be associated with the construction of the wall.
- 1.4.6 Other monuments in the area relate to medieval and post-medieval settlement and agriculture, predominantly houses and farm buildings.
- 1.4.7 Previous work undertaken by WA was part of a development project designed to improve the conveyance of water beneath the A372 road involving the construction of culverts beneath the road and the lowering of the adjacent ground. Archaeological investigations comprised the excavation of four stepped trial trenches which attempted to locate the wall and six boreholes arranged either side of the A372 which aimed to locate the relict river channel (WA2014).
- 1.4.8 No traces of the Beer Wall, or any associated structures were identified within the footprint of the four evaluation trenches and it is possible the course of the wall falls beneath the current line of the A372. The trenches revealed deposits associated with possible road construction and water management in the form of ditches and banks.
- 1.4.9 Laminated peat sequences were recorded in the trenches and boreholes though no dating material was recovered to provide a date for the formation of these deposits. Material could be extracted from these peat deposits for radiocarbon dating and a range of



palaeoenvironmental techniques undertaken; however these deposits do not warrant further investigation due to the lack of associated archaeological remains at this location.



2 METHODOLOGY

2.1 Introduction

- 2.1.1 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team between the 13th and 14th July 2015. The survey was conducted in accordance with English Heritage guidelines (English Heritage 2008).
- 2.1.2 The field conditions varied between the northern and southern areas. The north field provided the best conditions for geophysical survey with topographically unchanging grass land. The south field however contained large clumps of sedge grass that made survey conditions difficult particularly with maintaining constant coupling between the antenna and the ground surface. Day 1 of the survey was largely dry with some rain whilst day 2 was dry with warm temperatures. As a result of the changing temperature and moisture levels it was expected that there would be some amplitude changes in the radar results. An overall coverage of 0.7ha was achieved.

2.2 Method

- 2.2.1 Individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (2008).
- 2.2.2 The presence of peat and alluvium to a considerable depth at the site advocated the use of ground penetrating radar at Beer Wall. However, it must be noted that deposits of alluvium and peat, particularly with high water content can negatively affect the success and/or failure of a radar survey with the signal being attenuated and little to no reflection data returning to the radar receiver.
- 2.2.3 The ground penetrating radar survey was conducted using a GSSI SIR 3000 with 400 MHz antenna mounted on a tricycle cart with odometer to record horizontal distances. Data were collected at 60scans per unit (1 unit = 1 meter) along traverses spaced 0.5m apart with an effective time window of 110ns. The GPR survey was undertaken in accordance with English Heritage guidelines (2008) and data were collected in the zigzag method.
- 2.2.4 Subsurface radar-wave velocity was determined by migration calculations based upon hyperbole matching within the processing software. The resulting average velocity of radar pulses was 0.038 m/ns, and a relative dielectric constant value of 62.33 was calculated. This value is consistent with average values reported for peat materials which range from 52.4-70.4 (Slater and Reeve 2002) and enabled approximate depth conversions (**Table 1**). The sampling time window was 110ns which provides a maximum depth of 1.9m assuming that the dielectric constant remains constant with depth.
- 2.2.5 Data from the survey was subject to common radar correction processes. These comprise an amplitude and wobble correction of the radar profile to correct for variance in temperature and soil moisture content, background and band pass 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 survey. These steps were applied on the both datasets collected at the Site.
- 2.2.6 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix 1**.



Table 1 - Relative velocity to depth conversion based on a dielectric constant of 61.38

Time Slice	Time (ns)	Depth (cm)
1	0-6	0-11
2	5-11	9-21
3	10-16	19-30
4	15-21	29-40
5	20-26	38-49
6	25-31	47-59
7	30-36	57-68
8	35-41	66-78
9	40-46	76-87
10	45-51	85-97
11	50-56	95-106
12	55-61	104-116
13	60-66	113-125
14	65-71	123-135
15	70-76	133-144
16	75-81	142-153
17	80-86	151-163
18	85-91	161-172
19	90-96	171-182
20	95-99	180-189



3 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION

3.1 Introduction

- 3.1.1 The ground penetrating radar survey has identified several point reflectors and linear responses across the Site along with anomalous areas of high and low amplitude reflections. Results are presented as a series of greyscale plots and archaeological interpretations at a scale of 1:1000 (**Figures 3 to 6**) with black representing high amplitude responses and white relating to low amplitude responses.
- 3.1.2 The interpretation of the datasets highlights the presence of potential archaeological anomalies, interpreted agricultural features and anomalous areas of high or low amplitude responses (**Figure 4**). Full definitions of the interpretation terms used in this report are provided in **Appendix 2**.
- 3.1.3 Numerous point reflector 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.
- 3.1.4 It should be noted the small, waterlogged features may produce responses that are below the detection threshold of the radar, in particular in the presence of deeply stratified peat and alluvium. It may therefore be the case that more archaeological features may be present than have been identified through geophysical survey.

3.2 Ground Penetrating Radar survey results and interpretation

- 3.2.1 Two areas were surveyed at the Site by ground penetrating radar, one to the south and the other to the north of the A372 Beer Wall Road.
- 3.2.2 In the Southern area a large, high amplitude response **4000** can be seen crossing the survey area from the northeast – southwest. Similar in response are **4001** and **4001**, these cross the area perpendicular to **4000** on a northwest – southeast alignment and may be related to **4000**. It is possible that **4003** also represents an associated feature as it lies on a similar alignment to **4000**. These have been interpreted as agricultural in origin possibly representing an agricultural trackway or boundary. It is possible to map these features throughout the dataset, and are still visible in time slice 17 (**Figure 4**) at an approximate depth of 1.9m and are most likely due to compaction or an infilled ditch. During field work a depression was noted crossing the site which corresponds with **4000** and was initially interpreted as a trackway however the possible association of **4001-4003**, would not support this interpretation.
- 3.2.3 Across the southern field and throughout the time slices various linear responses are visible. At **4004**, in time slice 2 (c. 9-21cm) a series of linear response are visible that run parallel to a site boundary. These have been interpreted as agricultural and correspond to tractor furrows that could be seen on the surface.
- 3.2.4 At an approximate depth of between 38 and 49cm, time slice 5 (**Figure 4**) further linear trends have been identified (**4005-4007**) and have been tentatively interpreted as agricultural. Further trends can be seen but it is not possible to identify them without further investigation. At the same depth several high amplitude responses are visible in the southern part of this area, **4008**. It is possible that these are related to the surface conditions encountered at the time of survey.



- 3.2.5 In time slice 11 of the southern area (c.151-1643cm) further linear response are visible and an area of disturbance **4009** which is likely to be natural in occurrence and related to pass flooding causing changes in the dielectric constant in this area.
- 3.2.6 Similarly to time slice 11, time slice 14 shows several linear responses of uncertain origin (**4010**) in the southern area however a high amplitude response has been identified at **4011**, this may be related to feature **4000**, initially identified in time slice 2 a possible identification of this would need further investigation.
- 3.2.7 The northern area shows clear linear responses on a northeast – southwest alignment that run parallel to the Langacre Rhyne floor relief channel (**Figure 6** - features **4011** and **4012**, **Figure 6**. These correspond to linear features that can be seen in aerial imagery (Google Earth 2015) and have been interpreted as field drains. This configuration of drain is common in this area and has been documented at other sites that WA has worked on (c.f. WA 2012). These features are visible from slice 2 (c.9-21cm) to the penetration extents of the radar (c.189cm). Small linear responses, on the same alignment can be seen in slice 2 – **4013** and are likely to be agricultural in origin.
- 3.2.8 Slice 5 (c. 38-49cm depth) from the northern area shows the drainage features noted in slice 2 and also the smaller linear responses. Further to these responses a linear trend **4014** can be seen that crosses the area on a perpendicular alignment to **4011-4013**. It is not possible to identify this feature however due to the context of these responses it is tentatively interpreted as agricultural. High amplitude responses **4015** and **4016** are likely to represent pit type features or areas of compression.
- 3.2.9 A series of linear responses at **4017** have been interpreted as agricultural and may represent a series of plough lines. A number of high amplitude responses have been identified along the western edge of the northern survey area (**4018**). These features lie on the edge of the flood relief channel and may relate to the construction of this waterway.

3.3 Modern Services

- 3.3.1 There were no modern services detected within the survey area. 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 CONCLUSION

- 4.1.1 The ground penetrating radar survey has been successful in detecting anomalies in both the north and south fields however the potential depth penetration of the radar has been adversely affected by the geology at the Site.
- 4.1.2 The anomalies of archaeological interest are drainage and ditch-like features. Features identified in the northern field are likely to represent former drainage whilst the southern field presents evidence for agricultural practices.
- 4.1.3 Frequent agricultural linear anomalies and unidentifiable trends are visible across the Site on differing alignments. This is likely due to variable boundaries and different farming processes but these are likely to be medieval, post-medieval and modern in provenance.
- 4.1.4 The quality and quantity of Neolithic (and Bronze age) waterlogged archaeological remains within Somerset is noted to be very high despite only a small proportion of the Somerset wetlands having been archaeological investigated (Brunning 2000). This area of Somerset is categorised by its stratigraphy and topography; largely flat with deep set deposits of estuarine alluvium and peat and prone to flooding due to its low lying nature (c. 2-5m OD). Work done by WA approximately 20 miles north east encountered similar conditions at Steart Point (WA 2011). The habitation levels varied with some (those carbon dated to the Neolithic) covered by some 2-5m of peat and estuarine alluvium. As such it is possible that the archaeology at the Site is underrepresented in the radar data with archaeological deposits existing beneath the depth of investigation achieved by the GPR survey.



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5.2 Cartographic and documentary sources

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GoogleEarth 2015

5.3 Online resources

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British Geological Survey, <http://www.bgs.ac.uk> [accessed July 2015]



APPENDIX 1: SURVEY EQUIPMENT AND DATA PROCESSING

Survey Methods and Equipment

The ground penetrating radar (GPR) data were collected using a cart-based shielded antennae with central frequencies 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 c. 2.5m with the GPR signal having a velocity of approximately 0.1m/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 the 300MHz antenna, features of the order of 0.05m 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 0.5m 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 0.05m between traces is collected for all surveys.

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 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:

- 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;
- Bandpass – Removes GPR data lying outside a specified range, which removes high- and low-frequency noise.
- Background - is used to remove banding noises that are seen across the radargrams.
- XYZ Mean line – removes mosaic effects from day to day survey

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 colour scale with red indicating high amplitude and blue 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 2: 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:

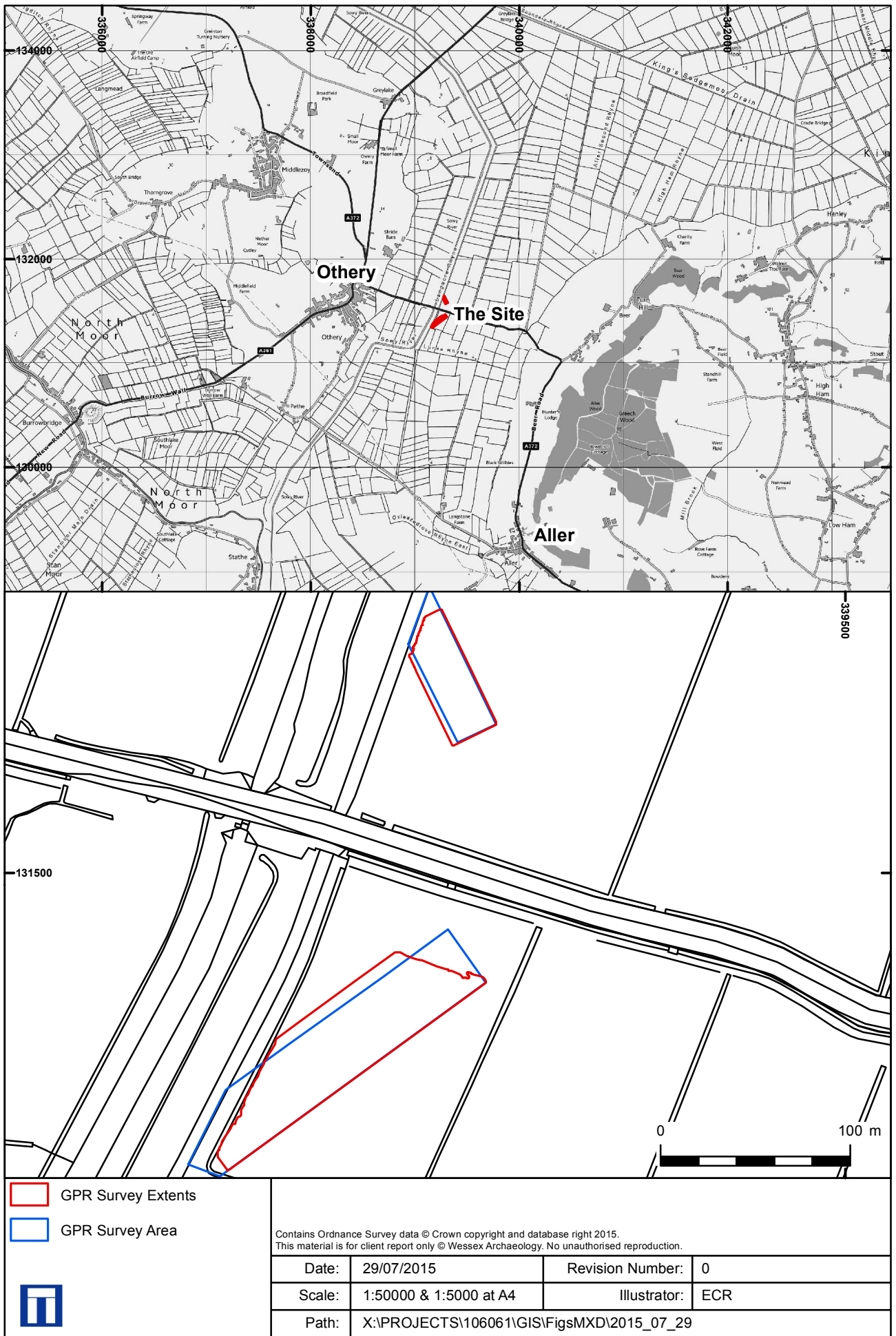
- Archaeology – used when there is a clear geophysical response and anthropogenic pattern.
- Probable archaeology – used for features which give a clear response but which form incomplete patterns.
- Possible archaeology – used for features which give a response but which form no discernible pattern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

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.
- Agricultural ditches – used for ditch sections that are aligned parallel to existing boundaries and former field boundaries that are not considered to be of archaeological significance.
- 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.

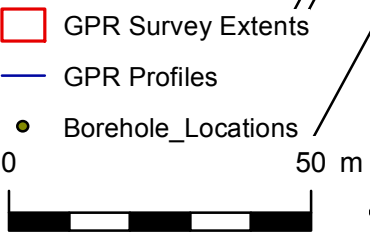
The uncertain origin/geological category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:

- 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.



Site Location and detailed survey extents

Figure 1



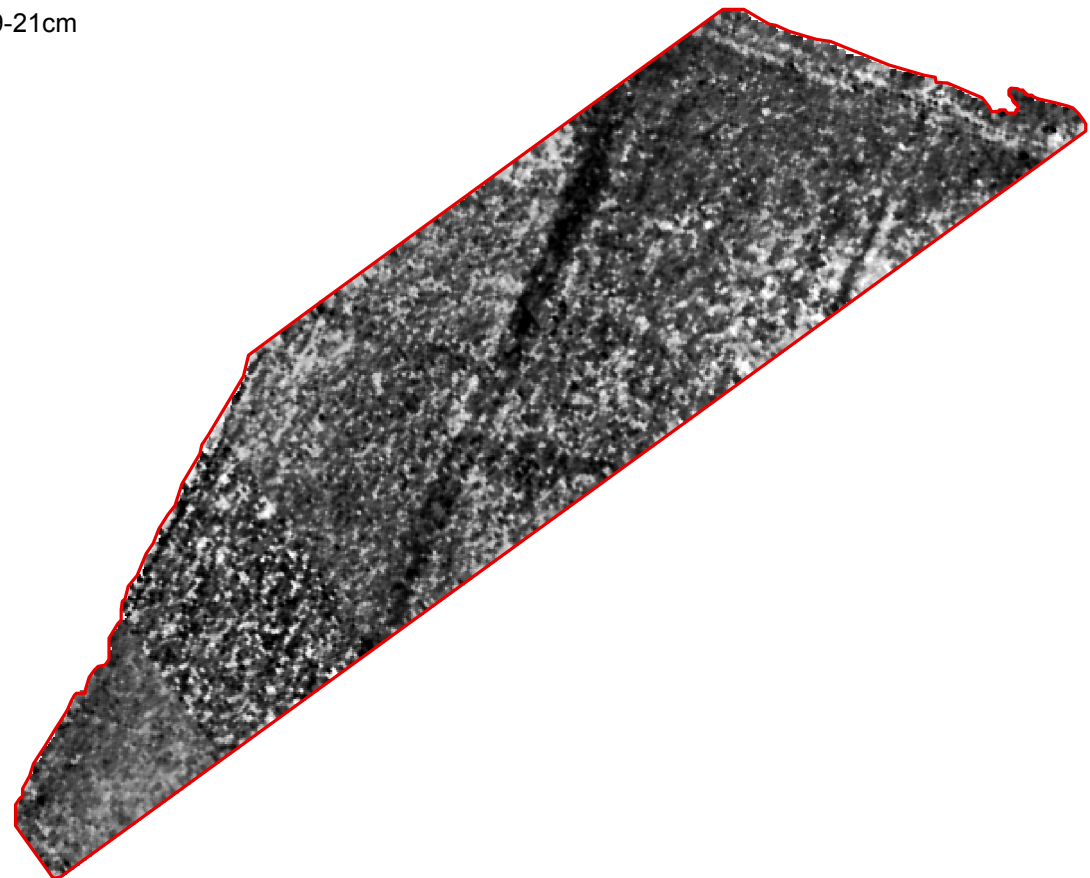
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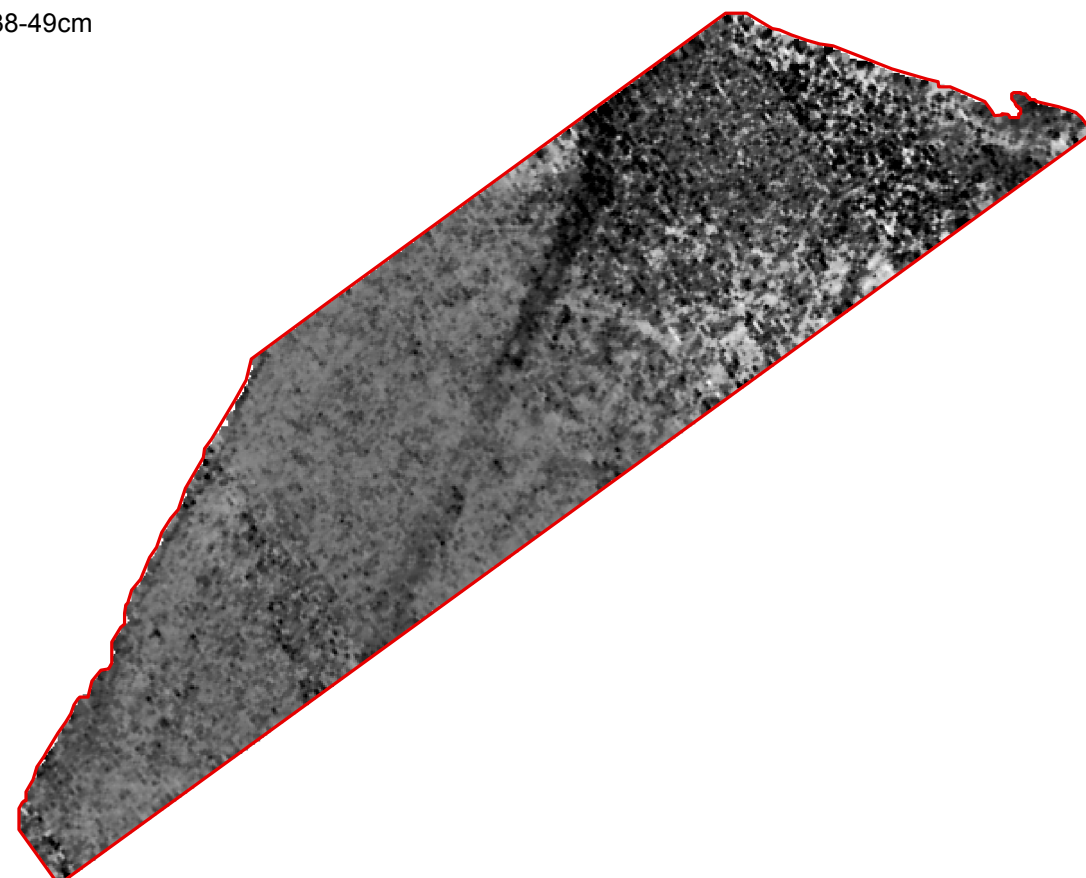
GPR Profile and Borehole Locations

Figure 2

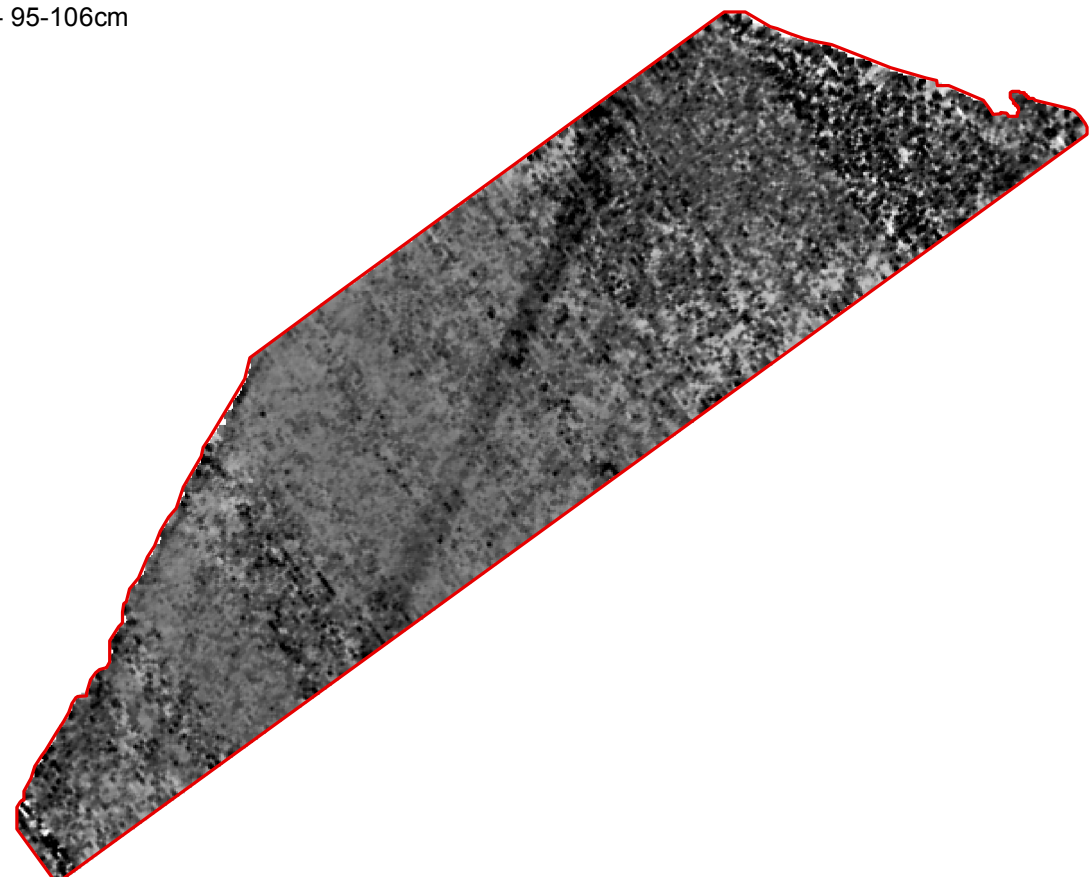
Time Slice 2 - 9-21cm



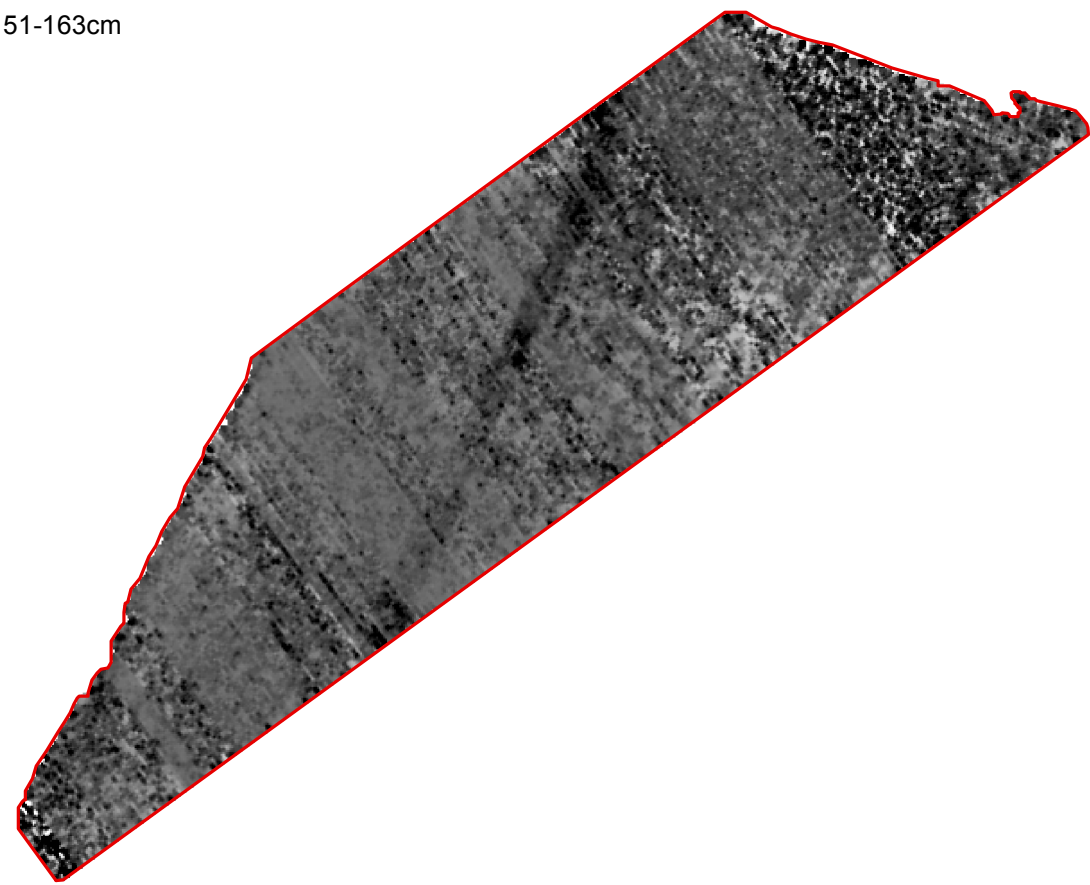
Time Slice 5 - 38-49cm



Time Slice 11 - 95-106cm



Time Slice 17 - 151-163cm

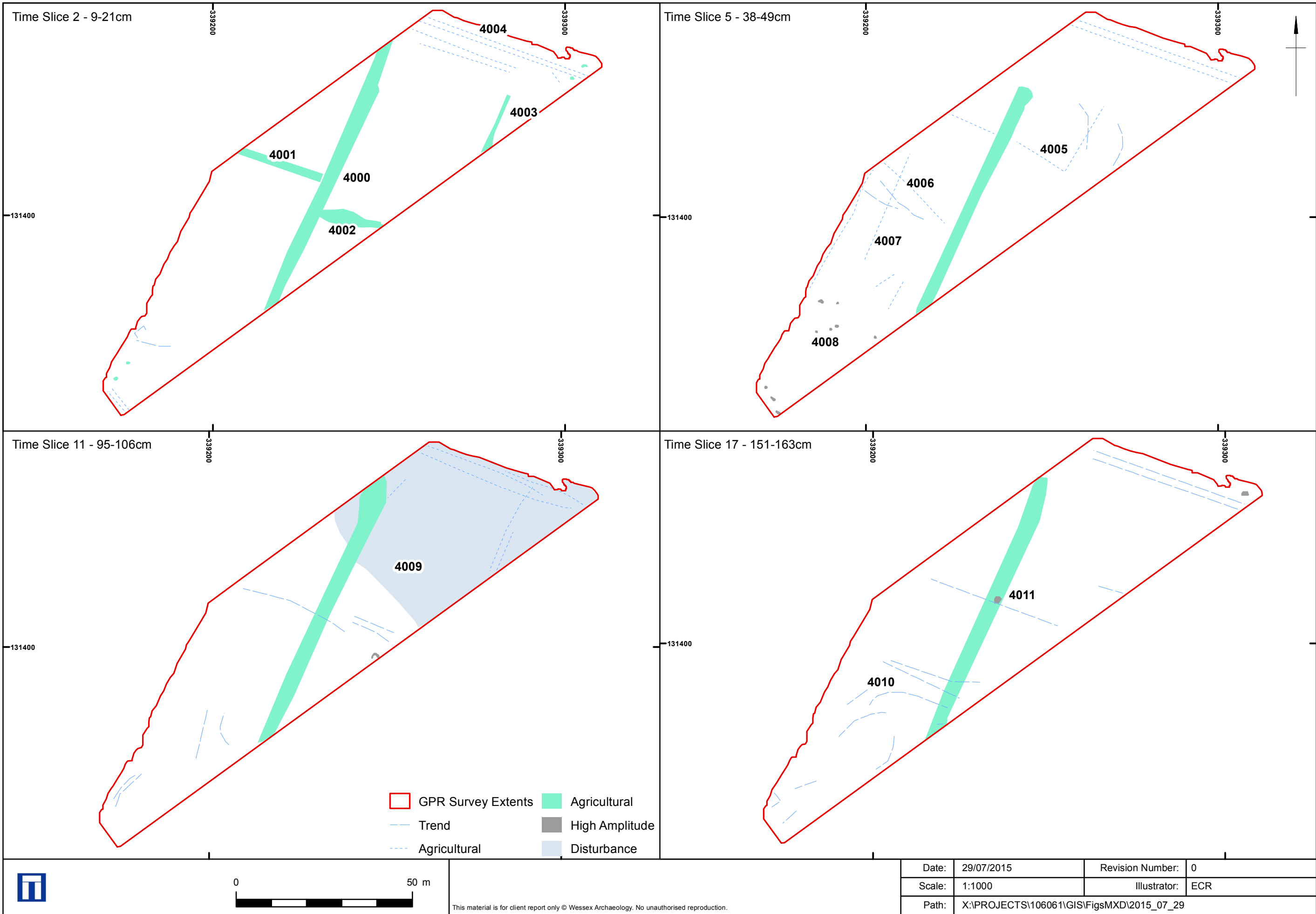


GPR Survey Extents

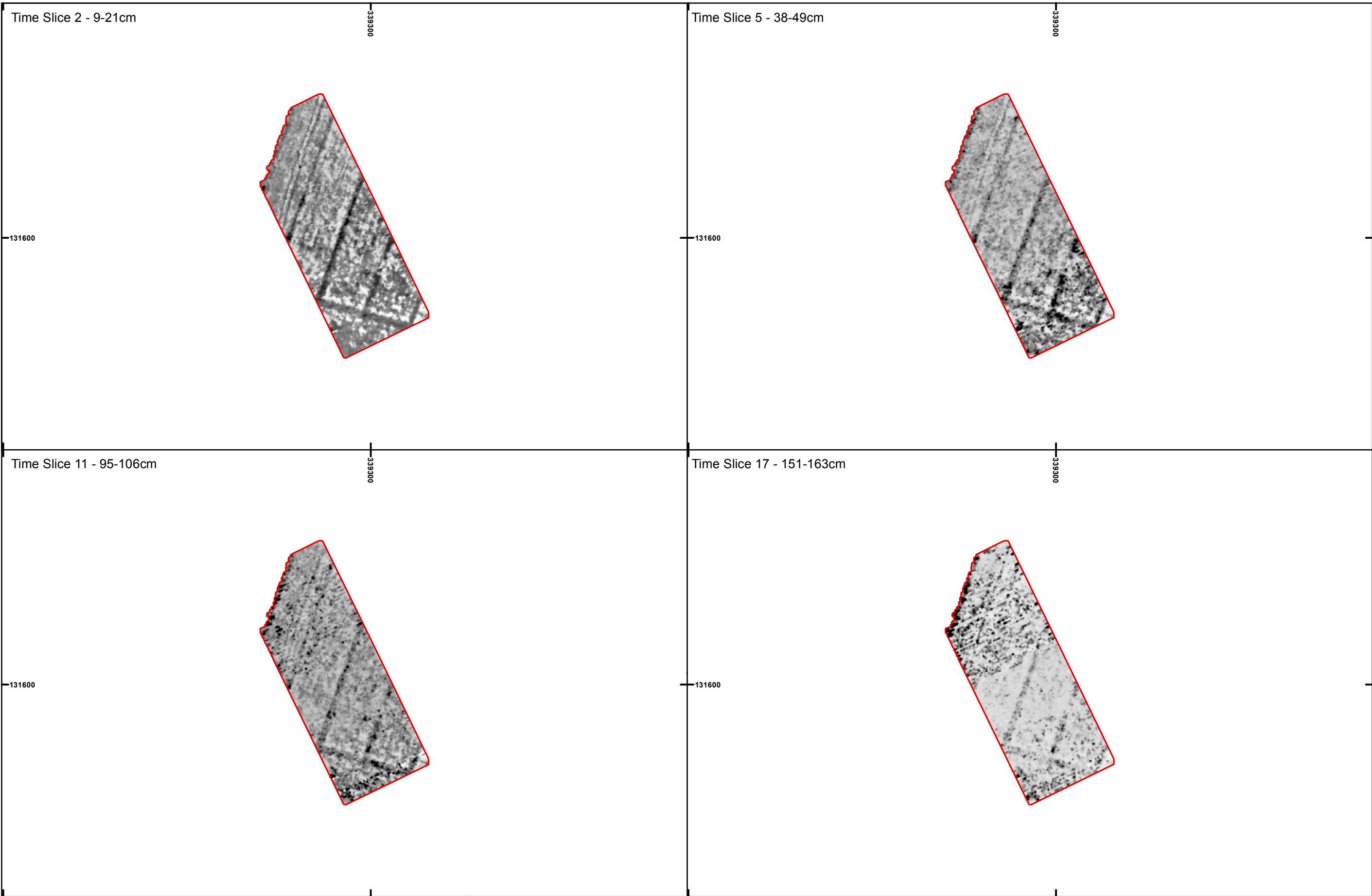






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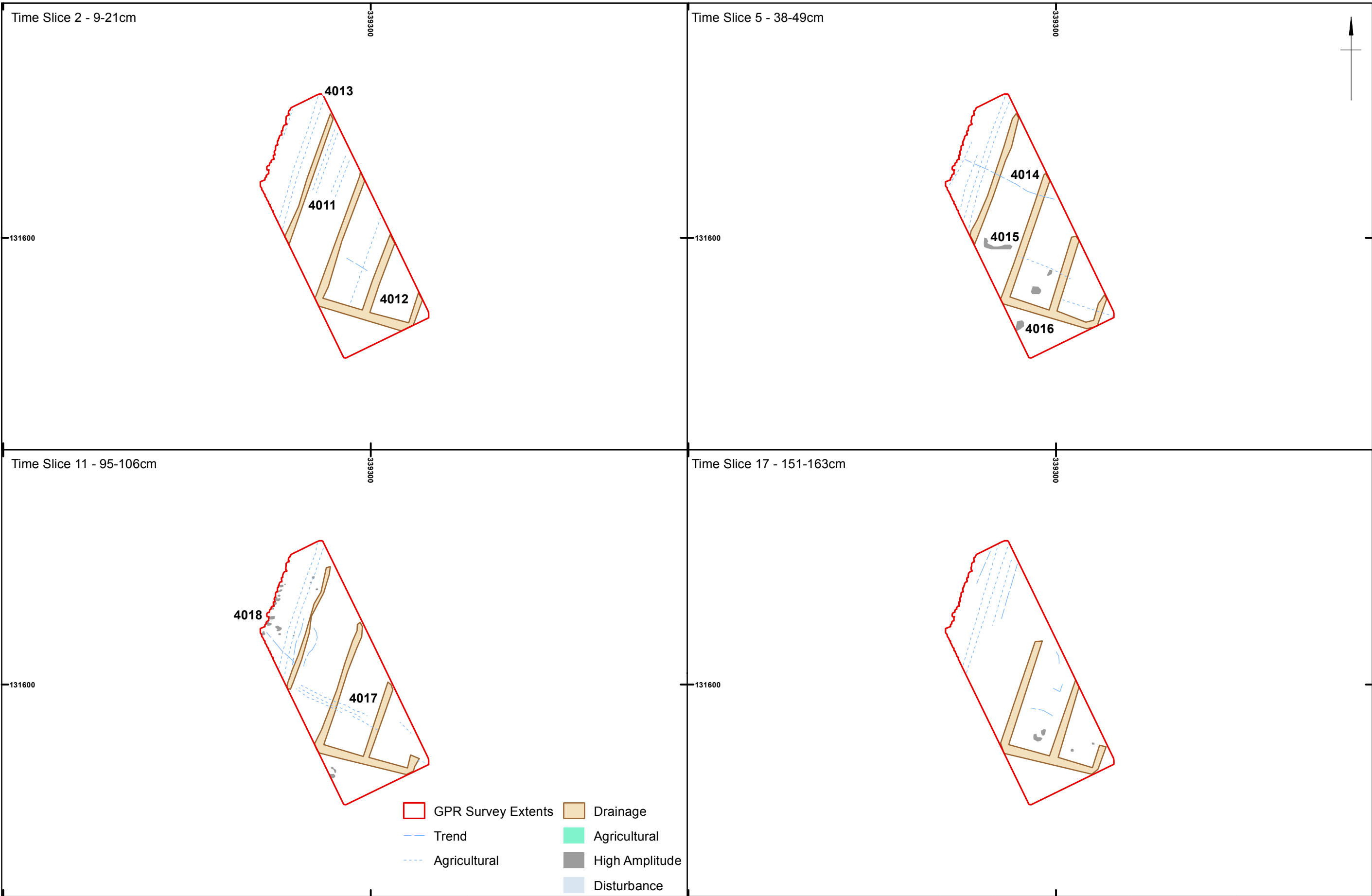
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