Prestonpans, East Lothian

Archaeological Geophysical Survey Report

National Grid Reference Number: 339122,674524

AOC Project No: 22739

Date: June 2014

AOC Archaeology Group

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Prestonpans, East Lothian
Archaeological Geophysical Survey Report

On Behalf of: Holly Scott
79 Harlawhill Gardens
Prestonpans
EH32 9JH

National Grid References (NGR): 339122,674524

AOC Project No: 22739

Prepared by: Alice James

Research: Martin Cook

Illustration by: Alice James

Date: June 2014

This document has been prepared in accordance with AOC standard operating procedures.

Author: Alice James	**Date: June 2014**
Approved by: Graeme Cavers	**Date: June 2014**
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Enquiries to: AOC Archaeology Group
The Raylor Centre
James Street
York
YO10 3DW

Tel. 01904 413404
Fax. 01904 430303
e-mail. york@aocarchaeology.com

www.aocarchaeology.com

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Non-Technical Summary

AOC Archaeology Group was commissioned by Holly Scott to undertake an archaeological geophysical survey in order to provide a record of the potential buried archaeological remains at 79 Harlawhill Gardens, Prestonpans, East Lothian. In particular, the survey aimed to identify whether a mineshaft was present in the area directly surrounding 79 Harlawhill Gardens.

The site is located in the north-east of the small town of Prestonpans (National Grid Reference: 339122, 674524*), which is approximately 20km to the north-east of Edinburgh.*

Ground penetrating radar (GPR) survey was undertaken in the garden of 79 Harlawhill Gardens and the area immediately surrounding it and covered an area of approximately 0.2Ha. The survey detected a number of anomalies which may relate to archaeological remains, but failed to conclusively locate any significant archaeological features.

1 Introduction

1.1 AOC Archaeology Group was commissioned by Holly Scott to undertake a geophysical survey at 79 Harlawhill Gardens, Prestonpans, East Lothian as part of a wider scheme of archaeological evaluation, in advance of the proposed housing extension to 79 Harlawhill Garden.

1.2 The survey was carried out to provide information on the extent and significance of potential buried archaeological remains and establish whether a mineshaft existed in the garden of 79 Harlawhill Gardens or the area immediately surrounding the garden.

2 Site Location and Description

2.1 The site is located towards the north-east of the small town of Prestonpans, East Lothian. Prestonpans is approximately 20km to the north-east of Edinburgh (National Grid Reference: 339122 674524).

2.2 The survey utilised ground penetrating radar (GPR) geophysical technique and covered a total area of approximately 0.2ha. The survey area included a road and three adjacent gardens and was dived into three areas: Area A (the road immediately surrounding 79 Harlawhill Gardens), Area B (the gardens of 79 and 78 Harlawhill Gardens) and Area C (the garden of 78 Harlawhill Gardens).

2.3 The natural topography is fairly even, with the site lying around 15m AOD.

2.4 Several areas of modern disturbances were present across the survey area, including utilities and drain covers and the location of these modern features was noted during data collection to aid in the interpretation stages. Modern metallic objects, such as drain covers and metal pipes can be problematic in GPR surveys as the electromagnetic properties of metallic objects causes ringing that can mask potential archaeological features. In particular, drain covers create 'noise' within the data set, which appears from the ground surface and can conceal any potential archaeological remains buried beneath the drain.

3 Geology and Soils

3.1 The bedrock geology within the site comprises of Limestone Coal Formation – Sedimentary Rock Cycles, Clackmannan Group (BGS 2014).

3.2 GPR surveys can be effected by the water content of the soil, whereby a high moisture content can result in the attenuation of the signal as the increased water content will heighten the conductivity of the soil (David *et al*, 2008: 15). Generally limestone geologies are fairly freely draining and so this should be unlikely to significantly affect the GPR survey results.

4 Archaeological Background

4.1 There are no known archaeological sites within the proposed development. A possible mine shaft, identified on an un-named illustration, was recorded in the approximate vicinity.

5 Aims

5.1 The aim of the geophysical survey was to identify any potential archaeological anomalies, which would enhance the current understanding of the archaeological resource within the proposed development site. In particular the survey attempted to determine whether the garden of 79 Harlawhill Gardens contains a mineshaft and if so the location and extent of this archaeological feature.

5.2 The results of the geophysical survey will be assessed and interpreted to gain a clear understanding of potential buried remains within the survey area in advance of development works.

5.3 Specifically the aims of the gradiometer survey were;

- To determine the presence or absence of buried archaeological remains within the proposed development site
- To record, plan and interpret any anomalies identified by the survey

6 Methodology

6.1 The GPR survey was carried out using a Mala shielded 250 HZ antenna (see Appendix 1 and 2). Parameters were selected that were suitable for the prospective aims of the survey and in accordance with recommended professional good practice (David *et al*. 2008, 8). Data was collected using zig-zag traverses, with a traverse interval of 0.5m

6.2 All geophysical survey work was carried out in accordance with recommended good practice specified in guideline documents published by English Heritage (David *et al.* 2008) and the Institute for Archaeologists (IfA revised 2013). Data processing, storage and documentation were carried out in accordance with the good practice specifications detailed in the guidelines issued by the Archaeology Data Service (Schmidt and Ernenwein 2009).

6.3 Interpreted point, polyline and polygon layers were created as layers in AutoCAD and technical terminology used to describe identified features can be found in Appendix 5.

7 Results and Interpretations

7.1 A complete set of unprocessed timeslices can be found in Appendix 6 and processed timeslices in Appendix 7. Four timeslices were chosen for interpretation. Geo-referenced greyscale plots are displayed as Figures 3, 4, 5, and 6 and Figures 7, 8, 9, and 10 display the interpretation of anomalies.

7.2 An individual characterisation of identified anomalies can be found in Appendix 8. The following section will summarise the archaeological potential and significance of identified anomalies.

Slice 3: 6-9ns (Figures 3 and 7)

Discrete archaeology

7.3 A1 and A2 are composed of higher amplitude values compared to background values. Although these anomalies have a slightly rectilinear form, incomplete patterning makes interpretation difficult and it is uncertain as to whether these anomalies relate to archaeological remains and, if so, their nature.

7.4 Several anomalies highlighted as A3 possibly relate to archaeological remains, but lack the necessary patterning for detailed interpretation.

Non-archaeology

7.5 The positioning of A4 appears to correspond with the line of the edge of the curb of the paths surveyed over in Harlawhill Gardens. Therefore it is possible that slight increase in amplitude values denote a change in material composition between the path and the road.

7.6 A5 is composed of similar values to A4 and in part correlates with the positioning of a path running on an east-west alignment towards the south of the survey area. A5 is on the same alignment to A6

and A7 and it is possible these anomalies belong to the same feature. However, given that these anomalies only occur in Slice 3, it is difficult to determine whether these anomalies have an archaeological origin or relate to modern activity such as a series of utilities running between the various houses in the Cul-de-sac.

7.7 A8 and A9 appear as linear anomalies running across the road in Harlawhill Gardens. Although composed of a faint increase in amplitude values, it is likely these anomalies denote modern activity, potentially relating to the positioning of sub-surface utilities.

7.8 A10 appears as a very fragmented anomaly and interpretation is difficult. This anomaly appears to align with the modern structure at 77 Harlawhill Gardens and this suggests it is unlikely to have archaeological significance instead belonging to modern activity.

7.9 Several areas of increased amplitude but lacking the necessary patterning for detailed interpretation have been highlighted A11-A16. It is unclear to the origins of these anomalies but it can be assumed they represent surfaces or areas composed of a compacted material. Many of these areas appear to exist at shallow depths and so it is probable they relate to modern activity and the composition of the current urbanscape.

Slice 7: 18-21ns (Figures 4 and 8)

Discrete archaeology

7.10 Although composed of a weak increase in amplitude compared with background values, B1 appears to have a rectilinear form. It is unclear as to whether this anomaly has an archaeological origin and if so whether it belongs to structural activity. Likewise B2, B3 and B4 also have rectilinear forms, but incomplete patterning makes more detailed interpretation difficult.

7.11 B5 –B9 lack definitive patterning and consequently the nature of these anomalies is uncertain.

Non-archaeology

7.12 Several anomalies which correspond with the curb of the path and so likely to have modern origins have been highlighted: B10

7.13 Although B11 has a different positioning to the line of the modern path, it has a similar signature to B10 and so it is plausible this anomaly relates to a similar activity.

7.14 Several areas of increase amplitude values, but lacking definitive patterning have been labelled B12.

Slice 8: 21-25ns (Figures 5 and 9)

Discrete archaeology

7.15 It is possible C1-C7 relate to archaeological remains. C1 has the most consistent patterning and appears to have a rectilinear form. It is possible C2 and C3; and C4 and C5 belong to the same features but are generally composed of incomplete patterning and this makes interpretation difficult.

7.16 C8 is composed of a distinct change in amplitude values but fails to have the necessary patterning for conclusive interpretation.

Non-archaeology

7.17 The edge of the paths curb is still evident at this depth and labelled, C9.

7.18 C10 has a similar signature to C9 and so it is plausible C10 relates to modern activity.

7.19 C11 marks areas of increased amplitude, but poor patterning results in difficulty in interpretation.

Slice 22: 64-68ns (Figures 10 and 11)

Discrete archaeology

7.20 Several anomalies have been labelled possible archaeology: D1 – D9. Incomplete patterning and poor contrast in amplitude values compared with background readings makes it difficult to determine the origin and potential archaeological significance of these anomalies.

Non-archaeology

7.21 Although more fragmented at this depth, the edge of the path is still evident, D10. This is interesting as the change in material between the road and the path may be expected to be observable at shallow depths but unlikely to have caused a 'ringing-effect' making the feature still visible at greater depths. This potentially offers insight into the properties that make up the path or could in fact suggest that these anomalies relate to disturbances caused by the installation of utilities the line of which is the same as the currently positioning of the path.

7.22 C10 is present at this depth, labelled D11. It is still unclear to the significance of D11, however given the similarity in signature between D10 and D11 it is likely this anomaly relates to modern activity.

7.23 Areas lacking in patterning but composed of increased amplitude have been labelled D12.

8 Conclusion

8.1 There several linear anomalies which have been identified, but generally these appear to be composed of either a faint increase in amplitude values or incomplete patterning. Generally the GPR survey results appear not to have conclusively identified any significant archaeological remains.

8.2 Several anomalies have been highlighted as having modern origins and several of which are likely to relate to utilities supplying houses in this area. In particular drain covers present in the current urbanscape are clearly visible in the GPR survey results.

9 Statement of Indemnity

9.1 Although the results and interpretation detailed in this report have been produced as accurately as possible, it should be noted that the conclusions offered are a subjective assessment of collected data sets.

9.2 The success of a geophysical survey in identifying archaeological remains can be heavily influenced by several factors, including geology, seasonality, field conditions, the technique used and the properties of archaeological features being detected. Therefore geophysical survey may only reveal certain archaeological features and not create a complete plan of all the archaeological remains within a survey area.

10 Bibliography

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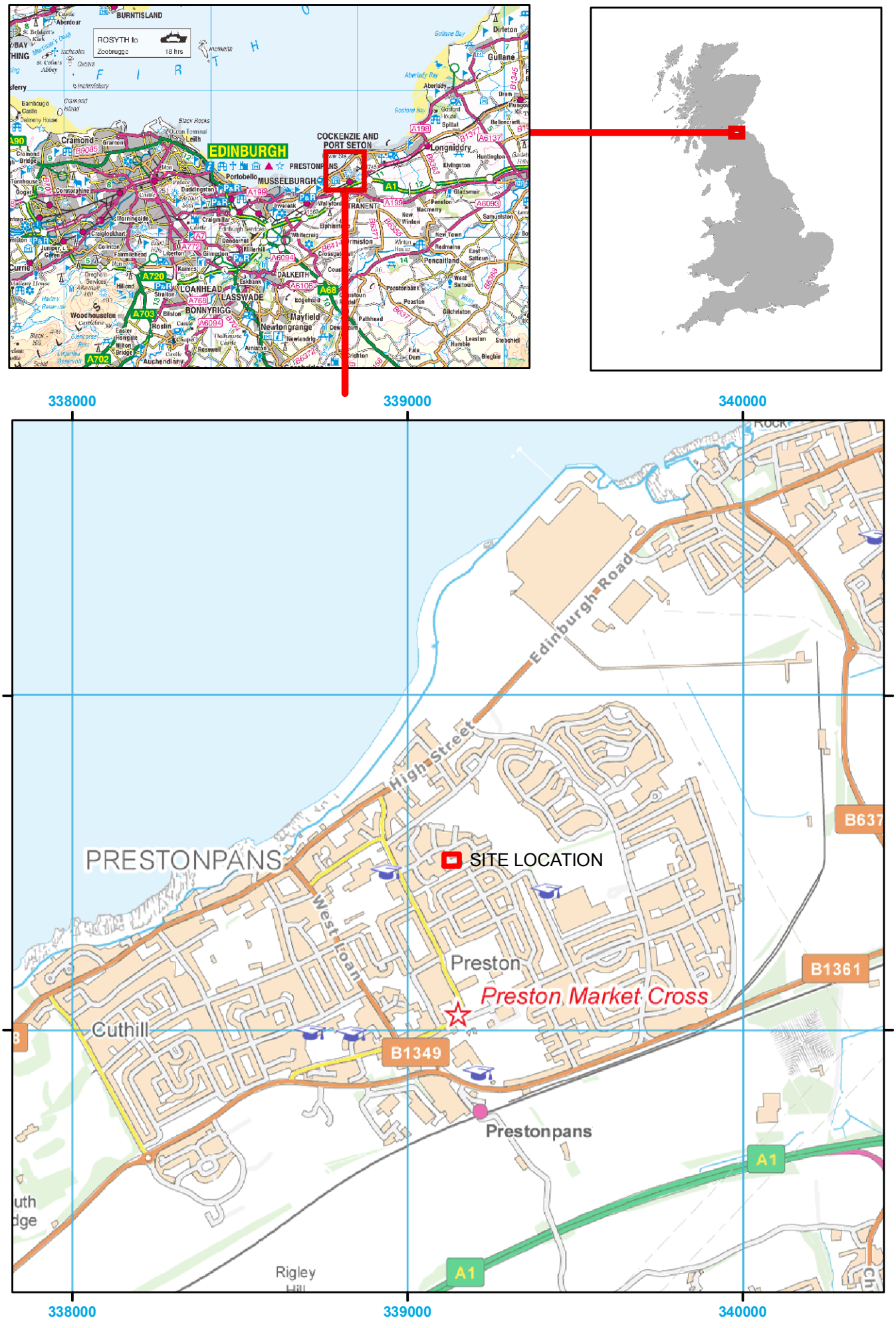


FIGURE 1: Site location

Figure 2: Location of areas targeted with geophysical survey

Figure 2	N		0 30m 1:500 at A3	AOC Archaeology Group

Amplitude
1
0

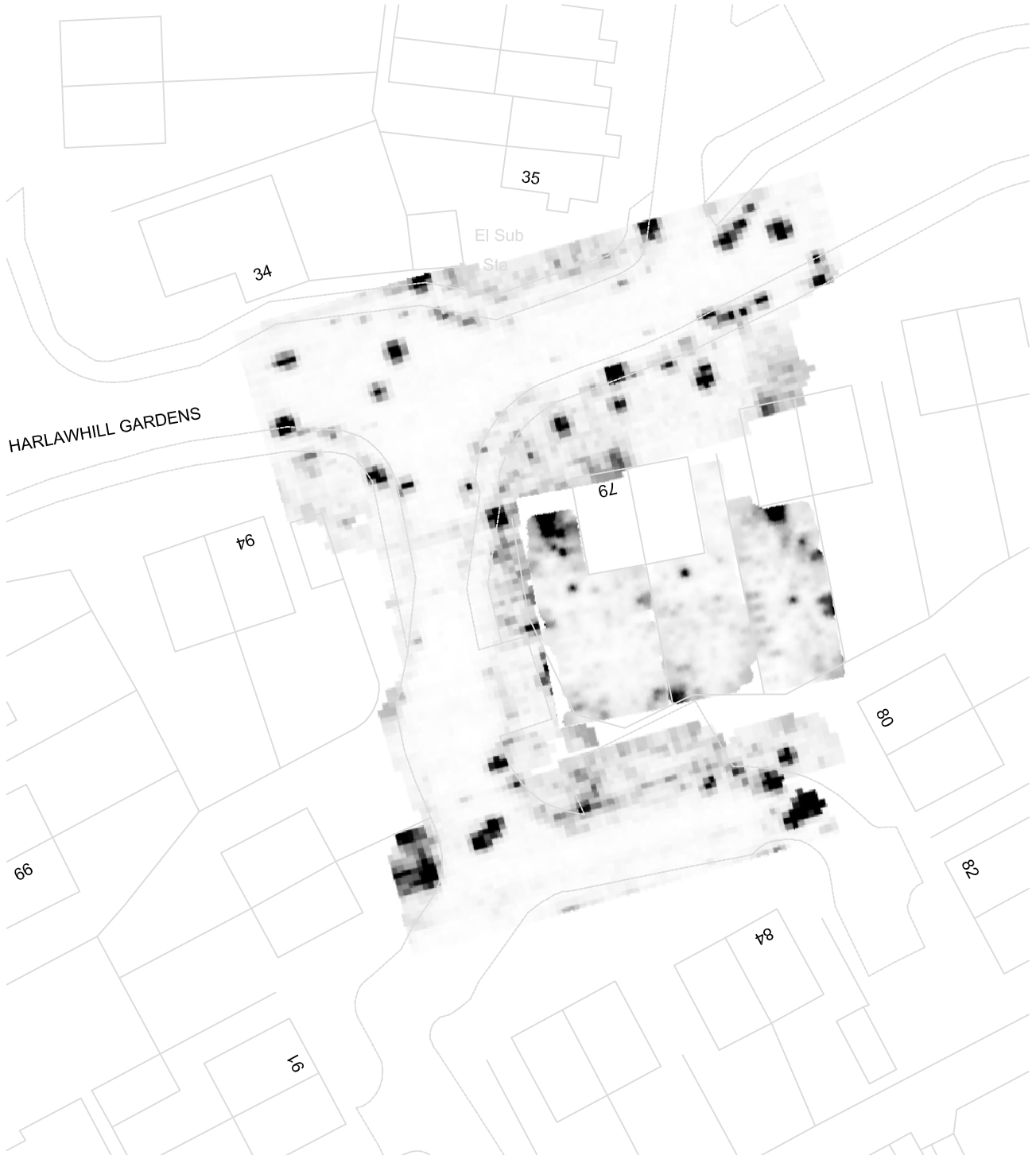
Figure 3: Processed GPR survey results slice 3 6-9ns

Figure
3

N

0 30m
1:500 at A3

AOC Archaeology Group



Amplitude
1
0

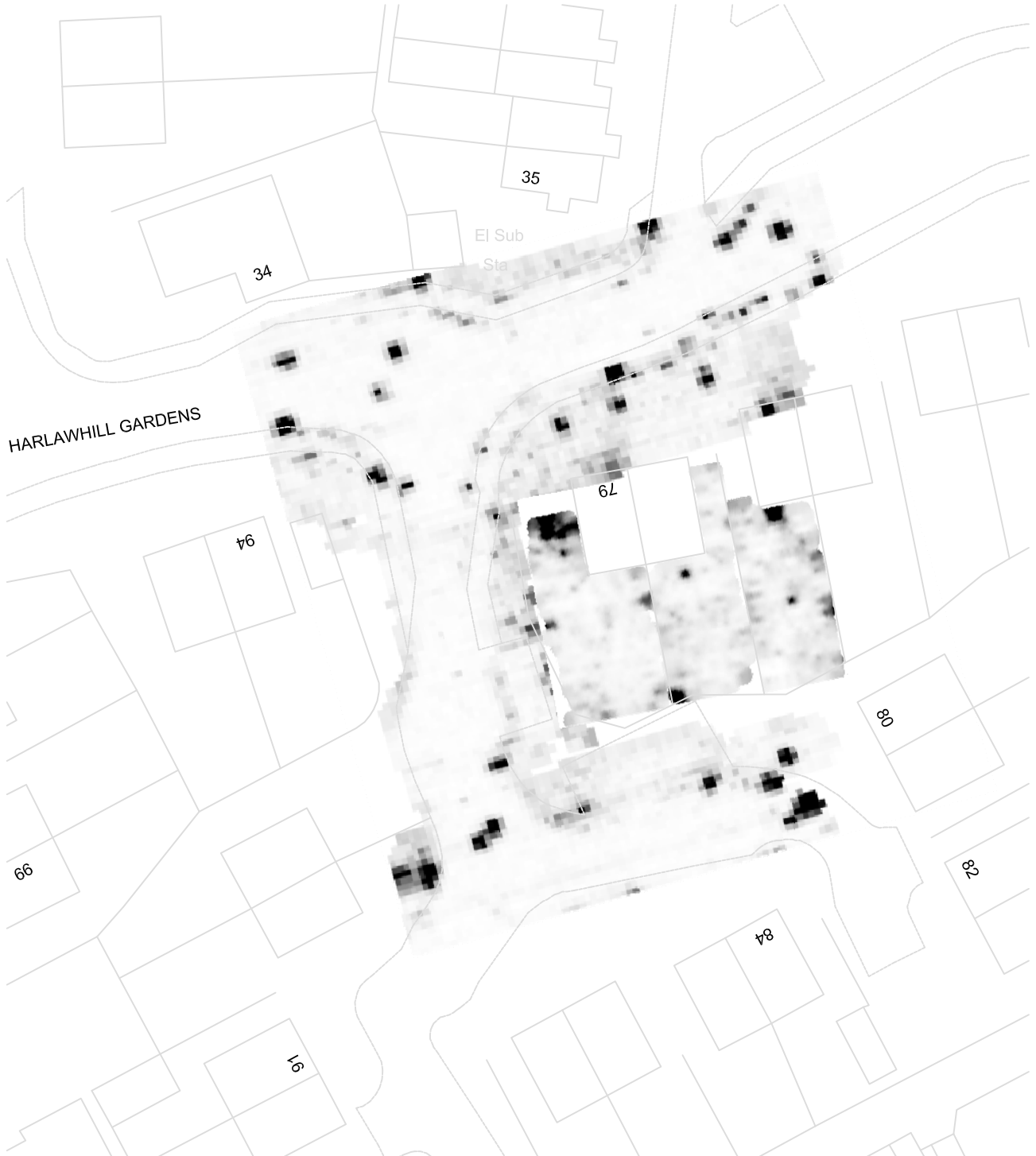
Figure 4: Processed GPR survey results slice 7: 18-21ns

Figure
4

N

0 30m
1:500 at A3

AOC Archaeology Group



Amplitude
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0

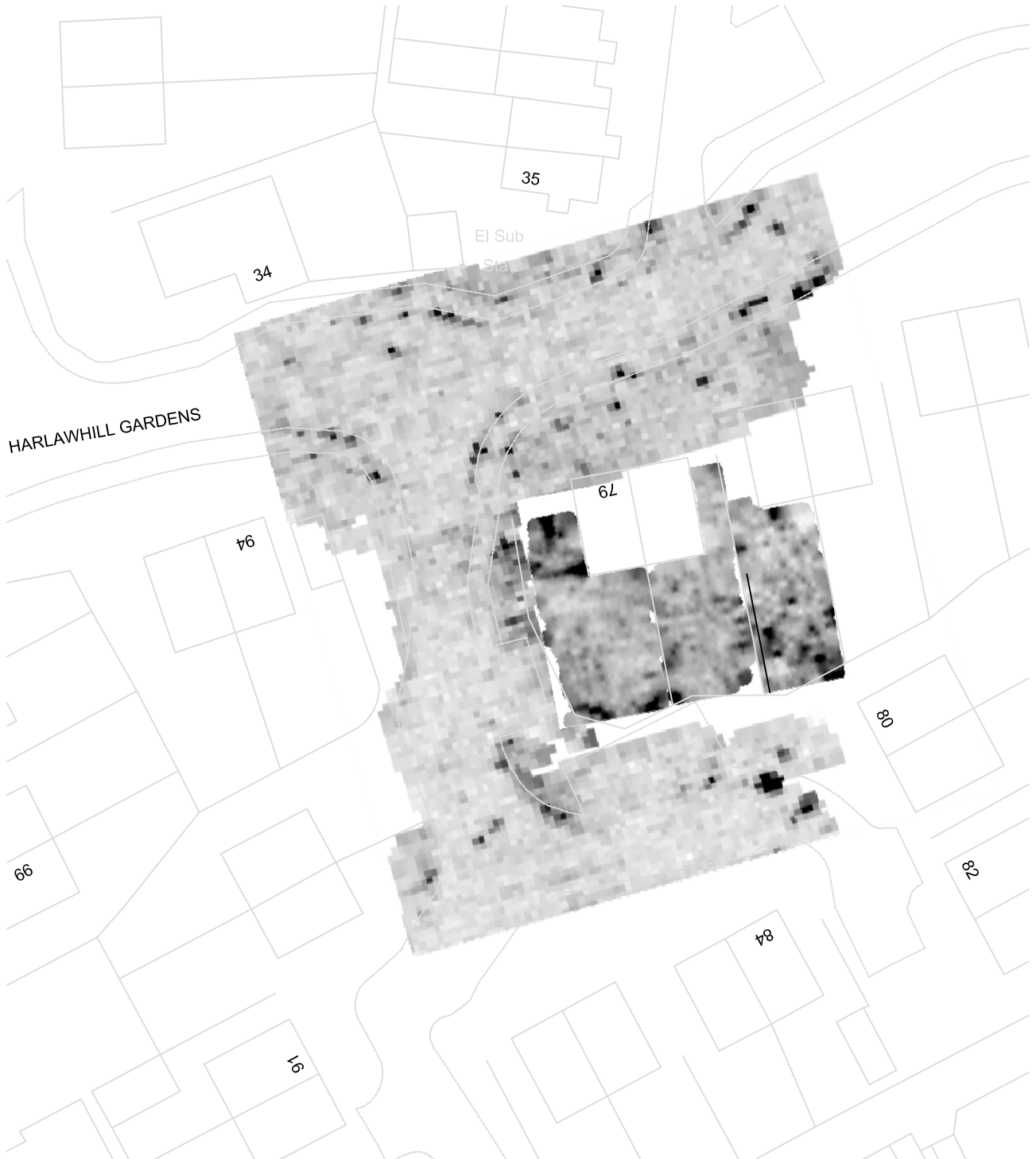
Figure 5: Processed GPR survey results slice 8: 21-25ns

Figure
5

N

0 30m
1:500 at A3

AOC Archaeology Group



Amplitude
1
0

Figure 6: Processed GPR survey results slice 22: 64-68ns

Figure
6

N

0 30m
1:500 at A3

AOC Archaeology Group

Figure 7: Interpretation of GPR survey results slice 3: 6-9ns

Figure 7

N

Disturbed area (archaeology?)
Possible archaeology
Utility (modern)
Linear trend (modern)
Linear trend (modern?)
Disturbed area (modern?)
Isolated anomaly
Survey area

0 30m
1:500 at A3

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Figure 8: Interpretation of GPR survey results slice 7: 18-21ns

Figure 8

N

Possible archaeology
Utility (modern)
Linear trend (modern)
Linear trend (modern?)
Disturbed area (modern?)
Isolated anomaly
Survey area

0 30m
1:500 at A3

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Figure 9: Interpretation of GPR survey results slice 8: 21-25ns

Figure 9

N

Possible archaeology
Utility (modern)
Linear trend (modern)
Linear trend (modern?)
Disturbed area (modern?)
Isolated anomaly
Survey area

0 30m
1:500 at A3

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Figure 10: Interpretation of GPR survey results slice 22: 64-68ns

Figure 10

N

Possible archaeology
Utility (modern)
Linear trend (modern)
Linear trend (modern?)
Disturbed area (modern?)
Isolated anomaly
Survey area

0 30m
1:500 at A3

AOC Archaeology Group

Appendix 1: Survey Information

Field	Description
Surveyor	AOC Archaeology
Client	Holly Scott
Site	Prestonpans
County	East Lothian
NGR	339122, 674524
Solid geology	Limestone Coal Formation – Sedimentary Rock Cycles, Clackmannan Group
Historical documentation/ mapping on site	None
Known archaeology on site	None
Scheduled Ancient Monument	No
Land use/ field condition	Housing estate
Duration	29th May 2014
Weather	Sunny
Survey type	GPR Survey
Instrumentation	Mala 250MHz Shielded Antenna
Area covered	0.2ha
Data collection staffing	Lindsay Dunbar, Alice James
Visualisation software	AutoCAD LT 2009
Report title	Prestonpans, East Lothian
Project number	22739
Report Author	Alice James
Report approved by	Graeme Cavers

Appendix 2: Archaeological Prospection Techniques, Instrumentation and Software Utilised

GPR survey

Ground Penetrating Radar (GPR) is an electromagnetic geophysics prospection technique where high frequency radar waves are transmitted into the ground from an antenna and the elapsed time, recorded in nanoseconds, for the wave to return is recorded (Conyers and Goodman, 1997: 23).

GPR can be useful at detecting a range of different archaeological features in particular within an urban setting (David et al, 2008: 28). The differences in the electrical and magnetic properties of buried remains and the surrounding soil affects the propagation of the signal into the ground and the time it takes to return to the antenna (Clark, 1996: 118). Reflections or hyperbole within the data set indicate the presence of buried features and through velocity analysis techniques it is possible to suggest depth estimations of identified features (Gaffney and Gater, 2003: 48).

GPR data sets can be visualised in several different ways. Data is initially collected as a series of vertical profile, known as radargrams, and these can be modelled into horizontal plans, known as timeslices. Both methods of displaying data sets can be useful for examining and interpreting data sets. In particular, timeslices offer a good mechanism for analysing different stratigraphic layers within a horizontal plan.

GPR Survey Instrumentation

AOC Archaeology's GPR surveys are carried out using a Mala 250MHz Shielded Antenna. The 250MHz shielded antenna is especially suited for urban investigations and can be effectively used for medium depth penetration and data resolution. The frequency of the antenna used in GPR survey determines both the depth penetration and resolution of the survey results: whereby a greater depth penetration will result in a lower data resolution. The Mala shielded 250 MHz antenna offers a compromise between depth and resolution, enabling a depth penetration suitable to detect potential archaeological remains, whilst producing a good quality of survey resolution. The collected radargrams are stored on a MALA GX Controller and radagrams, once downloaded are processed and resampled to create the timeslices used for interpretation.

Appendix 3: Summary of Processes Commonly Used for Processing GPR Survey Data

Process	Effect
Wobble	Wobble is used to subtract the dc-drift in data sets
Gain	Gain is used to amplify weaker signals at lower depths, which are often caused by attenuation as the transmitted radar wave propagates through the ground.
Background Filter	A backgrounds filter subtracts the average scan across a radargram from individual traces. This gives a greater definition to hyperboles by removing horizontal bands across the data set.
Migration	The energy emitted from the antenna spreads through the ground in a ‘conical footprint’. As a consequence the transmitted signal reflects of buried objects at different angles and this creates hyperbole within the data set. Through using a migration filter hyperboles are removed increasing anomaly definition.

Appendix 4: Gradiometer Survey Processing Steps

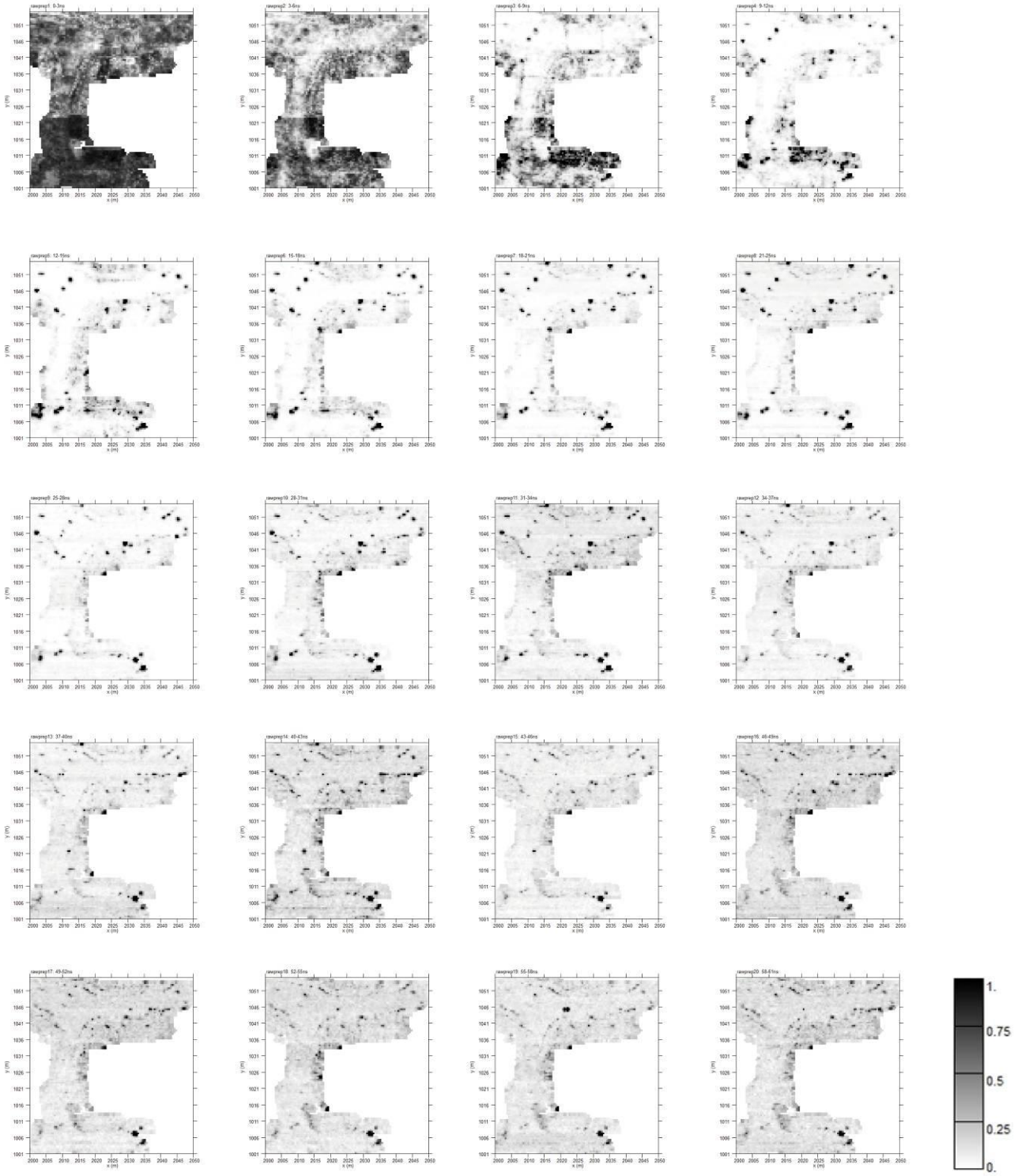
Process	Extent
Batch Gain-Wobble	-
Background Filter	Length – 9900 Sample start – 3 Sample end - 512
Migration	Dielectric -2.06 Vel m/s - 0.209 Width - 91 Gain -4 Sample start - 42 Sample end - 512

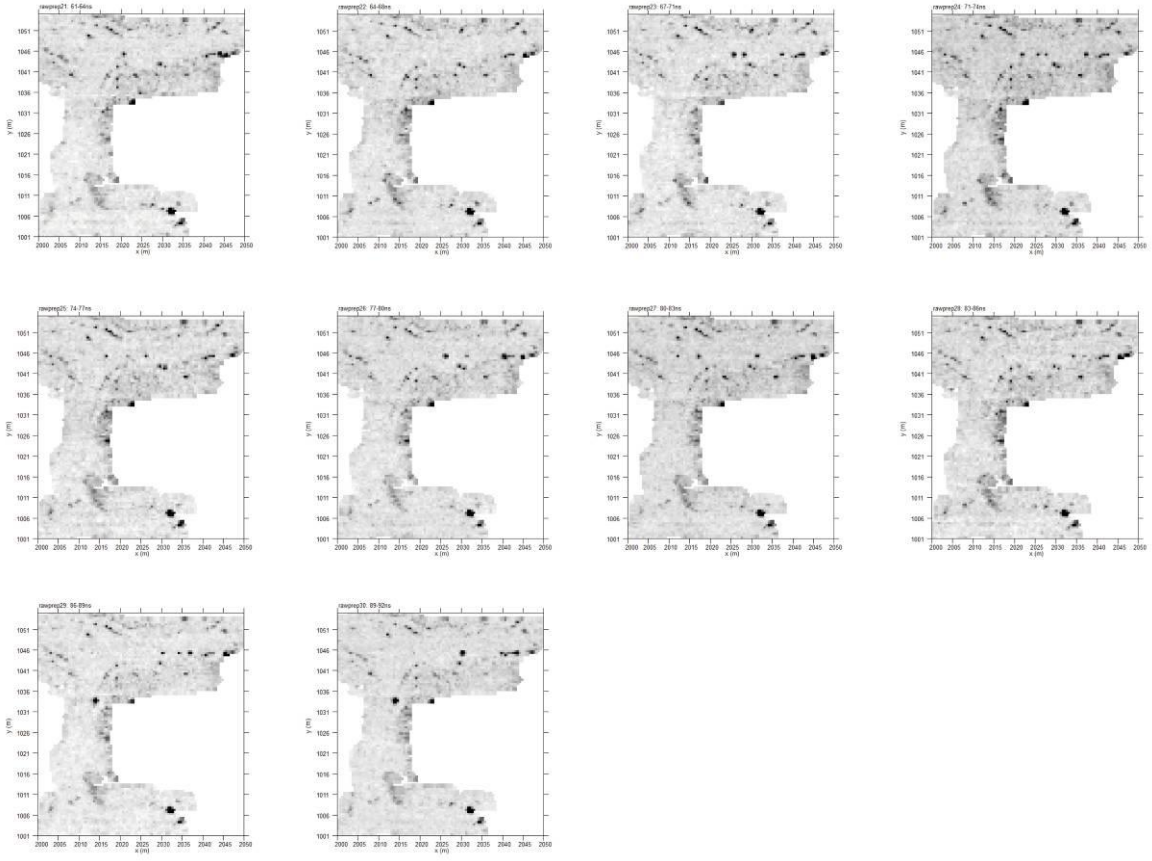
Appendix 5: Technical Terminology

Type of Anomaly	Description
Disturbed area (archaeological?)	These are characterised by a general increase or decrease in the amplitude values over a localised area but do not appear as having a clear form. Interpretation is difficult, but it is likely such anmalies belong to an archaeological nature.
Possible archaeology (Unclear to origins of the remains)	Anomalies composed of a weak change in signal values compared to background reading or are composed of incomplete patterning. Consequently, interpretation is tentative and it is unclear to whether anomalies belong to an archaeological nature.
Non- Archaeology	
Isolated anomalies	Response normally caused by a buried object composed of highly contrasting material properties compared to the surrounding soil. Given the lack of patterning is difficult to establish the origins of such anomalies and to whether they denote archaeological activity or have a geological nature.
Utility	Anomalies composed of significant changes in amplitude values compared with background readings, which appear consistently throughout timeslices in the data set. Often anomalies directly relate to the location of utilities recorded above the ground, such as drain covers.
Linear trend (modern)	Anomalies of a linear form often composed of contrasting high or low amplitude values and are likely to have modern origins. Often these anomalies begin at a low depth within the profile and often relate to features noted above the ground.
Linear trend (modern?)	Like above, but poor patterning, weak change in signal strength results in a more tentative interpretation.
Disturbed area (modern?)	Area of disturbance that is composed of increases or decreases in values compared with background readings. It is highly likely that these readings are caused by modern disturbances, but interpretation is tentative.

Appendix 6: Unprocessed GPR timeslices

Area A

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rawprep28: 83-86ms
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x (m)
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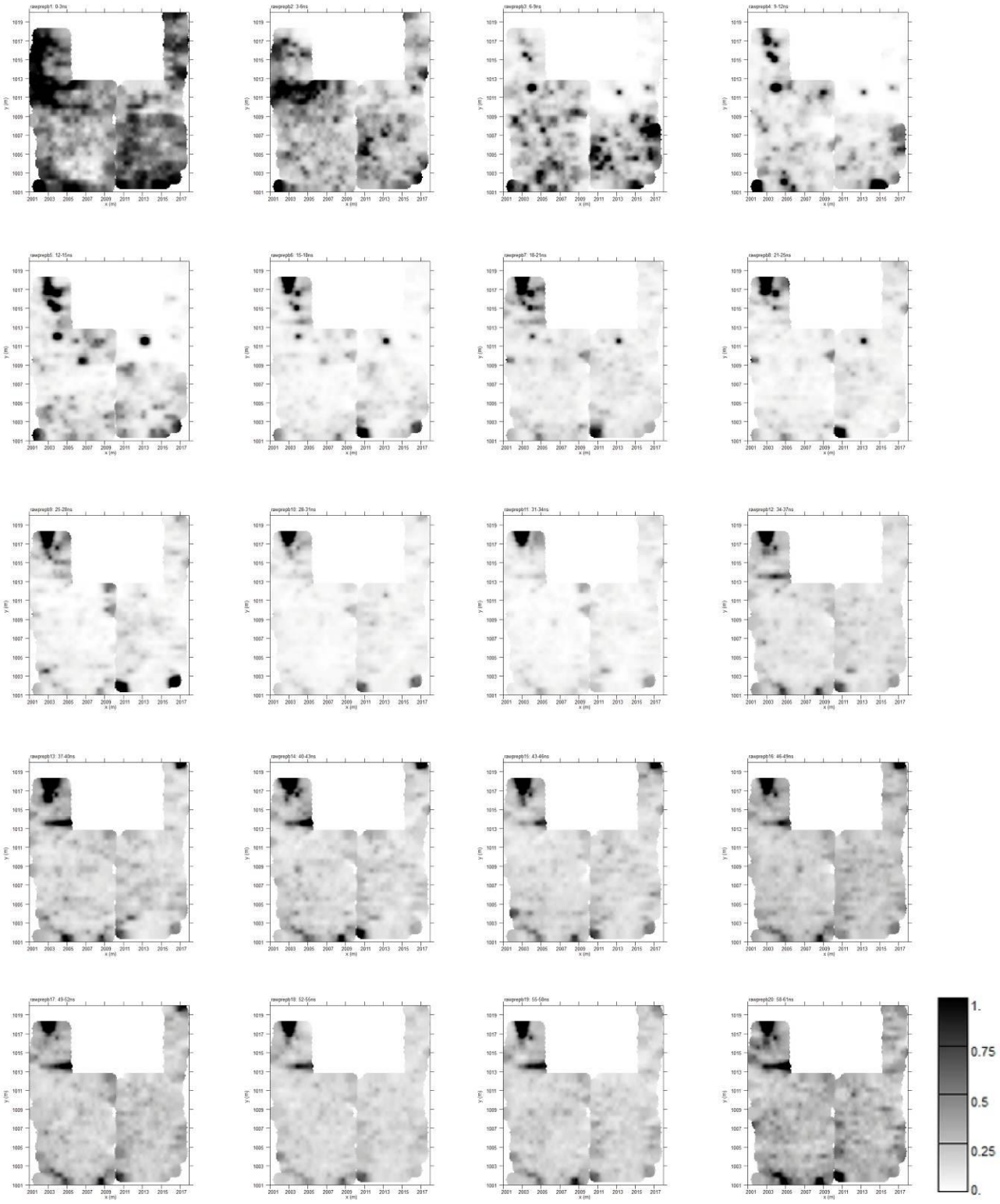
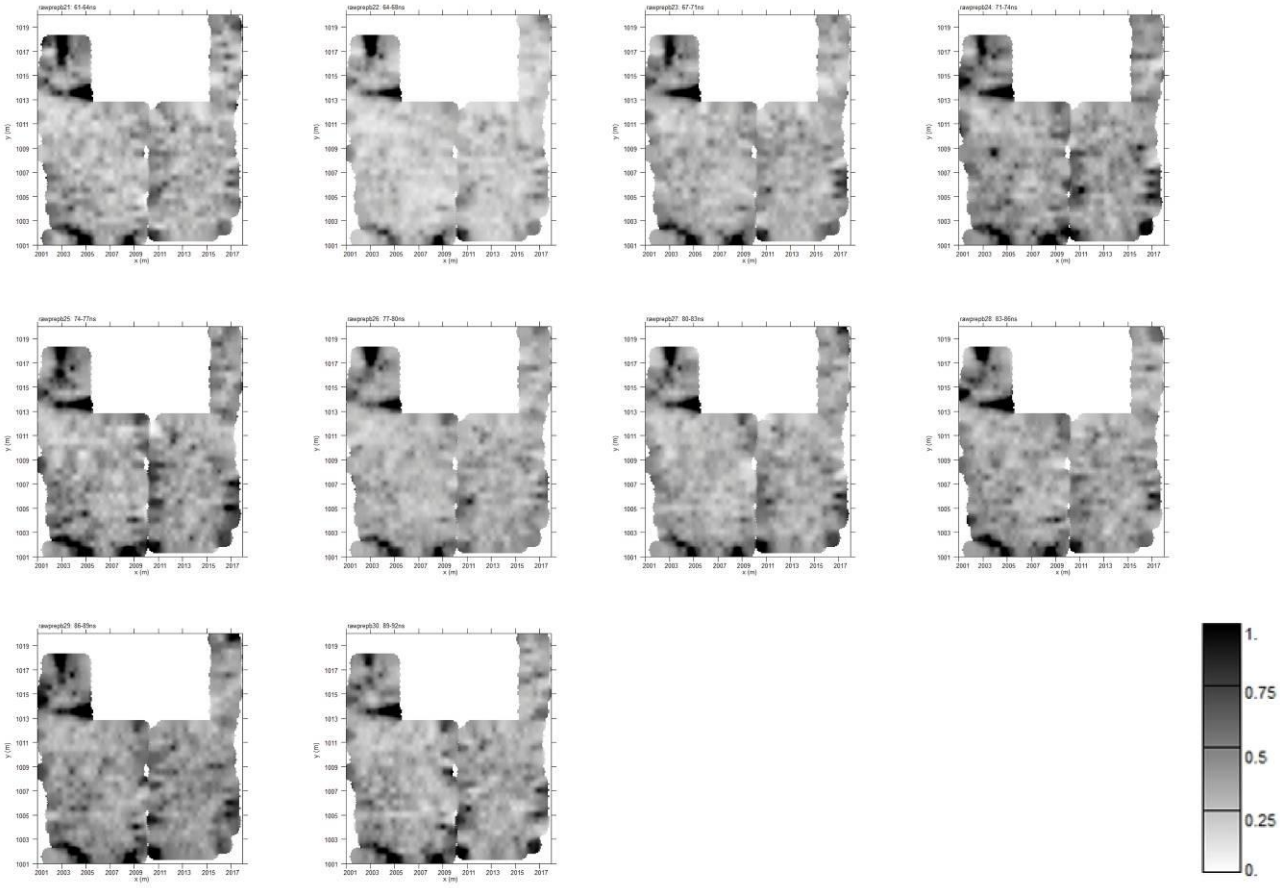
0.5
0.25
0.

Area B

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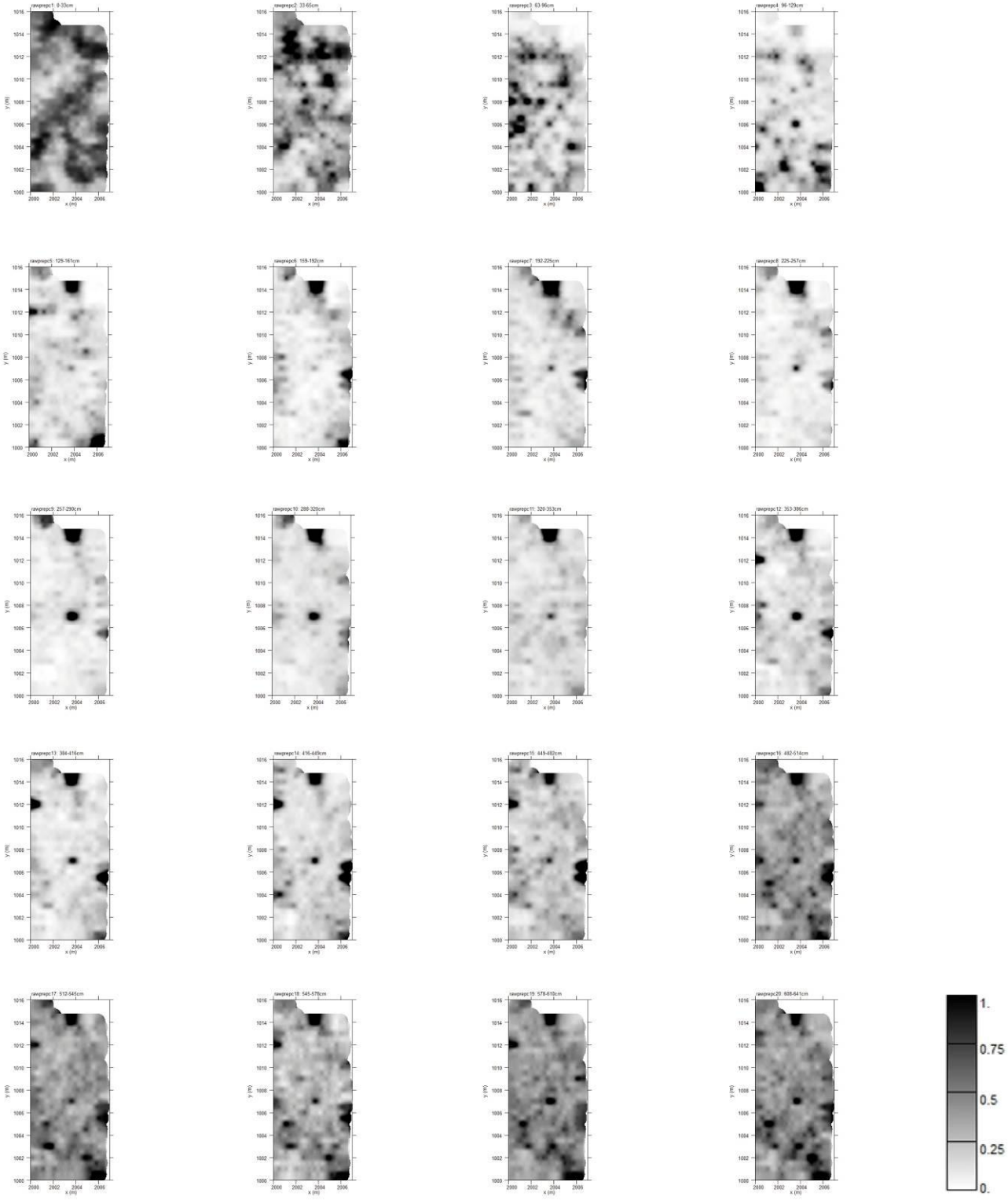
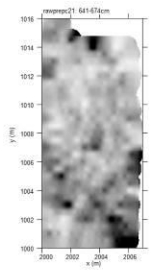
Area C

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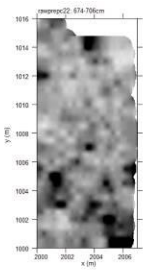
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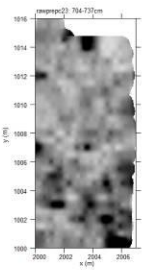
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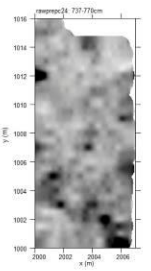
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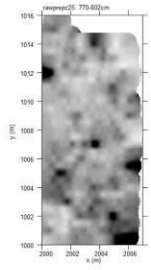
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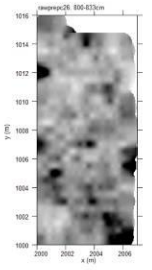
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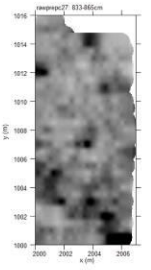
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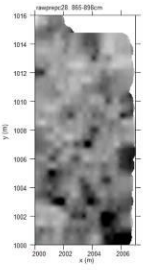
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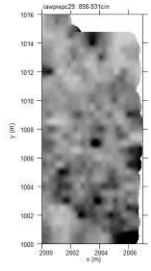
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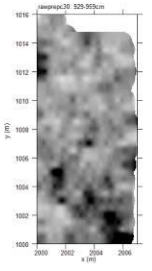
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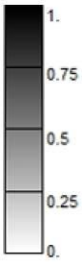
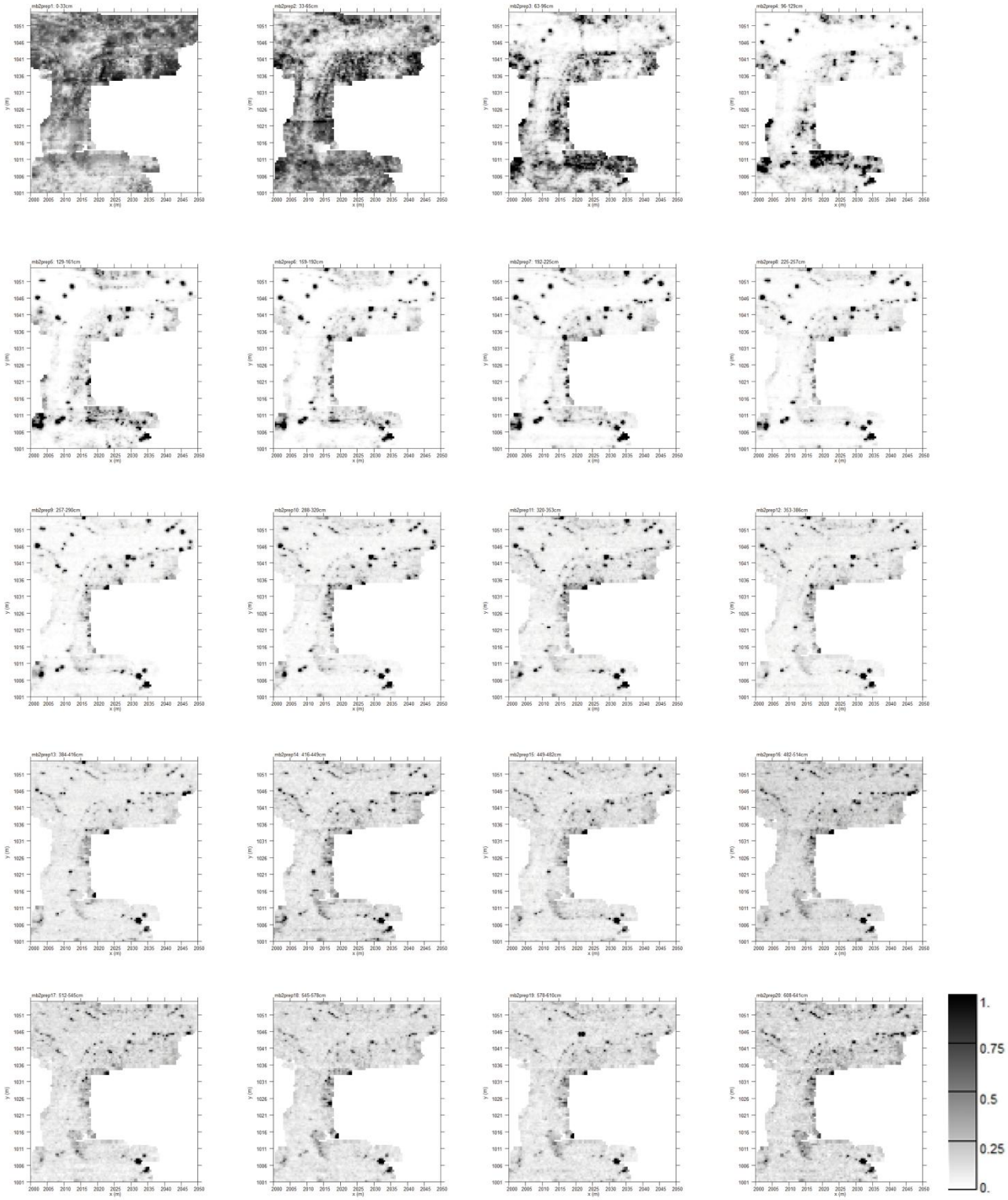
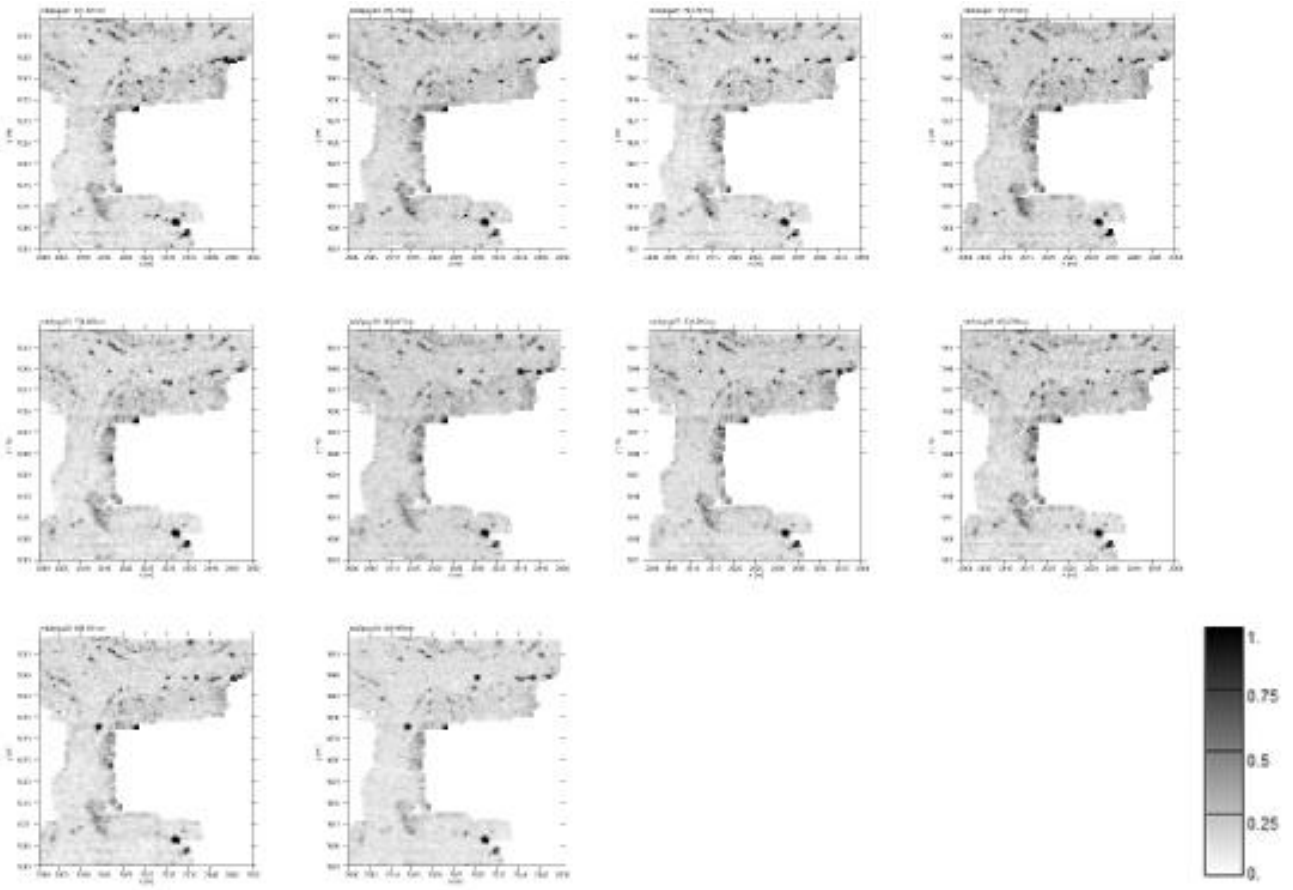
y (m)
x (m)


1.
0.75
0.5
0.25
0.

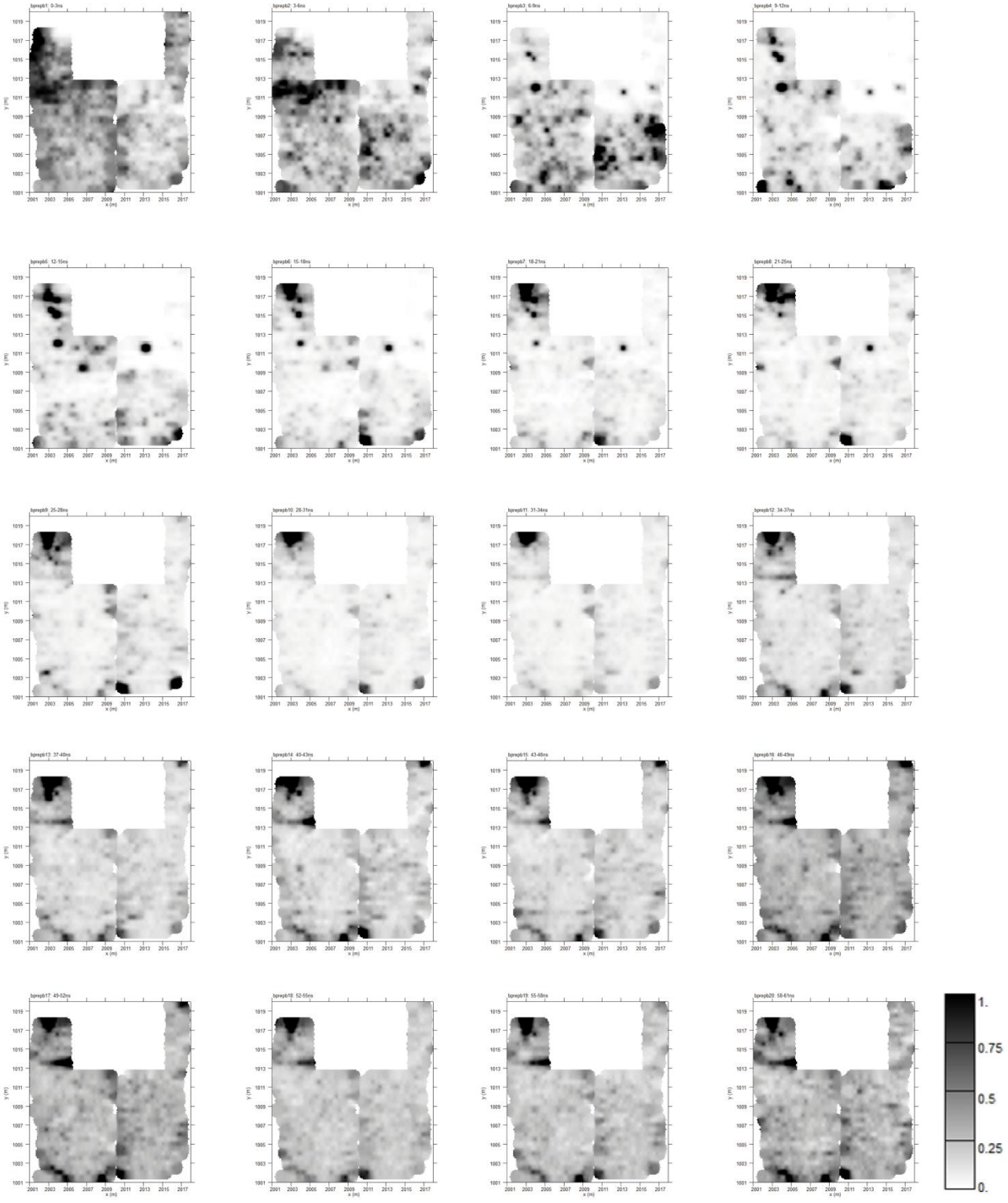
Appendix 7: Processed GPR timeslices

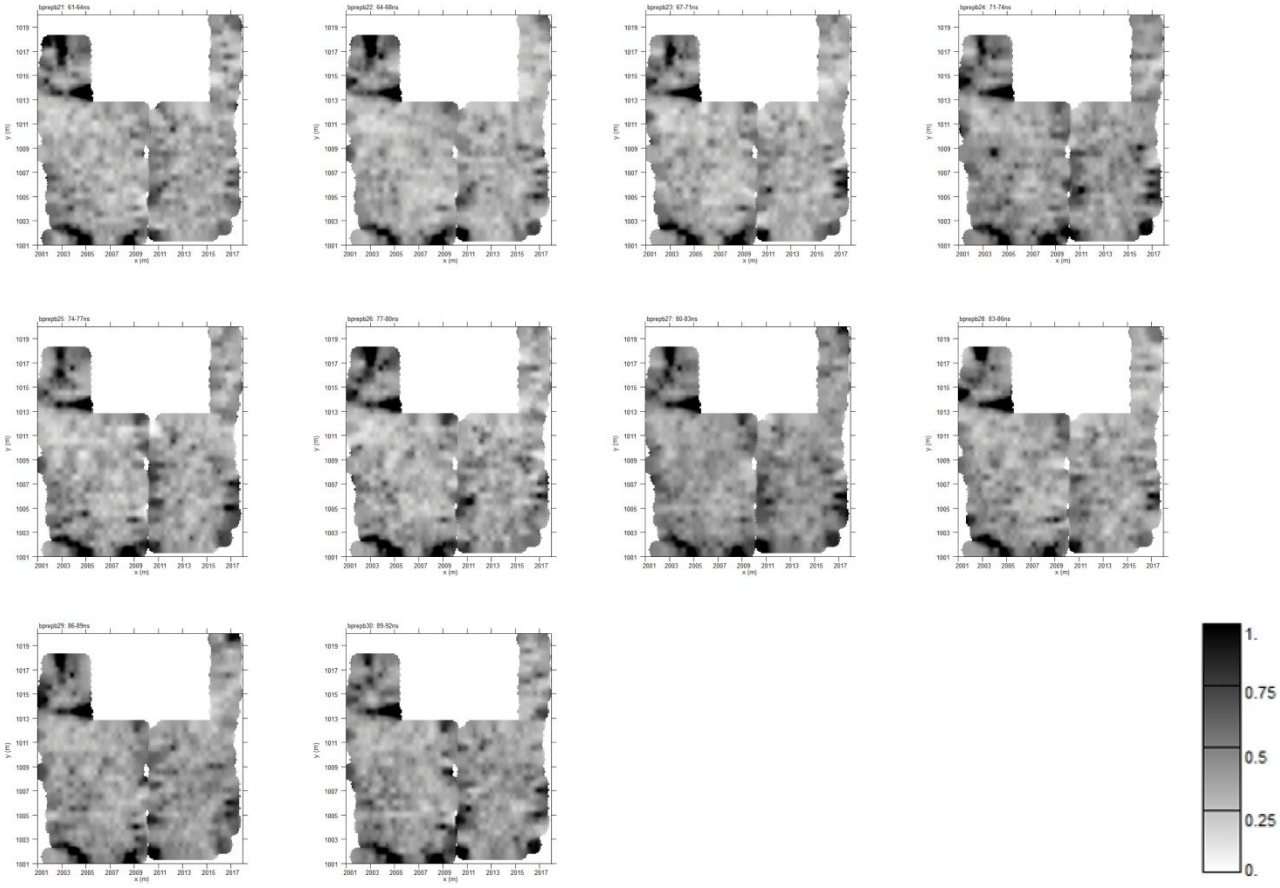
Area A



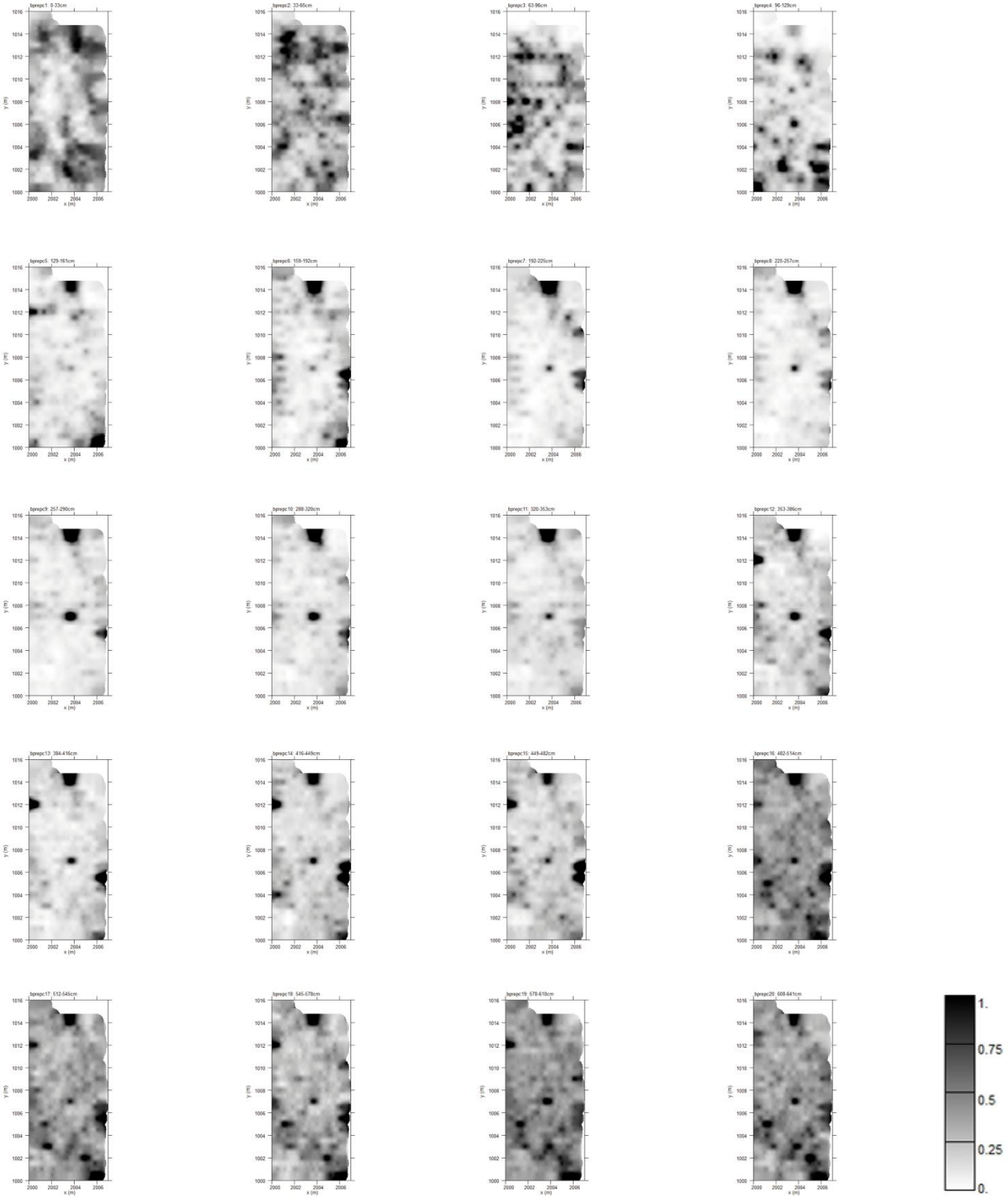

1.
0.75
0.5
0.25
0.

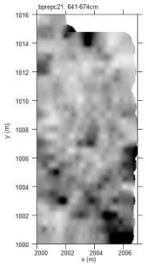
Area B

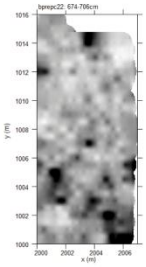


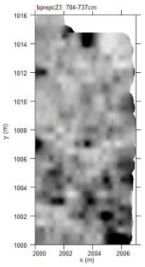

bprepb21: 61-64ns
bprepb22: 64-68ns
bprepb23: 67-71ns
bprepb24: 71-74ns
bprepb25: 74-77ns
bprepb26: 77-80ns
bprepb27: 80-83ns
bprepb28: 83-86ns
bprepb29: 86-89ns
bprepb30: 89-92ns
y (m)
x (m)
1.
0.75
0.5
0.25
0.

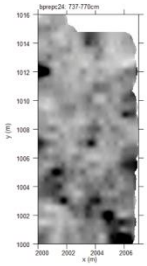
Area C

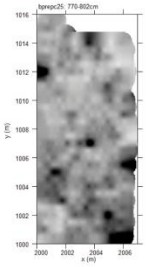

bprepc1: 0-33cm
bprepc2: 33-65cm
bprepc3: 63-96cm
bprepc4: 96-129cm
bprepc5: 129-161cm
bprepc6: 159-192cm
bprepc7: 192-225cm
bprepc8: 225-257cm
bprepc9: 257-290cm
bprepc10: 288-329cm
bprepc11: 320-353cm
bprepc12: 353-386cm
bprepc13: 384-416cm
bprepc14: 416-449cm
bprepc15: 449-482cm
bprepc16: 482-514cm
bprepc17: 512-545cm
bprepc18: 545-578cm
bprepc19: 578-610cm
bprepc20: 608-641cm
y (m)
x (m)
1.
0.75
0.5
0.25
0.

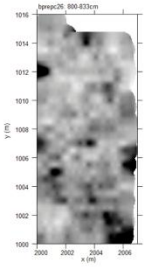

bprepc21: 641-674cm
y (m)
x (m)

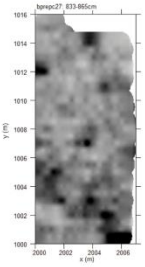

bprepc22: 674-706cm
y (m)
x (m)

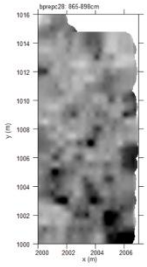

bprepc23: 704-737cm
y (m)
x (m)

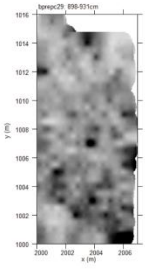

bprepc24: 737-770cm
y (m)
x (m)

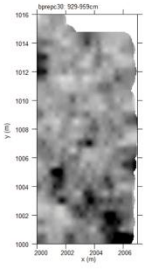

bprepc25: 770-802cm
y (m)
x (m)

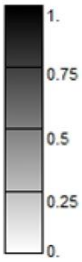

bprepc26: 800-833cm
y (m)
x (m)

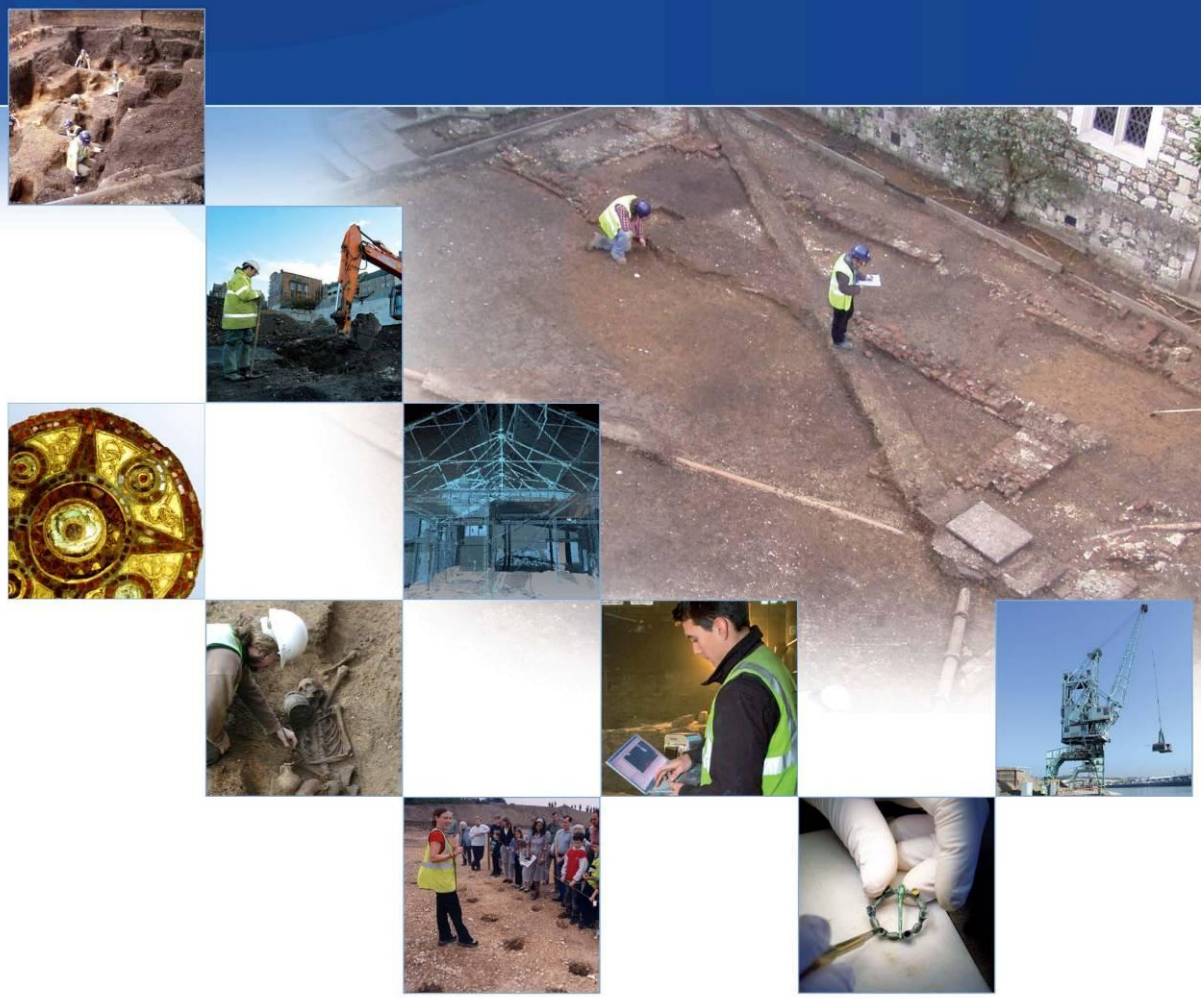

bprepc27: 833-865cm
y (m)
x (m)


bprepc28: 865-898cm
y (m)
x (m)


bprepc29: 898-931cm
y (m)
x (m)


bprepc30: 929-959cm
y (m)
x (m)


1.
0.75
0.5
0.25
0.



AOC Archaeology Group

AOC Archaeology Group, The Raylor Centre, James Street, York, YO10 3DW

tel: **01904 413 404** | fax: **01904 430 303** | e-mail: **york@aocarchaeology.com**

www.aocarchaeology.com