



# Old Wardour Castle, Tisbury, Wiltshire

Report on Geophysical Survey, March 2024

Megan Clements and Neil Linford



# Old Wardour Castle, Tisbury, Wiltshire

## Report on Geophysical Survey, March 2024

Megan Clements and Neil Linford

Old Wardour Castle,  
Tisbury, Salisbury  
SP3 6RR

NGR: ST 93860 26331

Print: ISSN 2398-3841

Online: ISSN 2059-4453

The Research Report Series incorporates reports by Historic England's expert teams, their predecessors and other researchers. Many Research Reports are interim, to make available the results of specialist investigations in advance of full publication. Although subject to internal quality assurance, they are not usually refereed externally and their conclusions may sometimes have to be modified in the light of information not available at the time of the investigation. Where no final project report is available, readers should consult the author before citing these reports.

For more information email [Res.reports@HistoricEngland.org.uk](mailto:Res.reports@HistoricEngland.org.uk) or write to:

Historic England  
Fort Cumberland  
Fort Cumberland Road  
Eastney  
Portsmouth PO4 9LD

Opinions expressed in Research Reports are those of the author(s) and are not necessarily those of Historic England.

## Summary

A Ground Penetrating Radar (GPR) survey was conducted within the grounds of Old Wardour Castle, Tisbury, Wiltshire, following a request from the English Heritage Trust. The aim of the survey (1.2ha) was to provide a better understanding of any limitations or risks relating to buried archaeology and to estimate its depth in order to inform the placement of temporary structures required for events held at the site. The results have confirmed the survival of formal garden features known from a previous earth resistance survey, and suggest polygonal wall-footings of the castle may have extended further beyond the standing remains than has previously been recognised. Historic drainage conduits and modern services have also been located.

## Contributors

The fieldwork was completed by Megan Clements and Neil Linford.

## Acknowledgements

The authors are grateful for the help provided by colleagues from the English Heritage Trust in coordinating access for the survey to take place. The cover image shows the survey in progress and looks towards the main entrance of the castle (photo by Megan Clements).

## Archive location

Historic England, Fort Cumberland, Fort Cumberland Road, Portsmouth, PO4 9LD.

## Date of survey

The fieldwork was conducted between the 4<sup>th</sup> and 7<sup>th</sup> of March 2024. The report was completed on 15<sup>th</sup> of April 2024.

## Contact details

Dr Neil Linford, Geophysics Team, Historic England, Fort Cumberland, Fort Cumberland Road, Portsmouth, PO4 9LD. Tel: 02392 856761. Email: [neil.linford@historicengland.org.uk](mailto:neil.linford@historicengland.org.uk).

# Contents

|                                       |   |
|---------------------------------------|---|
| Introduction .....                    | 1 |
| Method .....                          | 2 |
| Ground Penetrating Radar .....        | 2 |
| Results .....                         | 3 |
| Ground Penetrating Radar Survey ..... | 3 |
| Conclusions.....                      | 5 |
| List of Enclosed Figures .....        | 6 |
| References.....                       | 7 |
| Appendix .....                        | 9 |

## Introduction

A Ground Penetrating Radar (GPR) survey was conducted at Old Wardour Castle, Tisbury, Wiltshire. The aim of the survey was to better determine the location and depth of any buried archaeology to assist with the ongoing management of the site, in particular to inform the positioning of temporary structures required for events. The survey was conducted in response to a request from the English Heritage Trust under the Shared Services Agreement and addresses Historic England corporate plan activity “5.2 Work with English Heritage Trust to support the National Collection”.

The Monument (National Heritage List for England: 1013398, Historic England 1996) includes a 14th century castle keep, altered in the 16th century and ruined in the Civil War, an associated bailey that broadly reflects the hexagonal shape of the keep, later buildings which abut the bailey on its southern side, and formal gardens, from either the late 17<sup>th</sup> or early 18<sup>th</sup> century are depicted on a contemporary Buck brothers engraving to the north (Historic England 2004; Girouard 2012). Several additional listed buildings are included with the castle in the wider Wardour Castle and Old Wardour Castle Park and Garden (NHLE: 1000507, Historic England 2004).

Previous work at the site included earth resistance coverage across the majority of the inner bailey, that identified elements of the formal garden design (Linford 1998), and an unreported GPR survey to investigate an area of voiding immediately to the south of the castle (Appendix).

The solid geology across most of the site is Cann Sand Member Sandstone, a glauconitic and micaceous sand, with a strip of Gault Formation Mudstone to the very west. Superficial head deposits of clay, silt, sand and gravel are recorded to the very north of the survey area (Geological Survey of Great Britain 1996; British Geological Survey 2024). Slowly permeable, seasonally wet, slightly acidic but base-rich loamy and clayey soils of the Wickham 2 association (key 711f) are recorded over the site (Soil Survey of England and Wales 1983; Soilscales 2024). However, previous excavations at the site suggest a considerable degree of foreign material was introduced to level the ground (Reilly 1997).

The site was flat to the northeast and sloped down towards the southwest and consisted of a grass lawn with a metalled visitor footpath from the Ticket Office, following the northwest wall, to the banqueting pavilion. While it rained on the first day of the survey, the following days were warm and sunny with clouds, although soil conditions remained saturated in places throughout.

# Method

## Ground Penetrating Radar

A 3d-Radar (Kontur) MkIV GeoScope Continuous Wave Step Frequency (CWSF) Ground Penetrating Radar (GPR) system was used to conduct the survey collecting data with a hand operated multi-element DXG0908 ground coupled antenna array (Linford et al. 2010; Eide et al. 2018). A roving Trimble R8s Global Navigation Satellite System (GNSS) receiver was mounted on the GPR antenna array, that together with a second R8s base station was used to provide continuous positional control for the survey collected along the instrument swaths shown on Figure 1. The GNSS base station receiver was adjusted to the National Grid Transformation OSTN15 using the Trimble VRS Now Network RTK delivery service. This uses the Ordnance Survey's GNSS correction network (OSNet) and gives a stated accuracy of 0.01-0.015m per point with vertical accuracy being half as precise. Where tree cover compromised the use of a GNSS receiver a Trimble S7 tracking total station and active reflector prism mounted on the GPR array was used to provide continuous positional control.

Data were acquired at a 0.075m x 0.075m sample interval across a continuous wave stepped frequency range from 40MHz to 2.99GHz in 4MHz increments using a dwell time of 5ms. A single antenna element was monitored continuously to ensure data quality during acquisition together with automated processing software to produce real time amplitude time slice representations of the data as each successive instrument swath was recorded in the field (Linford 2013).

Post-acquisition processing involved conversion of the raw data to time-domain profiles (through a time window of 0 to 75ns), adjustment of time-zero to coincide with the true ground surface, background and noise removal, and the application of a suitable gain function to enhance late arrivals. Representative profiles from the full GPR survey data set are shown on Figure 3. To aid visualisation amplitude time slices were created from the entire data set by averaging data within successive 2.5ns (two-way travel time) windows (e.g. Linford 2004). An average sub-surface velocity of 0.123m/ns was assumed following constant velocity tests on the data and was used as the velocity field for the time to estimated depth conversion. Each of the resulting time slices therefore represents the variation of reflection strength through successive ~0.15m intervals from the ground surface, shown as individual greyscale images in Figures 4 to 7. Further details of both the frequency and time domain algorithms developed for processing this data can be found in Sala and Linford (2012).

# Results

## Ground Penetrating Radar Survey

A graphical summary of the significant GPR anomalies, [gpr1-21] discussed in the following text, superimposed on the base OS map data, is provided in Figure 8.

The GPR survey has confirmed the survival of a concentric circular, high-amplitude anomaly [gpr1] between 12.5 and 27.5ns (0.77 to 1.69m) that corresponds with a possible garden feature identified in the 1997 earth resistance survey (Linford 1998, 5). A second possible garden feature to the south-east, appears as a more fragmented, polygonal anomaly [gpr2] between 15.0 and 22.0ns (0.92 to 1.54m) that was also known from the previous survey (Linford 1998, 6). It is difficult to fully interpret [gpr2] due to the presence of mature trees and associated root systems [gpr3], that have been detected here and throughout the survey area. Although the circular anomalies do not appear within the view of the Buck engraving of the site it seems likely, from the symmetry with the entrance to the castle, that these represent contemporary garden features.

High-amplitude anomalies [gpr4], found between 17.5 and 22.5ns (1.08 to 1.38m) across the terrace between [gpr1] and [gpr2], could indicate shallow wall-footings associated with the formal garden design partially shown on the Buck engraving. Other high-amplitude anomalies [gpr5] are more difficult to interpret but may also be related to the former garden design.

Low-amplitude anomalies [gpr6] possibly indicate a local change in soil composition and moisture retention due to the topographic variation in this area. Diffuse anomalies [gpr7] located to the south and west of the castle, and also over areas of steep topographic change, possibly relate to landscaping to contour the ground surface.

A broad linear anomaly [gpr8] across the north lawn from the castle to the grotto represents a former path or desire line developed between the two. An orthogonal linear high-amplitude anomaly [gpr9] appears to overlie [gpr8], and partially replicates a narrow wall-type response in the earth resistance data (Linford 1998, 7). The modern visitor pathway has also been identified as a high-amplitude anomaly [gpr10].

Discrete high-amplitude anomalies [gpr11] together with a more diffuse area of response [gpr12] are found between 5.0 and 25.0ns (0.31 to 1.54m) to the north-west of the castle. A similar diffuse response [gpr13] has been identified to the south-east of the standing remains and while it is difficult to confidently interpret these anomalies they may, possibly, be associated with building debris.

High-amplitude anomalies [gpr14] to the south of the castle indicate the location of probable former outer walls before they were destroyed in the Civil War explosion. Other

possible interpretations could be outer works or paths following the line of the castle. Four of these responses [gpr15] correlate with narrow indicative stone kerbs laid out flush to the ground to show the location of the original castle walls. Such narrow surface features can be difficult to image when orientated parallel to the instrument traverses, as they may either fall between the footprint illuminated by adjacent radar channels or produce a continuous response inadvertently suppressed by a horizontal background filter. The low-amplitude anomalies [gpr16] identified in this area potentially indicate robbed-out walls or ditches. Anomalies [gpr11-16] suggest the walls of the castle, outer works or paths extended beyond the standing remains on every side other than the main entrance to the north.

A linear, diffuse, high-amplitude anomaly [gpr17] is found between 25.0 and 50.0ns (1.54 to 3.08m) and appears on a differing alignment to the hexagonal walls of the castle, possibly associated with the drainage conduit known in this area (Linford 1998).

A linear high-amplitude anomaly [gpr18] crosses the survey area from the ticket office passing through [gpr1], following the west wall around the castle, and then from a utility inspection cover to the south of the castle towards the banqueting pavilion. Anomaly [gpr18] most likely represents a water supply service to the Ticket Office installed prior to the 2005 GPR survey (Appendix). Rectilinear high-amplitude anomalies [gpr19], formed of two conjoined ~3m squares reverberate through the data set from the near-surface and overlap with [gpr18]. It is possible [gpr19] could, perhaps, be associated with a rainwater soak-a-way partially reutilising and aligned with the trench dug for the water supply service. A similar rectilinear anomaly [gpr20], consisting of three ~3.5m cells, has been identified to the southeast of the castle and may, again, represent a rainwater soak-a-way associated with a utility inspection cover close to the east wall of the castle. There is no apparent evidence for [gpr18] and [gpr19] in the previous earth resistance survey suggesting these are relatively recent interventions (Figures 9 and 10; Linford 1998). Both the location of [gpr18] together with the void investigated by the previous GPR survey (Appendix) can be discerned from Google Earth imagery dated December 2005.

Fragmented linear, high-amplitude anomalies [gpr21] found against the west corner of the castle wall are difficult to fully interpret but suggest garden features, a drainage conduit or a limited-scale structure. Given its location, which directly views the lake, it is possible this was the location of a former viewing platform back towards the new castle.



## Conclusions

The Ground Penetrating Radar survey has successfully identified elements of the former garden design established over the north terrace, including two circular anomalies known from the previous earth resistance survey, a central pathway and wall-footings. Anomalies follow the line of the castle walls to the south-east, south and north-west, although it is unclear whether these represent wall footings of the original castle footprint, outer works or paths complementing the standing building. A possible drainage conduit has also been identified to the south-west of the castle together with confirmation of a more recent water supply service to the Ticket Office. Two possible soak-a-way features have been found to the east and west of the castle that do not appear in the 1997 earth resistance survey, suggesting these have been introduced more recently to disperse rainwater run-off from the standing remains.

## List of Enclosed Figures

- Figure 1: Location of GPR instrument survey swaths superimposed over the base OS mapping data (1:1,000).
- Figure 2: GPR amplitude time slice between 17.5 and 20.0ns (1.08 to 1.23m) superimposed over the base OS mapping data (1:750).
- Figure 3: Representative topographically corrected GPR profiles shown as greyscale images with annotation denoting significant anomalies. The location of selected profiles can be found on Figures 1, 2 and 8.
- Figure 4: GPR amplitude time slice between 0.0 and 12.5ns (0.0 to 0.77m) (1:2,000).
- Figure 5: GPR amplitude time slice between 12.5 and 25.0ns (0.77 to 1.54m) (1:2,000).
- Figure 6: GPR amplitude time slice between 25.0 and 37.5ns (1.54 to 2.31m) (1:2,000).
- Figure 7: GPR amplitude time slice between 37.5 and 50.0ns (2.31 to 3.08m) (1:2,000).
- Figure 8: Graphical summary of significant GPR anomalies superimposed over the base OS mapping data (1:750).
- Figure 9: Histogram equalised greyscale image of 0.5m mobile probe separation data superimposed over the base OS mapping data (1:750).
- Figure 10: Histogram equalised greyscale image of 1.0m mobile probe separation data superimposed over the base OS mapping data (1:750).

## Reference

- British Geological Survey 2024. "Old Wardour Castle, Donhead St. Andrew, Wiltshire, England." British Geology Viewer. Retrieved 22/01/2024, 2024, from <https://geologyviewer.bgs.ac.uk/>.
- Eide, E, Linford, N, Persico, R and Sala, J 2018 'Advanced SFCW GPR systems' in Persico, R, Piro, S and Linford, N (eds), *Innovation in Near-Surface Geophysics Instrumentation, Application, and Data Processing Methods* Amsterdam: Elsevier, 253-285.
- Geological Survey of Great Britain 1996 Wincanton Geological Survey of England and Wales, Sheet 297 Solid and Drift Edition Solid and Drift. Southampton, The Director General of the Ordnance Survey.
- Girouard, M 2012 *Old Wardour Castle, English Heritage Guidebook*. Swindon, English Heritage.
- Historic England 1996. "Old Wardour Castle: a tower keep castle, 17th century stables and later garden features, 1013398." National Heritage List for England. Retrieved 11/03/2024, from <https://historicengland.org.uk/listing/the-list/list-entry/1013398>.
- Historic England 2004. "WARDOUR CASTLE AND OLD WARDOUR CASTLE, 1000507." National Heritage List for England. Retrieved 15/04/2024, from <https://historicengland.org.uk/listing/the-list/list-entry/1000507?section=official-list-entry>.
- Linford, N 1998 '*OLD WARDOUR CASTLE, WILTSHIRE, REPORT ON GEOPHYSICAL SURVEY, 1997*'. Historic England.
- Linford, N 2004 'From Hypocaust to Hyperbola: Ground Penetrating Radar surveys over mainly Roman remains in the U.K.'. *Archaeological Prospection*, **11** (4), 237-246.
- Linford, N 2013. *Rapid processing of GPR time slices for data visualisation during field acquisition*. In Neubauer, W, Trinks, I, Salisbury, R and Einwogerer, C (Editors), *Archaeological Prospection, Proceedings of the 10th International Conference, May 29th - June 2nd 2013 2013* (Vienna: Austrian Academy of Sciences Press). 176-78.
- Linford, N, Linford, P, Martin, L and Payne, A 2010 'Stepped-frequency GPR survey with a multi-element array antenna: Results from field application on archaeological sites'. *Archaeological Prospection*, **17** (3), 187-198.
- Reilly, S 1997 '*Old Wardour Castle Garderobe Excavations, CAS site 626, summary of archaeological evaluation*'.
- Sala, J and Linford, N 2012 'Processing stepped frequency continuous wave GPR systems to obtain maximum value from archaeological data sets '. *Near Surface Geophysics*, **10** (1), 3-10.

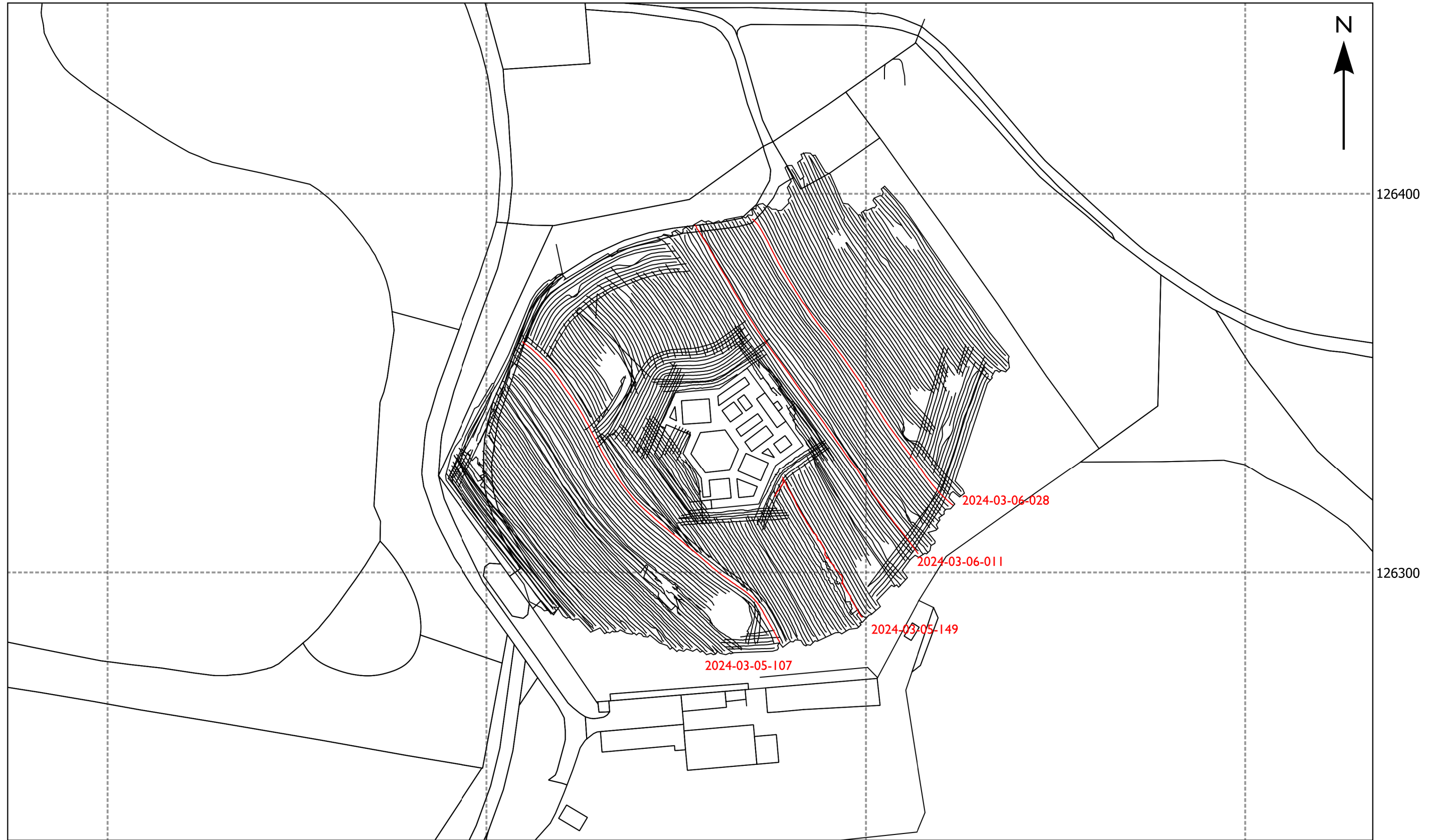
Soil Survey of England and Wales 1983 Soils of England and Wales, Sheet 5 - South West England, 1:250,000 scale soil map, Lawes Agricultural Trust, Harpenden.

Soilscapes 2024. "Old Wardour, SP3, Wiltshire, South West, England." Retrieved 22/01/2024, 2024, from <https://www.landis.org.uk/soilscapes/>.

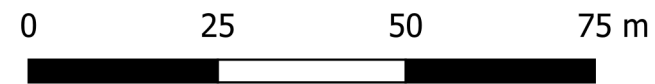
# OLD WARDOUR CASTLE, TISBURY, WILTSHIRE

## Location of GPR instrument swaths, March 2024

Figure 1




© Crown Copyright [and database rights] 2024. OS 100024900.



1:1,000

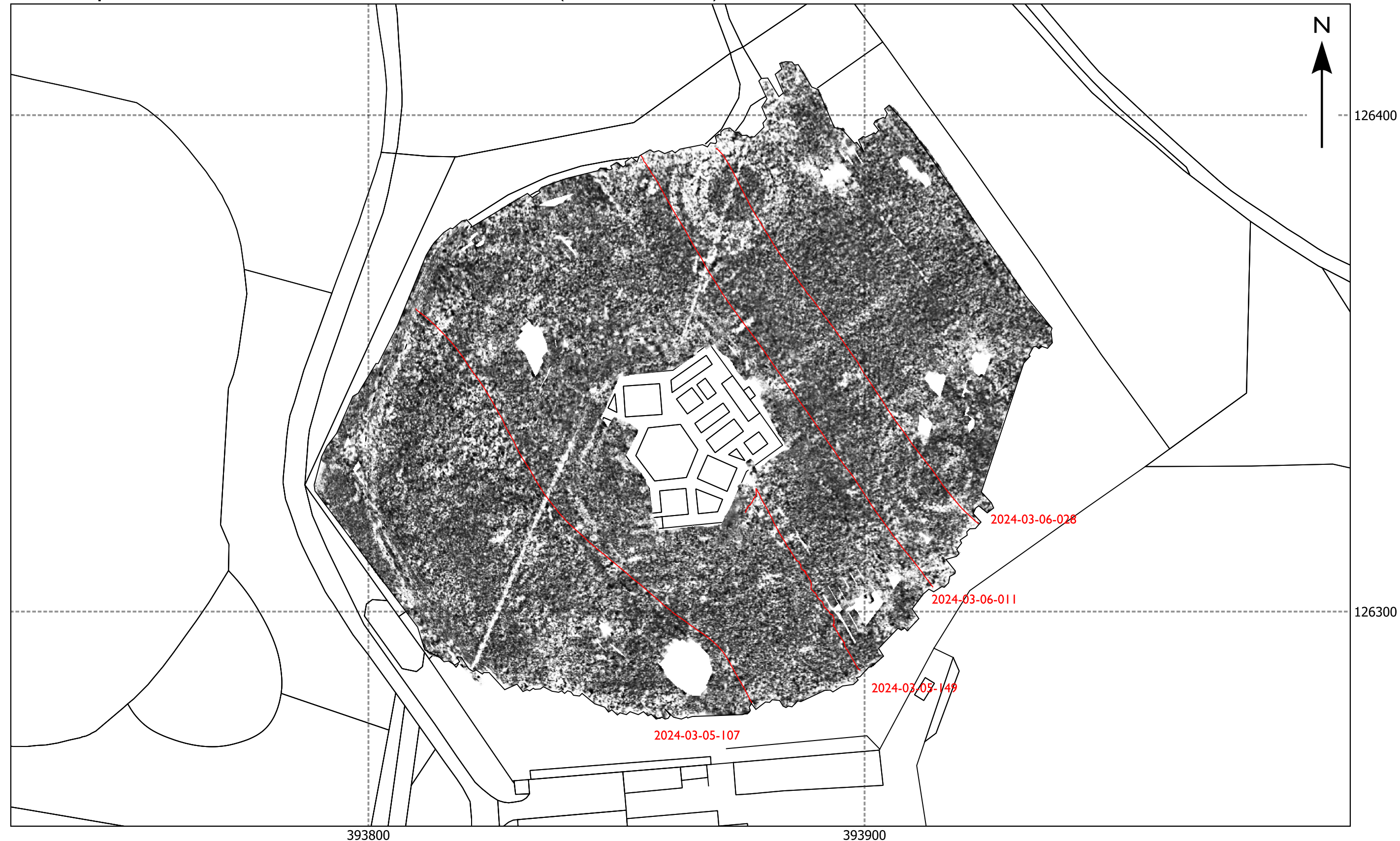
 GPR Survey Swaths

 Location of selected GPR profiles drawn on Figure 3

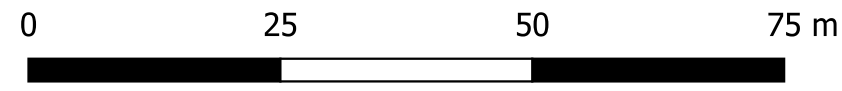
# OLD WARDOUR CASTLE, TISBURY, WILTSHIRE

Figure 2

## GPR amplitude time slice between 17.5 and 20.0ns (1.08 to 1.23m), March 2024



© Crown Copyright [and database rights] 2024. OS 100024900.



1:750

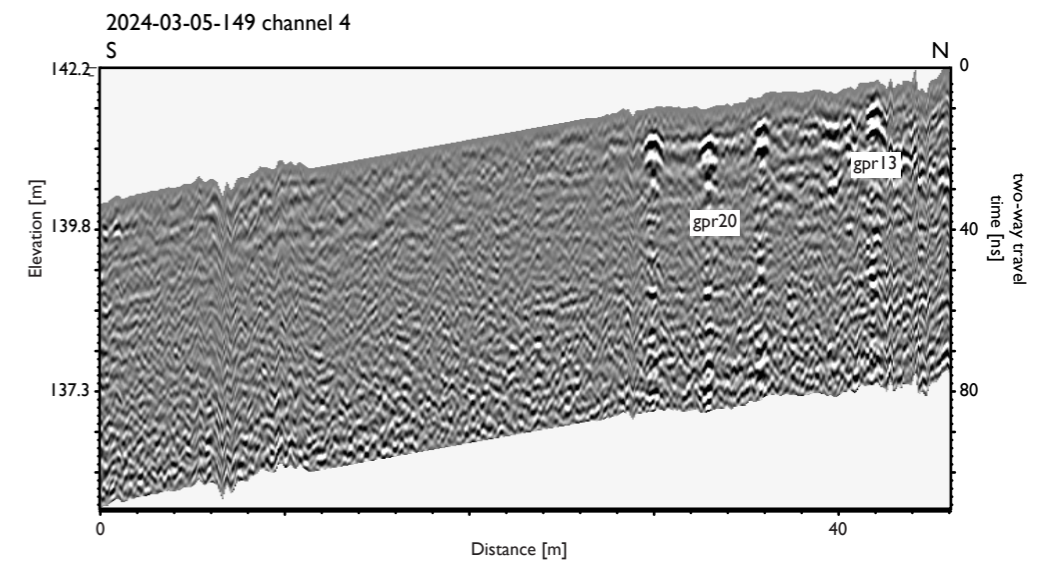
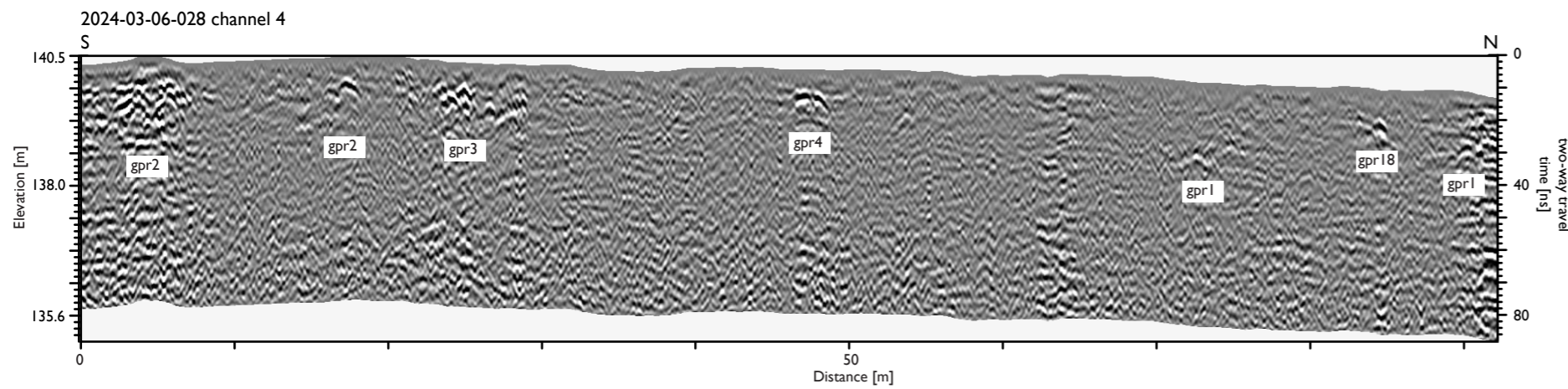
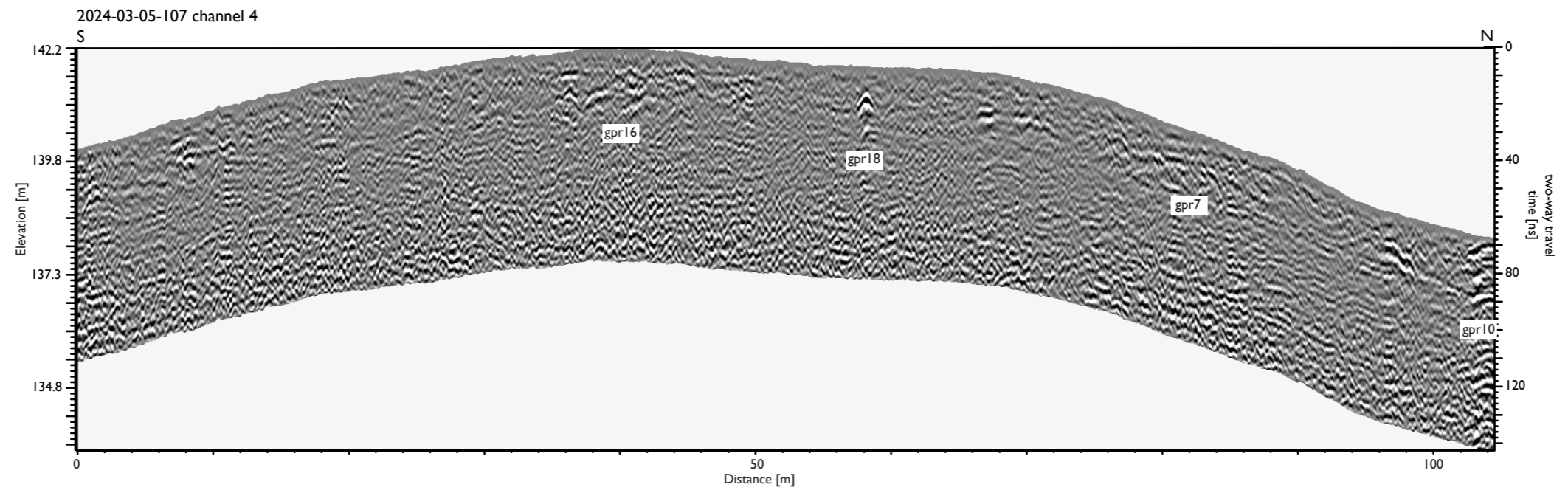
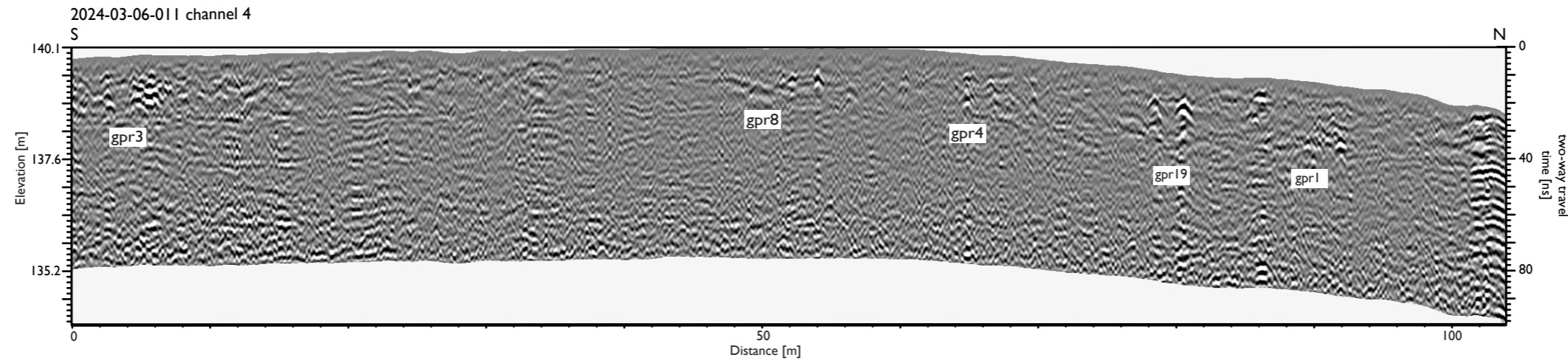


— Location of selected GPR profiles drawn on Figure 3

# OLD WARDOUR CASTLE, TISBURY, WILTSHIRE

## Representative topographically corrected GPR profiles, March 2024

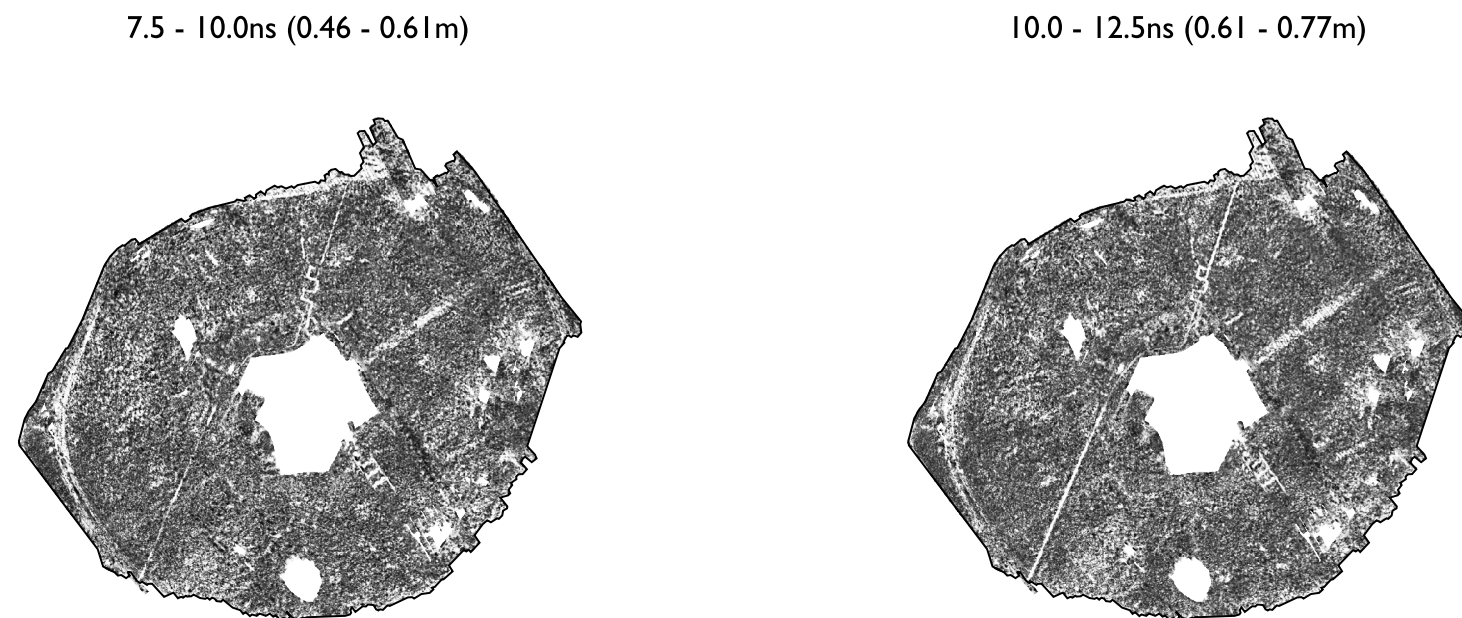
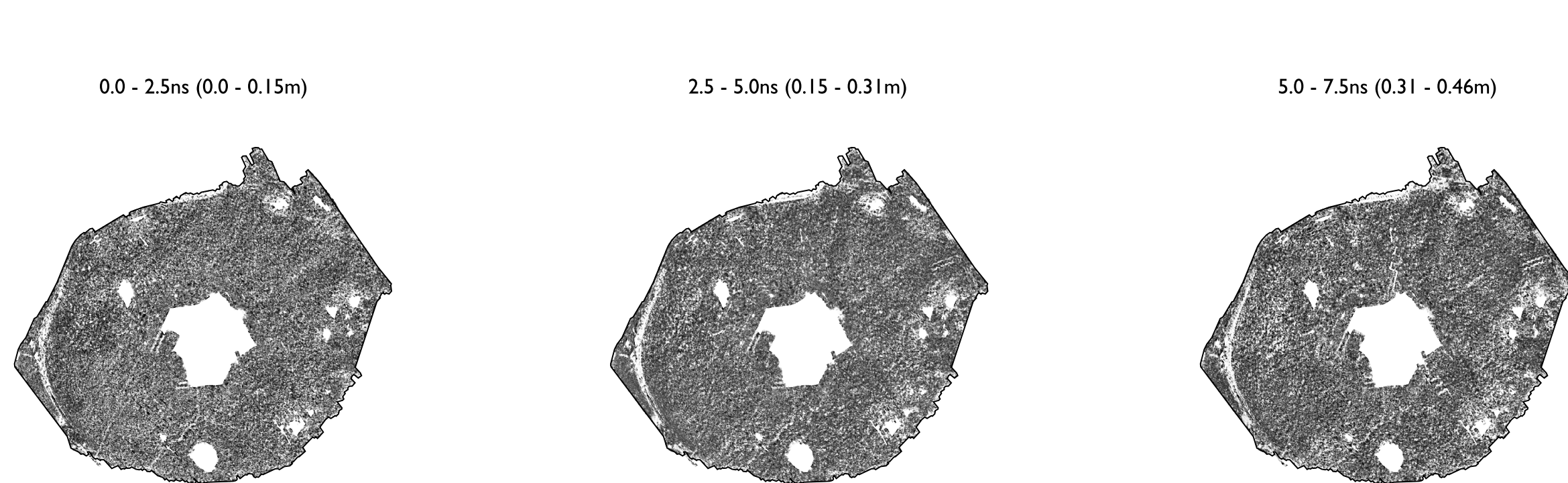
Figure 3



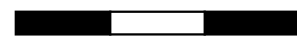
OLD WARDOUR CASTLE, TISBURY, WILTSHIRE

GPR amplitude time slices between 0.0 and 12.5ns (0.0 to 0.77m), March 2024

Figure 4



0 50 100 150 m



1:2,000

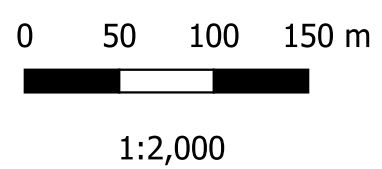
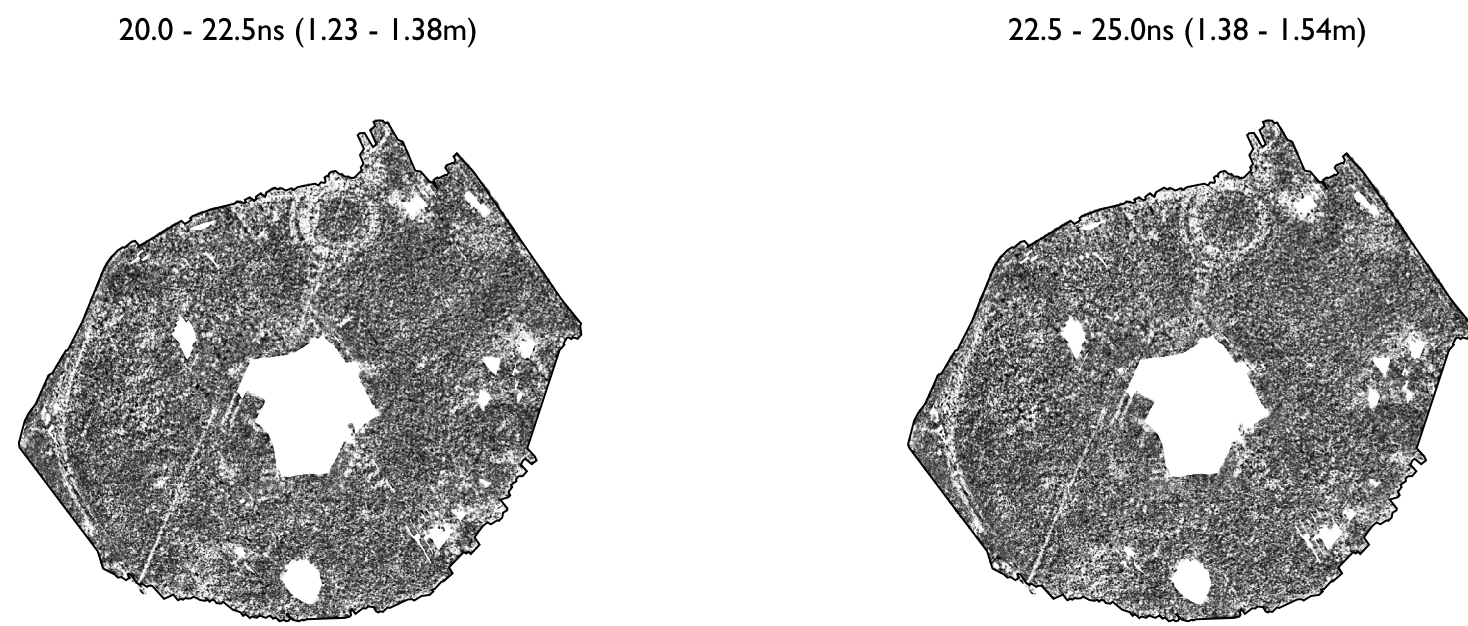
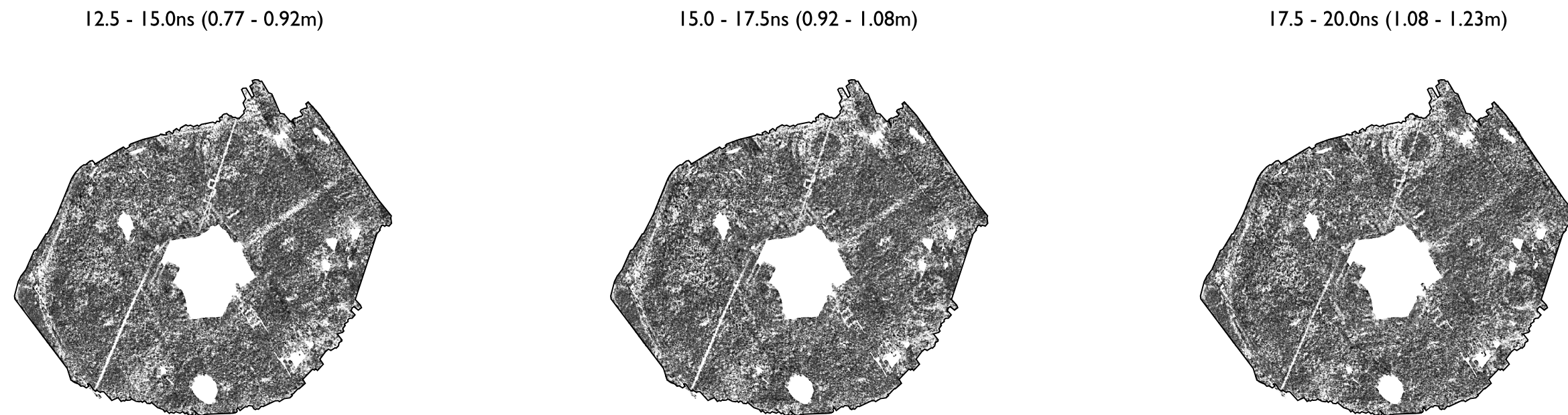


Low High  
relative reflector strength



# OLD WARDOUR CASTLE, TISBURY, WILTSHIRE

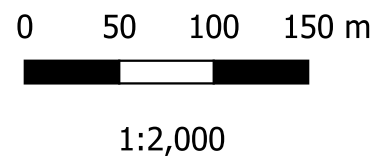
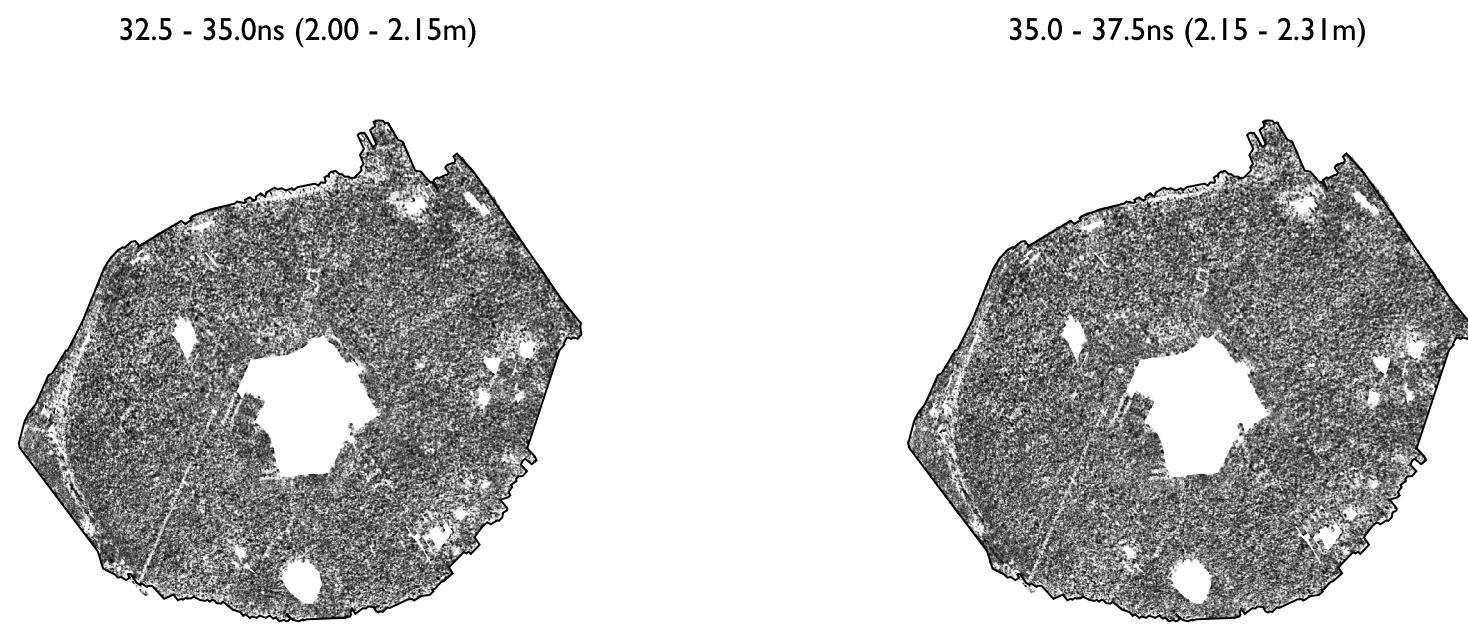
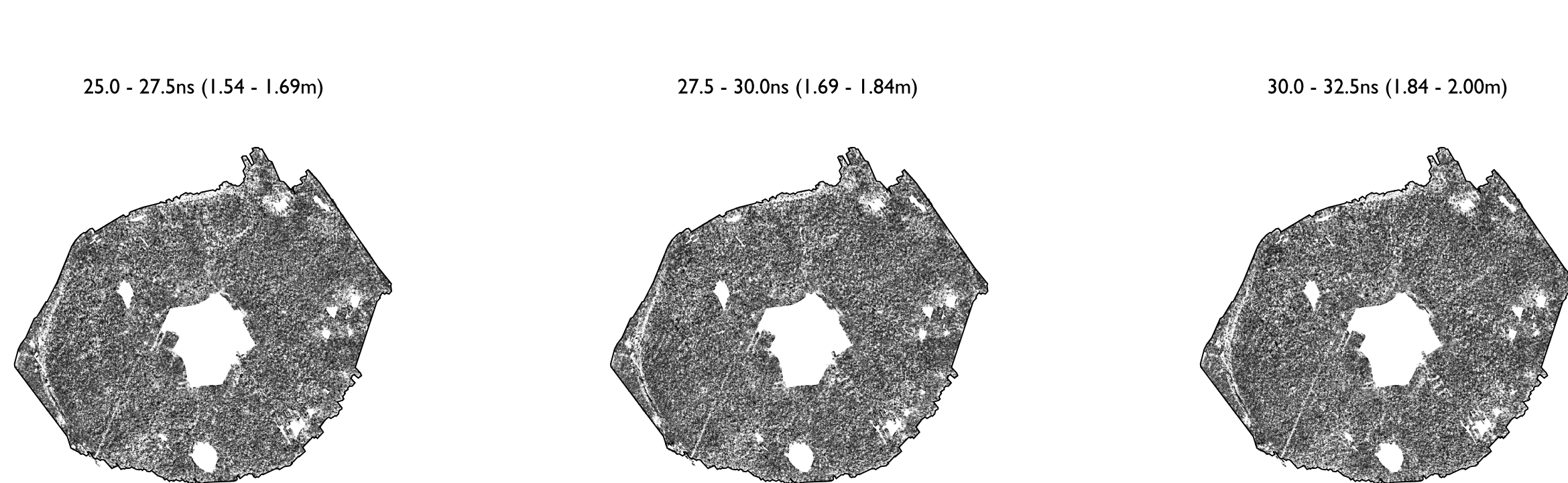
## GPR amplitude time slices between 12.5 and 25.0ns (0.77 to 1.54m), March 2024



OLD WARDOUR CASTLE, TISBURY, WILTSHIRE

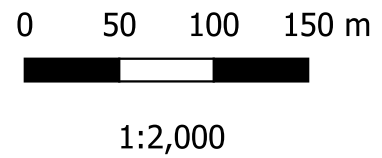
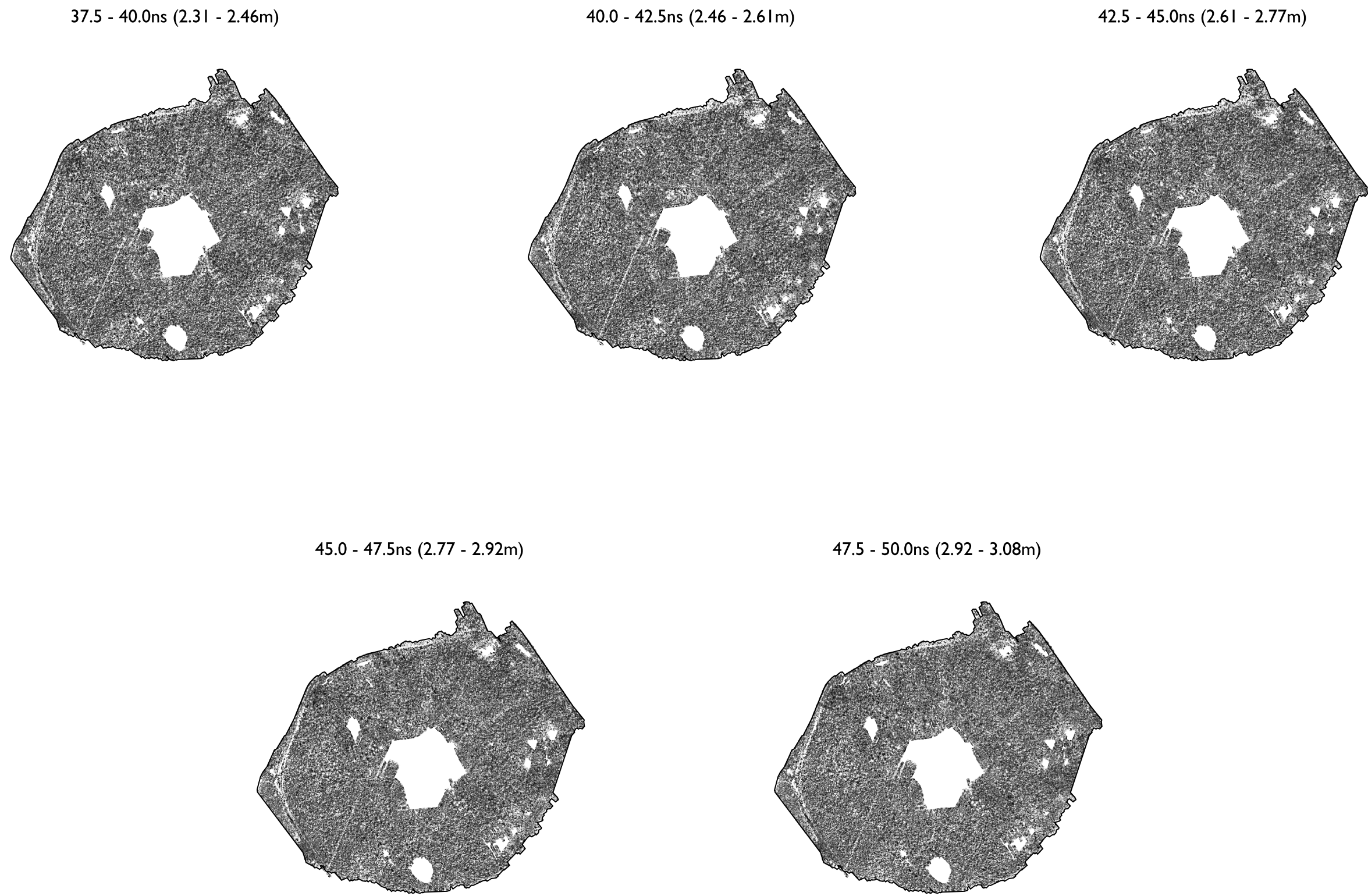
GPR amplitude time slices between 25.0 and 37.5ns (1.54 to 2.31m), March 2024

Figure 6



# OLD WARDOUR CASTLE, TISBURY, WILTSHIRE

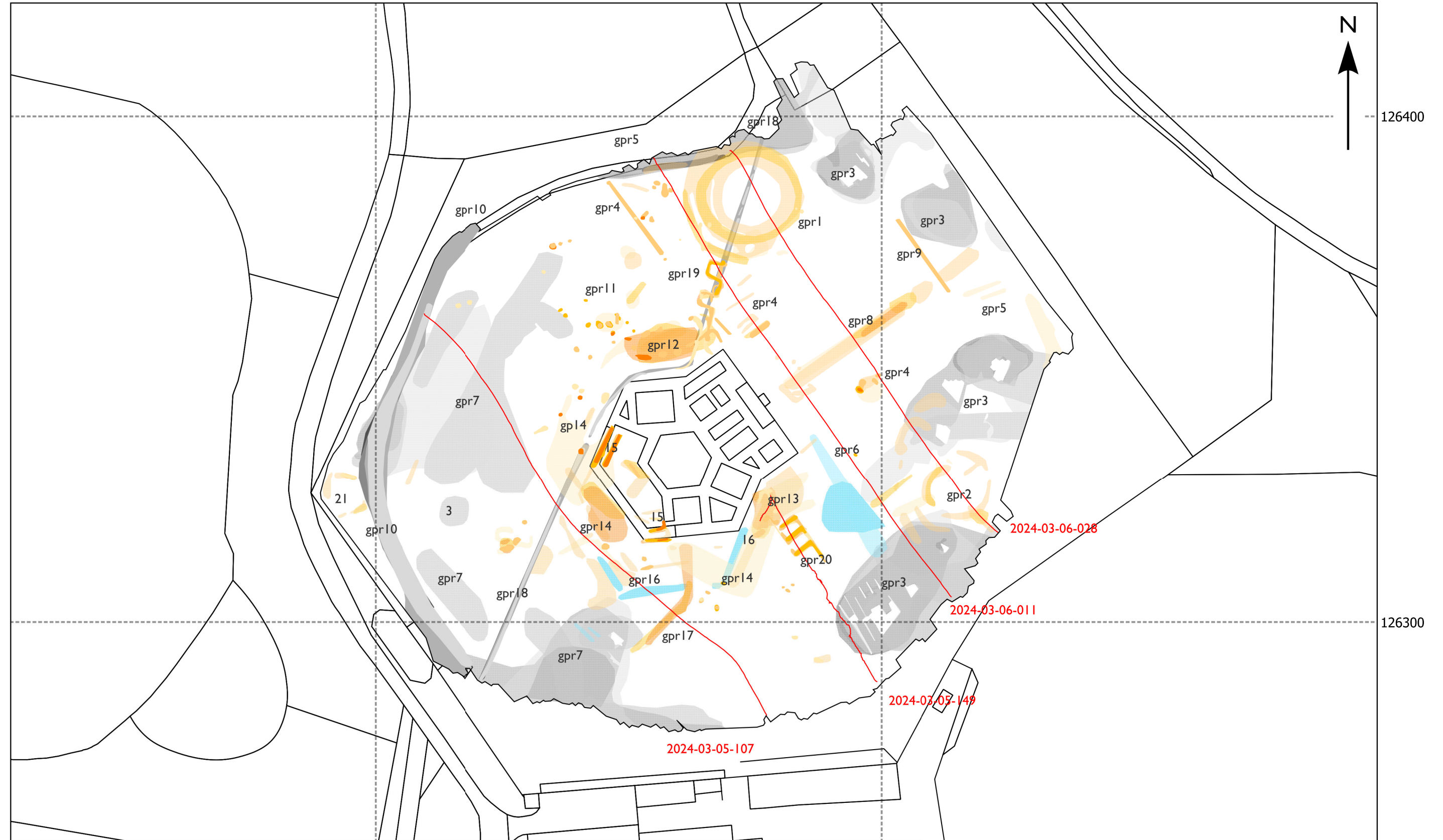
## GPR amplitude time slices between 37.5 and 50.0ns (2.31 to 3.08m), March 2024



# OLD WARDOUR CASTLE, TISBURY, WILTSHIRE

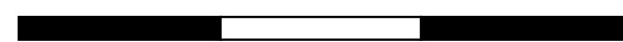
## Graphical summary of significant GPR anomalies, March 2024

Figure 8



© Crown Copyright [and database rights] 2024. OS 100024900.

0 20 40 60 m



1:750

High Amplitude Reflectors  
0.0 - 50.0ns

High Amplitude Reflectors (diffuse)  
0.0 - 50.0ns

Low Amplitude Reflectors  
0.0 - 50.0ns

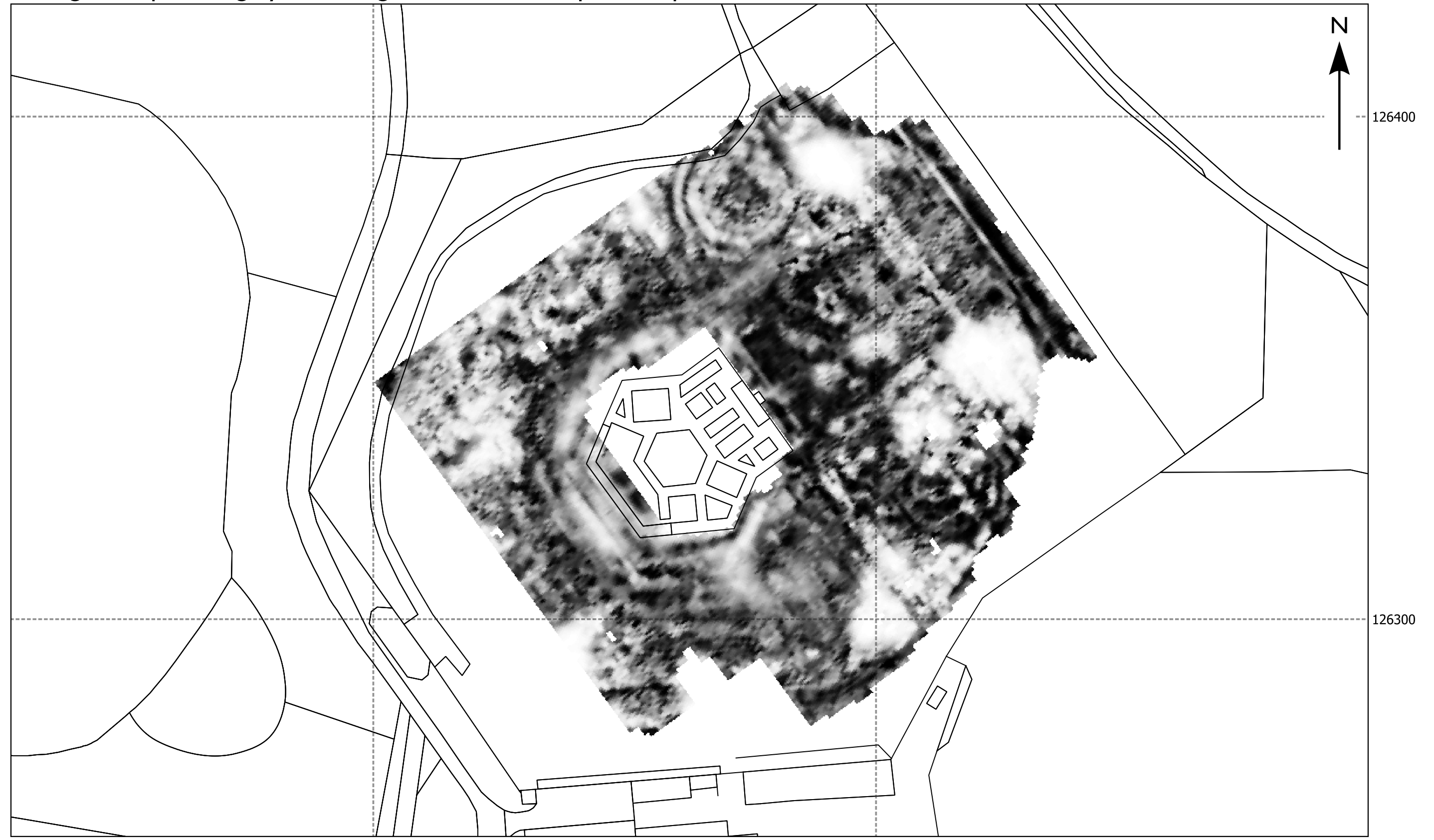
Anomalies of Recent or Known Origin  
0.0 - 50.0ns

Anomalies of Known or Recent Origin (diffuse)  
0.0 - 50.0ns

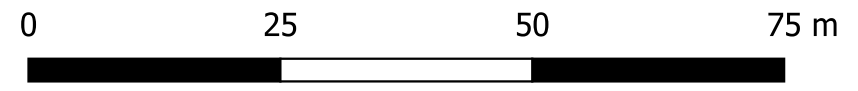
— Location of selected GPR profiles shown on Figure 3

# OLD WARDOUR CASTLE, TISBURY, WILTSHIRE

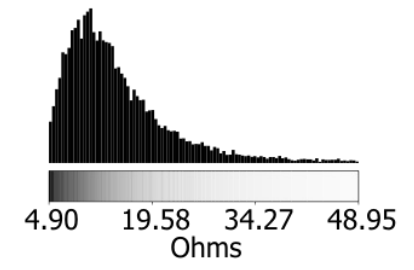
## Histogram equalised greyscale image of 0.5m mobile probe separation data, October 1997



© Crown Copyright [and database rights] 2024. OS 100024900.

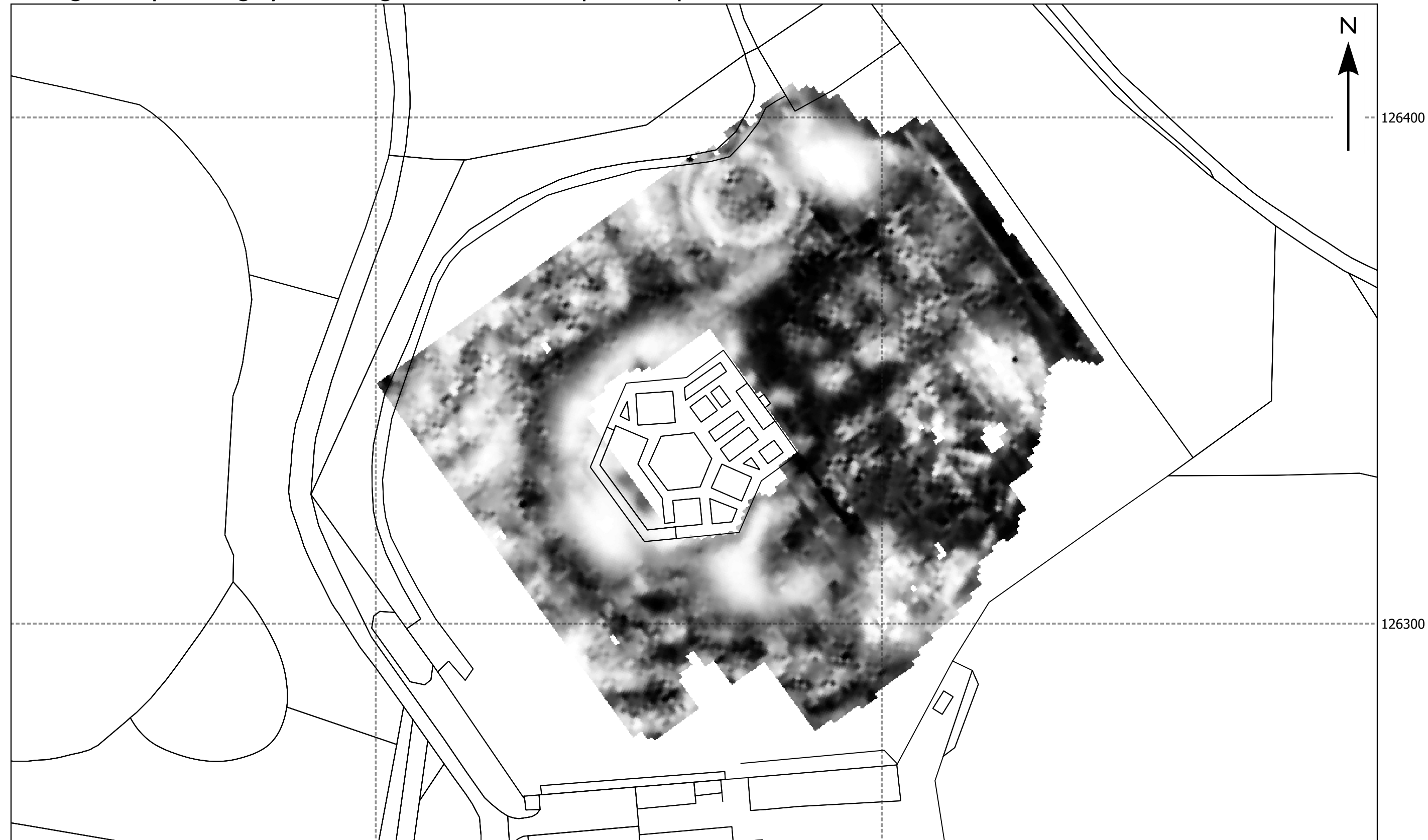


1:750

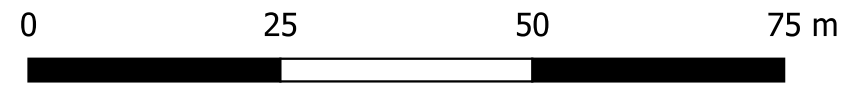


# OLD WARDOUR CASTLE, TISBURY, WILTSHIRE

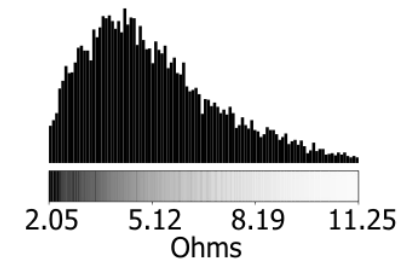
## Histogram equalised greyscale image of 1.0m mobile probe separation data, October 1997



© Crown Copyright [and database rights] 2024. OS 100024900.



1:750



## Appendix

The following text and figures are taken from a letter from Neil Linford to the English Heritage Building Manager at Bristol in September 2005:

### **Letter report: GPR survey, Old Wardour Castle, Wilts.**

Please find the results of GPR survey conducted on 19/8/05 over the void feature that has appeared at the above site. As you are aware, this area has been surveyed previously using the earth resistance technique that failed to reveal any significant anomalies in the immediate vicinity of the void (Linford 1997).

The current survey was conducted with a PulseEKKO 1000 GPR system with a 450MHz centre frequency antenna over a 10m x 10m area at a sample interval of 0.05m x 0.5m. Figure 1 shows the location of the survey area and the individual survey profiles superimposed over a greyscale image of the 10 to 12ns amplitude time slice.

Figure 2 shows the GPR profile from line 10 that was initially collected with a 450MHz antenna crossing the centre of the void anomaly and extending for 20m to the N to encompass the known course of a recently installed service trench. The response to the modern service trench is clearly evident at a distance of 17.5m along the profile where as the void feature has produced a more subtle reflection at approximately 5m. A trial profile over the void feature was also conducted with 225MHz (deeper penetrating) centre frequency antenna (Figure 2; Line 10 225MHz) that again detected the void feature but with some loss of near surface resolution.

The 450MHz centre frequency antenna was therefore chosen to conduct the area survey over a 10m x 10m grid centred over the void feature. Figure 3 shows the results of this survey presented as a series of amplitude time slice images. Each successive image represents the horizontal variation in reflection strength from the surface to a depth of ~1.25m in increments of ~0.06m. The most significant anomaly appears as a low amplitude reflector in the near surface data between 6 and 14ns (0.18 to 0.42m based on an estimated subsurface wave front velocity of 0.06m/ns). The dimensions of this anomaly are far greater than the void itself, but match the approximate size and location of the fenced off longer grass surrounding this feature. It is likely that this longer grass has led to increased moisture retention in the immediate topsoil that has attenuated the incident radar wave front. Data from between 12 and 14ns (0.36 to 0.42m) suggests a series of smaller anomalies that appear to match the dimensions of the void space and its apparent subterranean

extension. Below this depth the radar signal is rapidly attenuated and most of the signal is lost by ~20ns (cf Figure 2: Lie 10 450MHz).

The data contain no convincing evidence for any additional features, such as a drainage conduit, approaching the location of the void from the main castle building. There is some evidence for wall foundations following the marked course of the original walls destroyed during the civil war and a degree of rubble, perhaps associated with the levelling of the site, is apparent to the SW.

The geophysical survey has not provided any conclusive evidence to suggest the origin of the void feature. However, it seems unlikely that the void forms part of a larger, unstable structure, for example a partially collapsed drainage conduit. The single piece of wood recovered from the void was identified as coniferous and likely to be a worked stake or plank rather than root material (Gill Campbell *pers. comm.*). It is still possible that the void represents the location of a former tree planting pit, although it may also be related to the levelling of the site when the garden terrace was created.

I trust this information will be of use to you and please do not hesitate to get in contact should you have any further queries regarding this matter.

### Enc. 3

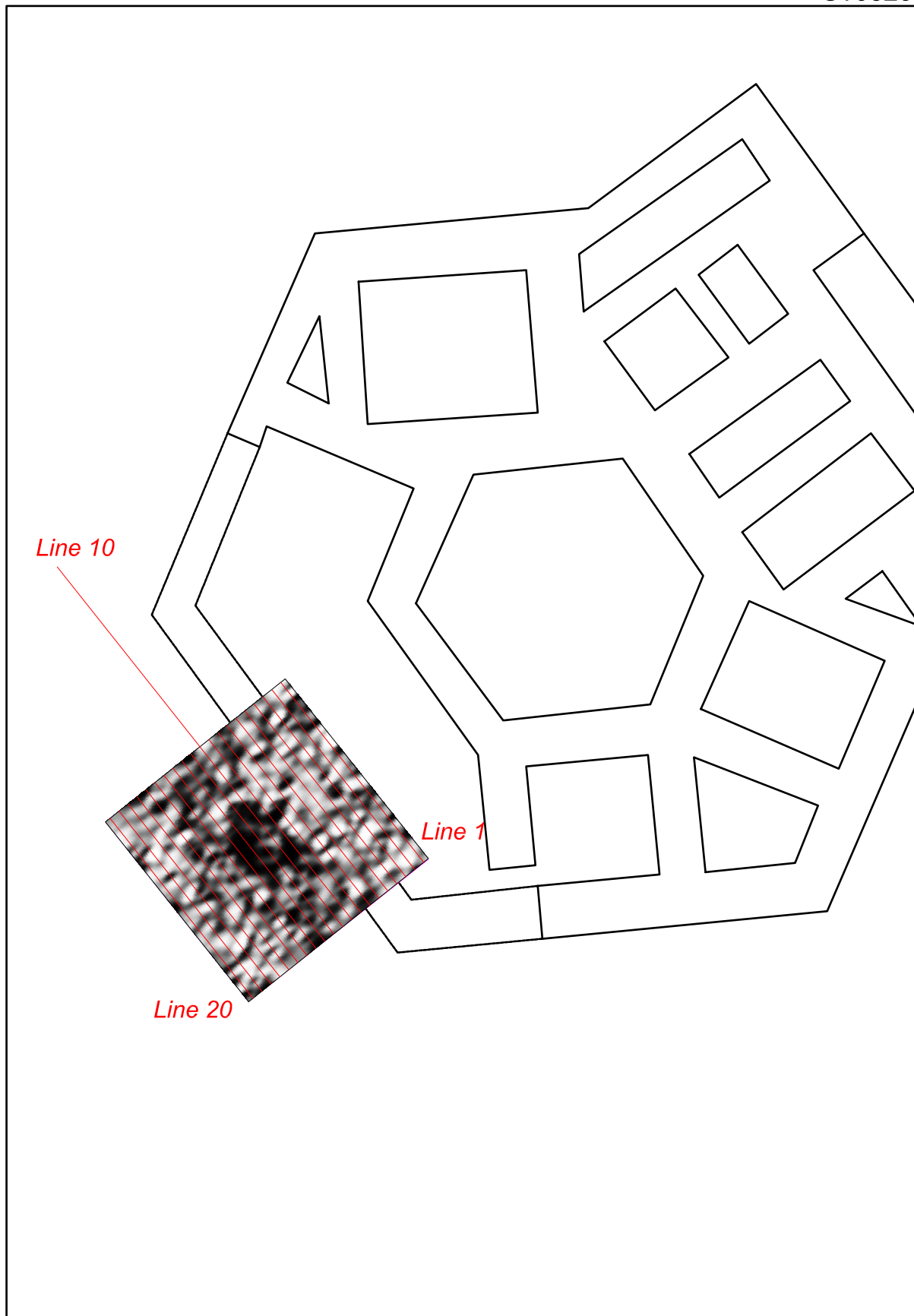
Linford, N. T., 1997, OLD WARDOUR CASTLE, WILTSHIRE, Report on Geophysical Survey, 1997, Ancient Monuments Laboratory Report Series, **5/98**.



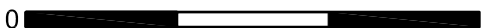
# OLD WARDOUR CASTLE, Wilts.

Location of GPR survey, August 2005

ST9326

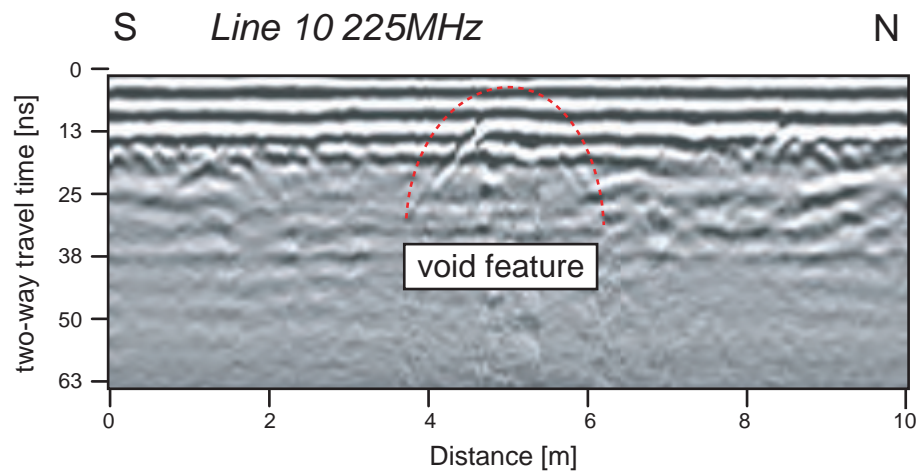
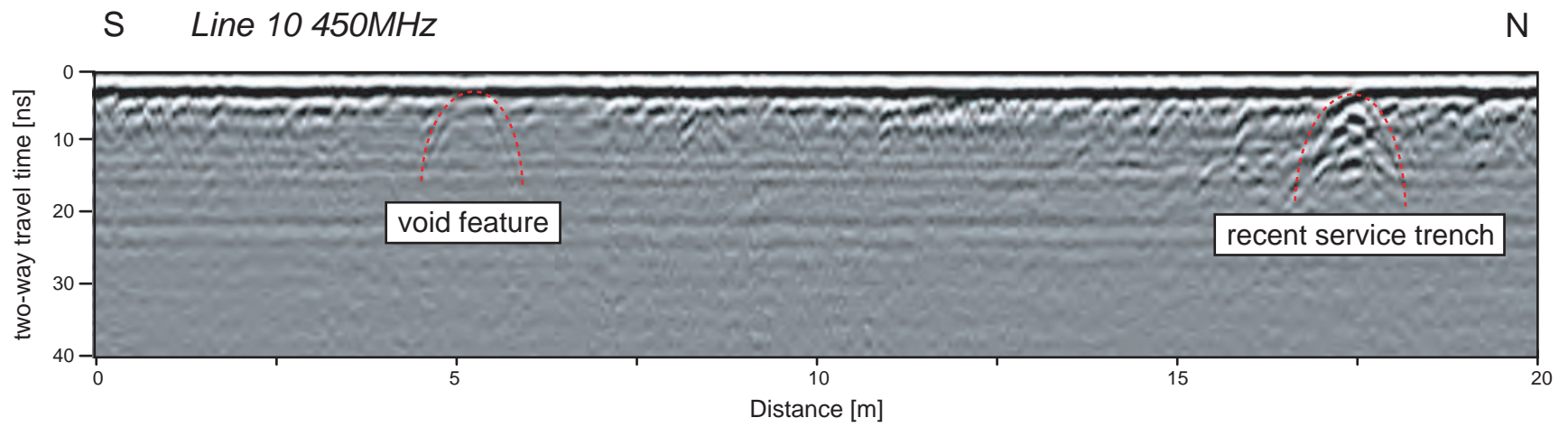


This map is based upon Ordnance Survey material with the Permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown copyright. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings. English Heritage 100019088 2005.

0  15m  
1:250

OLD WARDOUR CASTLE, Wilts.  
Ground Penetrating Radar survey, August 2005

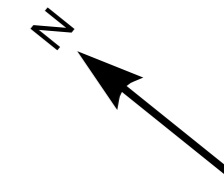
Figure 2



relative reflector strength

OLD WARDOUR CASTLE, Wilts.  
GPR Amplitude Time Slices 450MHz data, August 2005

Figure 3



0 - 2ns (0.0 - 0.06m)



2 - 4ns (0.06 - 0.12m)



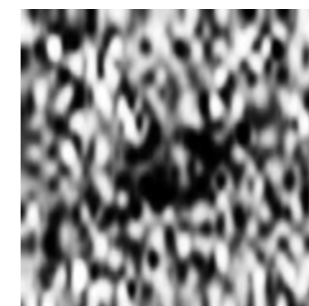
4 - 6ns (0.12 - 0.18m)



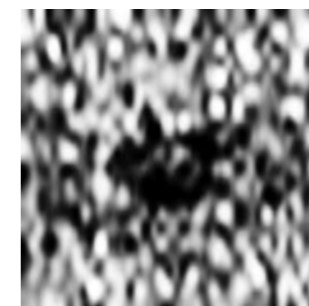
6 - 8ns (0.18 - 0.24m)



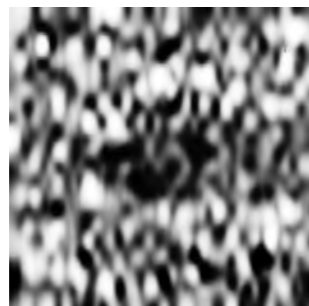
8 - 10ns (0.24 - 0.3m)



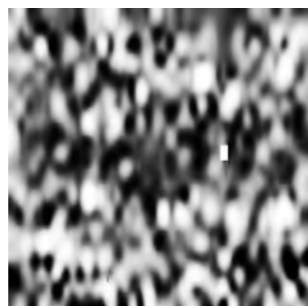
10 - 12ns (0.3 - 0.36m)



12 - 14ns (0.36 - 0.42m)



14 - 16ns (0.42 - 0.48m)



16 - 18ns (0.48 - 0.56m)



18 - 20ns (0.56 - 0.64m)



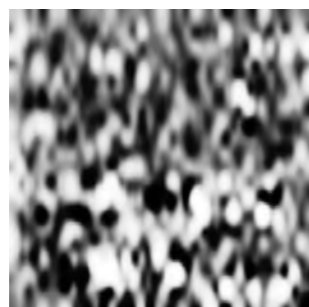
20 - 22ns (0.64 - 0.72m)



22 - 24ns (0.72 - 0.78m)



24 - 26ns (0.78 - 0.84m)



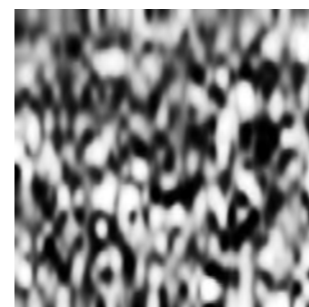
26 - 28ns (0.84 - 0.9m)



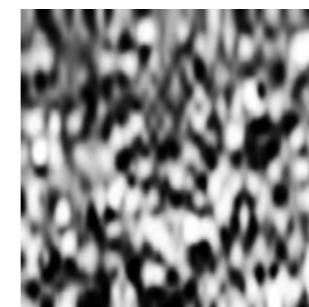
28 - 30ns (0.9 - 0.96m)



30 - 32ns (0.96 - 1.02m)



32 - 34ns (1.02 - 1.08m)



34 - 36ns (1.08 - 1.14m)



36 - 38ns (1.14 - 1.2m)



38 - 40ns (1.2 - 1.26m)



40 - 42ns (1.26 - 1.32m)



■ low  
□ high  
relative reflector amplitude

0 15m  
1:250



Historic England

# Historic England's Research Reports

We are the public body that helps people care for, enjoy and celebrate England's historic environment.

We carry out and fund applied research to support the protection and management of the historic environment. Our research programme is wide-ranging and both national and local in scope, with projects that highlight new discoveries and provide greater understanding, appreciation and enjoyment of our historic places.

More information on our research strategy and agenda is available at

[HistoricEngland.org.uk/research/agenda](https://HistoricEngland.org.uk/research/agenda).

The Research Report Series replaces the former Centre for Archaeology Reports Series, the Archaeological Investigation Report Series, the Architectural Investigation Report Series, and the Research Department Report Series.

All reports are available at [HistoricEngland.org.uk/research/results/reports](https://HistoricEngland.org.uk/research/results/reports). There are over 7,000 reports going back over 50 years. You can find out more about the scope of the Series here: [HistoricEngland.org.uk/research/results/about-the-research-reports-database](https://HistoricEngland.org.uk/research/results/about-the-research-reports-database).

Keep in touch with our research through our digital magazine *Historic England Research*

[HistoricEngland.org.uk/whats-new/research](https://HistoricEngland.org.uk/whats-new/research).