

MONA OFFSHORE WIND PROJECT

Environmental Statement

Annex 5.4: Intertidal survey report

Reference Number: MOCNS-J3303-RPS-10117

Document Reference: F7.5.4

APFP Regulations: 5(2)(a)

February 2024

F01



Image of an offshore wind farm

MONA OFFSHORE WIND PROJECT**Document status**

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
F01	Application	RPS	Mona Offshore Wind Ltd	Mona Offshore Wind Ltd	February 2024

Prepared by:

RPS

Prepared for:

Mona Offshore Wind Ltd.

MONA OFFSHORE WIND PROJECT

Client Name: RPS
 Document Title: Intertidal Survey Report
 Document Type: Intertidal UAV and Walkover Survey
 Report No.: 2022-23/2253
 Grid Reference: SH 9159 7858 to SH 9471 7901

Receiving Body: National Monuments Record, Royal Commission on the Ancient and Historical Monuments of Wales

Issue No: V. 1
 Date: March 2023
 Prepared by: (Senior Project Manager)
 Checked by: (Project Officer)
 Edited by: (Senior Project Manager)
 Approved for Issue by: (Operations Manager)
 Signature:

Disclaimer:

This document has been prepared for the titled project or named part thereof and should not be relied upon or used for any other project without an independent check being carried out as to its suitability and prior written authority of Oxford Archaeology being obtained. Oxford Archaeology accepts no responsibility or liability for the consequences of this document being used for a purpose other than the purposes for which it was commissioned. Any person/party using or relying on the document for such other purposes agrees and will by such use or reliance be taken to confirm their agreement to indemnify Oxford Archaeology for all loss or damage resulting therefrom. Oxford Archaeology accepts no responsibility or liability for this document to any party other than the person/party by whom it was commissioned.

OA South

Janus House
 Osney Mead
 Oxford
 OX2 0ES

t. +44 (0)1865 263 800

OA East

15 Trafalgar Way
 Bar Hill
 Cambridge
 CB23 8SQ

t. +44 (0)1223 850 500

OA North

Mill 3
 Moor Lane Mills
 Moor Lane
 Lancaster
 LA1 1QD

t. +44 (0)1524 880 250

e. info@oxfordarch.co.uk

w. oxfordarchaeology.com

Oxford Archaeology is a registered Charity: No. 285627



Chief Executive Officer
 Ken Welsh, BSc, MCIFA
 Private Limited Company, No: 1618597
 Registered Charity, No: 285627
 Registered Office: Oxford Archaeology Ltd
 Janus House, Osney Mead, Oxford OX2 0ES

Contents

CONTENTS	III
Summary	v
Acknowledgements	vi
1 INTRODUCTION	1
1.1 Scope of Work	1
1.2 Location, topography and geology	1
1.3 Archaeological and historical background	1
2 AIMS AND METHODOLOGY	3
2.1 Aims and objectives	3
2.2 Methodology	3
3 RESULTS	4
3.1 Introduction and presentation of results	4
3.2 Survey results	5
4 CONCLUSIONS	8
4.1 Discussion	8

Figures

Figure 1	Site location
Figure 2	Results of the intertidal survey in the vicinity of Llanddulas Beach
Figure 3	Results of the intertidal survey in the vicinity of Hen Wrych Farm
Figure 4	Results of the intertidal survey in the vicinity of Pensarn Beach

Appendices

Appendix A: Written Scheme of Investigation
Appendix B: Bibliography
Appendix C: Site Summary Details
Appendix D: Geoarchaeological Technical Report

MONA OFFSHORE WIND PROJECT

Glossary

Term	Meaning
Groyne	A low wall or sturdy barrier built out into the sea from a beach to check erosion and drifting.

Acronyms

Acronym	Description
AHEF	Archaeology and Heritage Engagement Forum
CPAT	Clwyd-Powys Archaeological Trust
DCO	Development Consent Order
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
NGR	National Grid Reference
NPAAW	National Panel for Archaeological Archives for Wales
OA	Oxford Archaeology
RCAHMW	Royal Commission on the Ancient and Historical Monuments of Wales
RTK	Real-time kinematic
SSSI	Site of Special Scientific Interest
UAV	Unmanned Aerial Vehicle
WSI	Written Scheme of Investigation

Units

Unit	Description
km	Kilometres
m	Metres

Summary

Oxford Archaeology (OA) North was commissioned by RPS to undertake an Unmanned Aerial Vehicle (UAV) and walkover survey of the site of the proposed landfall of the Mona Offshore Cable Corridor, between Llanddulas Beach (NGR: SH 9159 7858) and Pensarn Beach, Abergele (NGR: SH 9471 7901).

A survey of the intertidal area was undertaken due to the potential for encountering significant peat deposits. RPS produced a Written Scheme of Investigation (WSI) (see Appendix A) for the UAV and walkover survey of the intertidal area, and subsequently, commissioned OA North to undertake the necessary fieldwork, which was completed in three days between 18 and 20 October 2022. The results of the survey support the Environmental Statement and are used to characterise the baseline environment in Volume 3, Chapter 5: Historic environment of the Environmental Statement.

The survey area was fully recorded by UAV and on foot during the three-day survey, revealing no evidence of significant archaeological remains or deposits on the surface of the intertidal area. The presence of an unstratified lump of clayey peat suggests that there is survival of peat in the vicinity.

MONA OFFSHORE WIND PROJECT

Acknowledgements

Oxford Archaeology (OA) North would like to thank RPS for commissioning this survey. Thanks are also extended to the Development Control Archaeologist for Clwyd-Powys Archaeological Trust (CPAT), who monitored the work.

The project was managed for OA North by Paul Dunn. The fieldwork was directed by Andy Phelps, who was supported by Debbie Lewis. The survey and digitising were carried out by Debbie Lewis and Mark Tidmarsh.

1 INTRODUCTION

1.1 Scope of Work

- 1.1.1.1 This document forms Volume 7, Annex 5.4: Intertidal survey report, of the Environmental Statement.
- 1.1.1.2 Oxford Archaeology (OA) North was commissioned by RPS to undertake an Unmanned Aerial Vehicle (UAV) and walkover survey of the site of the proposed Mona Landfall between Llanddulas Beach (at national grid reference (NGR): SH 9159 7858; see Figure 1) and Pensarn Beach, Abergele (NGR: SH 9471 7901; see Figure 1).
- 1.1.1.3 In discussion with the archaeological consultant for the Mona Offshore Wind Project, a survey of the intertidal area was designed due to the potential for encountering significant peat deposits.
- 1.1.1.4 A survey of the intertidal area was undertaken due to the potential for encountering significant peat deposits. RPS produced a Written Scheme of Investigation (WSI) (see Appendix A) for the UAV and walkover survey of the intertidal area, and subsequently, commissioned OA North to undertake the necessary fieldwork, which was completed in three days between 18 and 20 October 2022. The results of the survey support the Environmental Statement and are used to characterise the baseline environment in Volume 3, Chapter 5: Historic environment of the Environmental Statement.

1.2 Location, topography and geology

- 1.2.1.1 The site is located on the intertidal area between Llanddulas, specifically Llanddulas Beach (NGR: SH 9159 7858; Figure 1) and Pensarn Beach, Abergele (NGR: SH9471 7901; Figure 1). Traeth Pensarn Site of Special Scientific Interest (SSSI) is located within the central and eastern part of the survey area (Figure 1) and is designated for its vegetated shingle beach plant communities.
- 1.2.1.2 The solid geology in the western half of the area is mapped as limestone, of the Clwyd Limestone Group, formed in the Carboniferous Period, whilst in the eastern half of the area it is mapped as mudstone, siltstone and sandstone, of the Warwickshire Group, formed in the Carboniferous and Permian Periods (BGS, 2023). The overlying superficial geology of the site is mapped as sand, marine beach deposits, formed during the Quaternary Period (BGS, 2023).

1.3 Archaeological and historical background

- 1.3.1.1 The archaeological and historical background of the site is taken from the WSI (Appendix A), which was summarised from Volume 7, Annex 5.1: Desk based assessment of the Environmental Statement.
- 1.3.1.2 The general area of the Vale of Clwyd has a long history of human occupation. Excavation in several of the caves has produced evidence of early prehistoric habitation, in some cases dating as far back as the Lower Palaeolithic. At Pontnewydd Cave near St Asaph, the early Neanderthal material represents the oldest hominin remains in Wales (recently dated to c. 230,000BP), whilst other important material has been recovered from the Brasgyll, Galltfaenan, Cefn and Cae Gronw caves (cf. Aldhouse-Green et al., 1996). The location of the Vale of Clwyd Cave Sites is shown on Figure 1.
- 1.3.1.3 This very early material has survived within the caves and rock shelters in the higher parts of the limestone uplands. Subsequent advances and retreats of ice sheets have

MONA OFFSHORE WIND PROJECT

changed the lower lying parts of the landscape on numerous occasions through to the ending of the most recent glacial episode at about 12,000BP. As the ice sheet diminished, sea levels in the area started to rise quickly and much of what is currently dry land would have been inundated. Studies in the Liverpool Bay area indicate that the sea level reached a high stand (maximum peak) at about 2,300BP before beginning to fall back again (Tooley 1978; 1985).

- 1.3.1.4 Sea level rise and fall was not a constant process; there would have been many periods of marine transgression and regression. During more stable times, land surfaces would have developed, only to be inundated and covered (and possibly eroded through subsequent regressive stages). Evidence for these sequences is in the form of Holocene peat deposits that have been found at depths of 10 m and 13 m below current ground level close to the mouth of the River Clwyd.
- 1.3.1.5 Most of the material found on the foreshore is broadly attributable to the Neolithic and Bronze Age periods. However, an antler mattock from here has been recently dated to c. 4,560BC and it is increasingly clear that there was a considerable amount of activity in the area during the Mesolithic period (c. 8,500-4,000BC) (Murphy 2002). The higher ground at Abergele is set on a ridge of Clwyd Limestone and would have remained above the sea level high stands; it probably represents the most seaward habitable land at such times.
- 1.3.1.6 Shell middens have been identified at Prestatyn, where consumption of mussels in the Mesolithic period suggest a rocky coastline and a subsequent change to a largely cockle based consumption in the Neolithic indicates the development of sandy beaches.

2 AIMS AND METHODOLOGY

2.1 Aims and objectives

- 2.1.1.1 The principal objective of the UAV and walkover survey were to establish whether any archaeological material and deposits of palaeoenvironmental interest survives within the proposed landfall locations. The survey was to aim to determine, as far as is reasonably possible, the location, form, extent, date, character, condition, significance and quality of any surviving archaeological remains and deposits of palaeoenvironmental interest, irrespective of period, that could be impacted by the Mona Offshore Wind Project. The survey also aimed to record the nature and extent of any existing disturbance and intrusion that may have the potential to affect the survival of buried archaeological deposits or remains.

2.2 Methodology

- 2.2.1.1 The full methodology was outlined in the WSI (Appendix A) which was adhered to in full and was fully compliant with prevailing guidelines and established industry best practice (ClfA 2020; 2022; Historic England 2015; 2017). A programme of field observation accurately recorded the form and character of all features of archaeological interest.
- 2.2.1.2 The area to be surveyed was set out and control established utilising a real-time kinematic (RTK) global navigation satellite system (GNSS) accurate to within 0.02 – 0.03 m. The UAV survey was undertaken through the use of a DJI Inspire 2 UAV piloted by trained, experienced and licensed pilots, in a systematic fashion to take photographs from multiple angles. The photographs were then processed in specialist photogrammetric software, (Agisoft Metashape Professional), to produce an accurate scaled model of the intertidal area to assist in the identification of peat outcroppings.
- 2.2.1.3 The walkover survey consisted of close field walking, on individual parallel transects based at 50 m intervals between Mean Low Water Springs (MLWS) and Mean High Water Springs (MHWS). This was dependent on visibility and safety considerations. If any features or deposits of archaeological interest were identified, they were to be recorded both photographically and described on conventional pro forma sheets.
- 2.2.1.4 The photographic archive was generated through landscape and detailed photography. Detailed photographs were taken of all sites using a scale bar, with all photographs being recorded on photographic pro-forma sheets which include a description of the subject, orientation and date.
- 2.2.1.5 A full professional archive was compiled in accordance with the WSI (Appendix A), and in accordance with current professional guidelines (ClfA 2020b; Historic England 2015). The archive will be deposited with the National Monuments Record of Wales, Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW) and National Panel for Archaeological Archives for Wales (NPAAW) following their standards and guidance (RCAHMW 2015; NPAAW 2019). The results of the RCAHMW are part of the Archaeology and Heritage Engagement Forum (AHEF) for the Mona Offshore Wind Project. The scope and results of this survey have been shared with the AHEF (see Volume 3, Chapter 5: Historic environment of the Environmental Statement).

3 RESULTS

3.1 Introduction and presentation of results

3.1.1.1 The results of the survey are presented below, and a description of the survey area provided. The light and weather conditions were adequate during the hours the site could be accessed. The UAV (Plate 1, Plate 2 and Plate 3) and walkover survey (Figure 2 to Figure 4) were fully completed during the three days on site.



Plate 1: Photogrammetric plan of the west of the survey area.

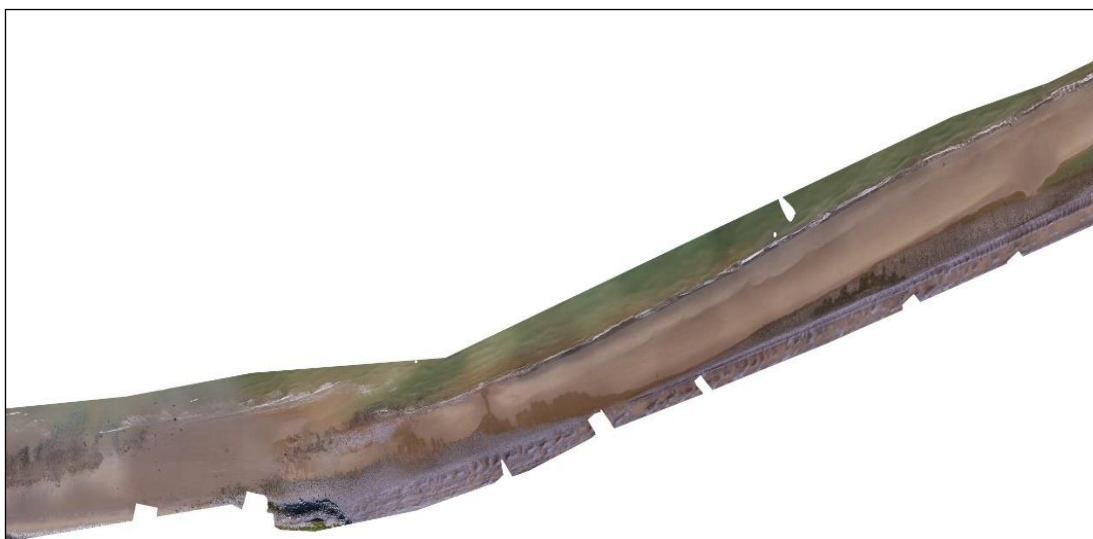


Plate 2: Photogrammetric plan of the central part of the survey area.



Plate 3: Photogrammetric plan of the east of the survey area.

3.2 Survey results

- 3.2.1.1 The UAV and walkover survey identified no significant archaeological remains within the survey area. Several groynes were identified interspersed throughout the survey area, primarily of timber construction, although one survived only as stone foundations (Figures 2, 3 and 4 and Plates 4 and 5); all probably of late 19th or early 20th century date.



Plate 4: Stone groyne foundations looking northwest, scale 1m.



Plate 5: Timber groyne with stone foundations, looking southeast, scale 1m.

3.2.1.2

The survey was also unable to find any evidence of peat outcroppings that were to be specifically targeted. Although an unstratified lump of clayey peat (Plate 6 and Plate 7) was identified, indicating the presence of peat in the vicinity, there was no evidence of where this peat had been washed-out from; it had clearly been ex-situ for a period of time due to the presence of sea-mollusc within the peat.



Plate 6: Unstratified clayey peat lump with 1m scale.

MONA OFFSHORE WIND PROJECT



Plate 7: Close up view of peat lump.

4 CONCLUSIONS

4.1 Discussion

- 4.1.1.1 The present investigation identified no significant archaeological remains or deposits within the intertidal available for inspection at the time of the survey. There was no evidence of any peat outcroppings within the survey area; however, an unstratified lump of clayey peat was identified within the survey area, suggesting that there are peat deposits in the vicinity of the survey area.

MONA OFFSHORE WIND PROJECT

FIGURES

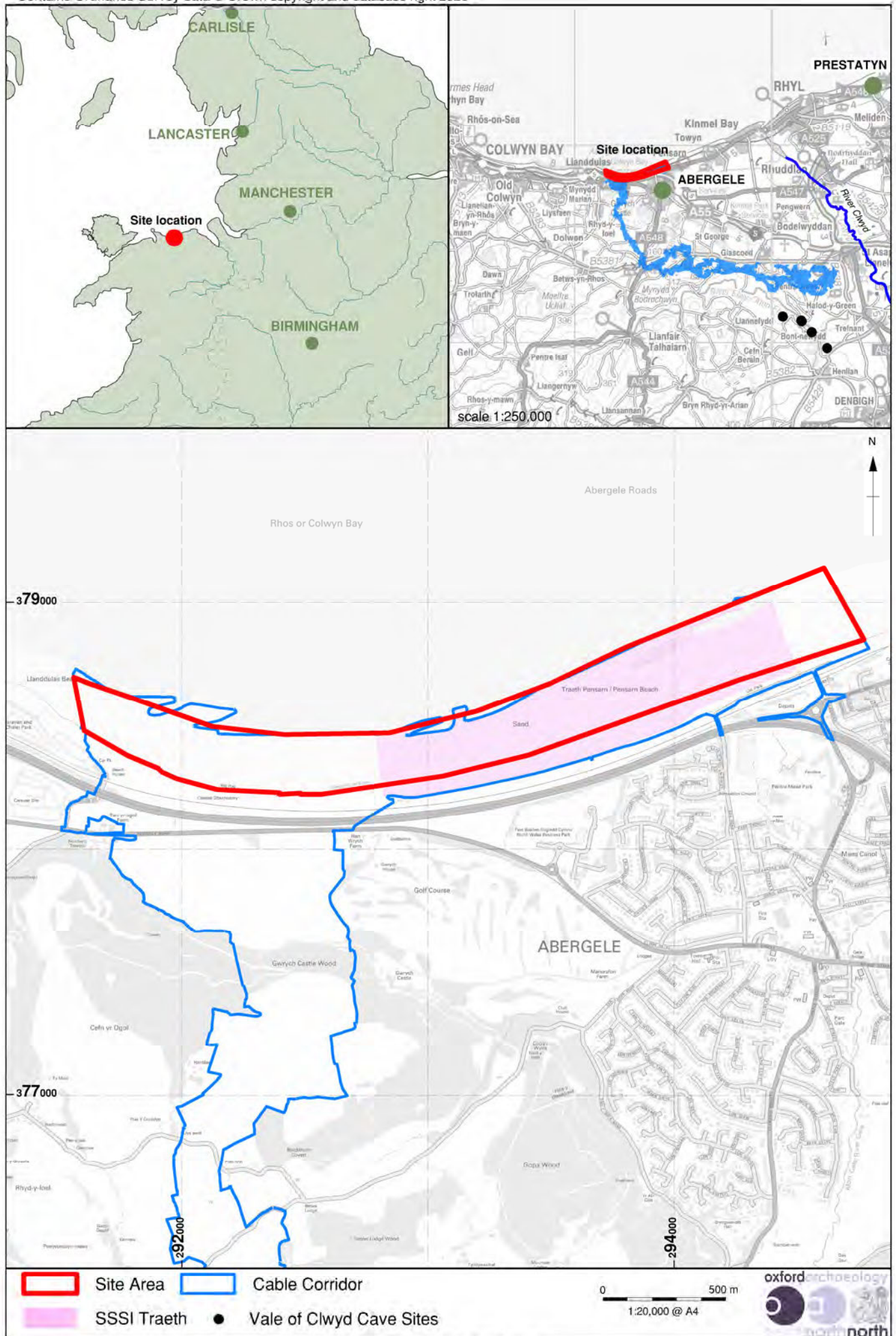


Figure 1: Site location

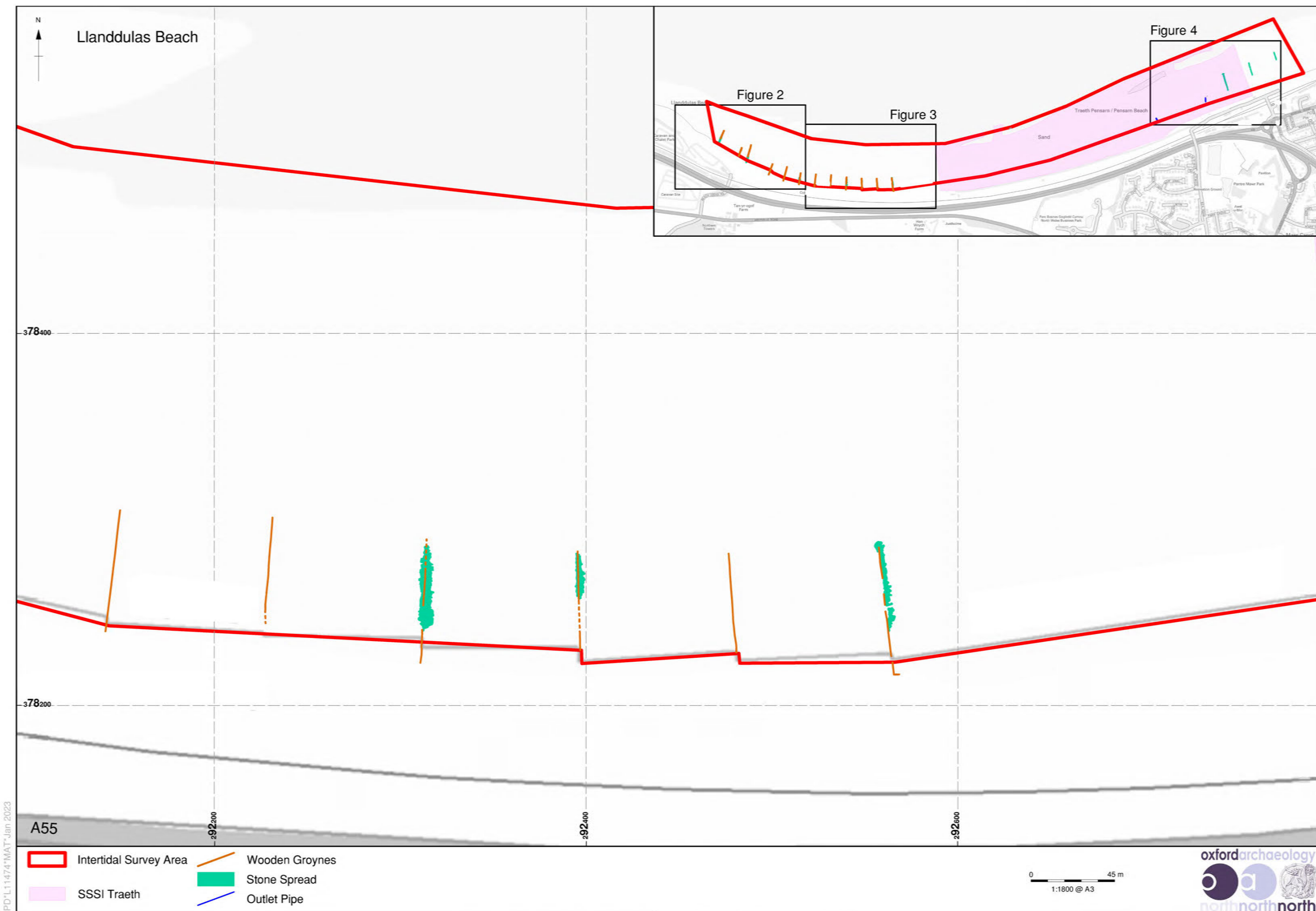


Figure 3: Results of the intertidal survey in the vicinity of Hen Wrych Farm

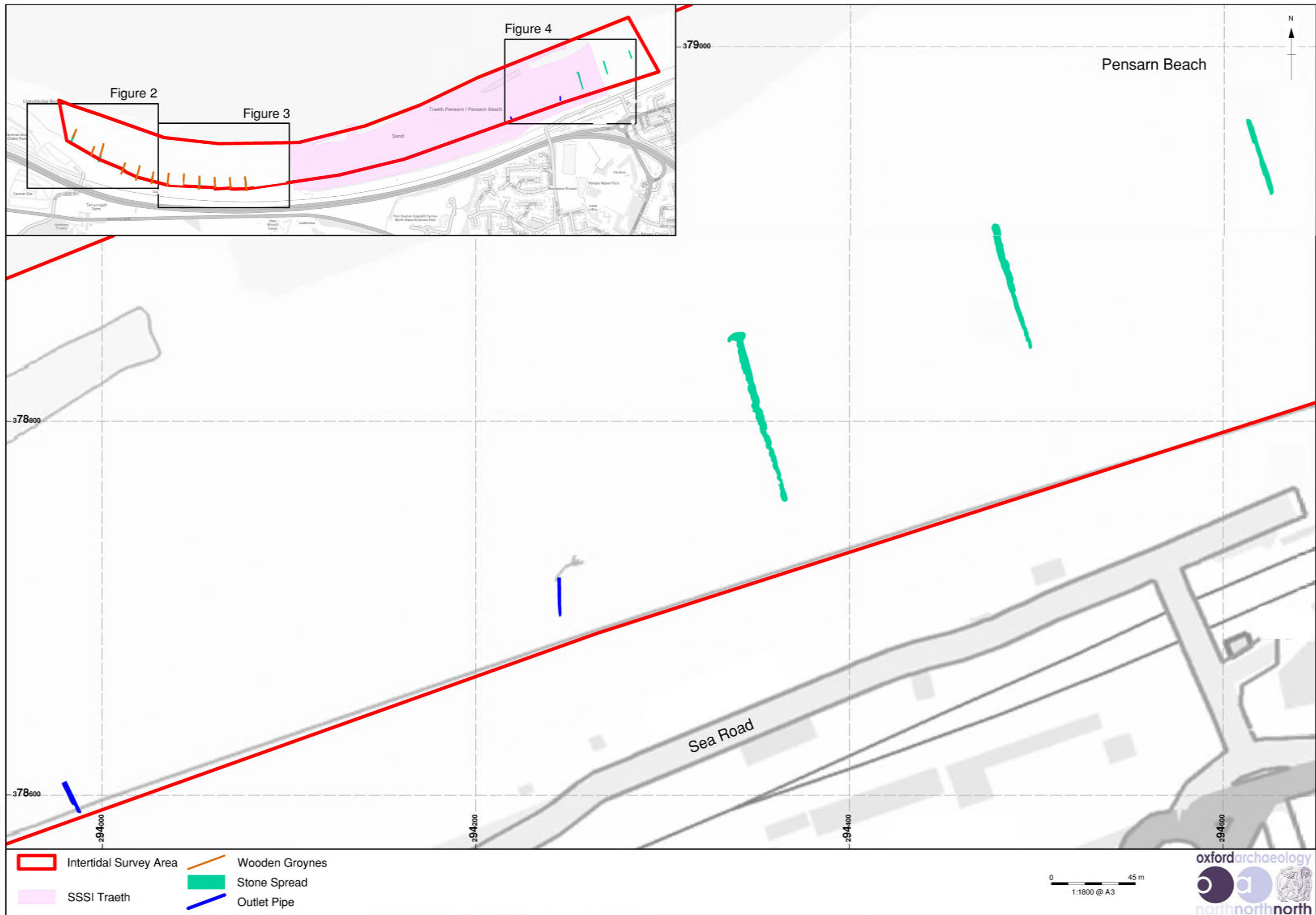


Figure 4: Results of the intertidal survey in the vicinity of Pensarn Beach

Appendix A: Written Scheme of Investigation

MONA OFFSHORE WIND PROJECT ONSHORE CABLE ROUTE

Specification for an Intertidal Historic Environment Survey

JAC27767
Mona Offshore Wind
Project Onshore Cable
Route
V3
March 2023

Contents

1 INTRODUCTION2

 The Study Site2

2 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND.....3

3 OBJECTIVES AND RATIONALE OF THE INTERTIDAL HISTORIC ENVIRONMENT SURVEY4

4 INTERTIDAL SURVEY – SPECIFICATION5

Figures

Figure 1 Intertidal Survey Areas

1 INTRODUCTION

- 1.1 This Specification has been prepared by Senior Associate Director at RPS Group, on behalf of bp/EnBW. It details the methodology that will be used in order to facilitate an intertidal historic environment survey related with the potential landfall sites associated with the onshore cable routes, part of the proposed Mona Offshore Wind Project.
- 1.2 In general, the onshore elements of the proposed scheme are located in Conwy and Denbighshire (North Wales) and comprise:
- a single landfall site near Abergele;
 - potential substation locations to the west of St Asaph;
 - an onshore cable route, approximately 12 km in length, that links the landfall site(s) to the potential substation locations; and
 - a shorter cable route that links the scheme substation to the National Grid Bodelwyddan substation.
- 1.3 The intertidal survey will focus on an area to the northwest of Abergele, located between National Grid Reference SH 9159 7858 and SH 9471 7901 (Figure 1). The route of the onshore cable corridor shown in Figure 1 is most likely that which will be taken forward to the Preliminary Environmental Information Report (PIER) review process, although there is potential for the route of the onshore cable corridor to be modified prior to this event.
- 1.4 It is intended that the intertidal survey will initially be used to support the Preliminary Environmental Information Report (PIER) consultation process. It will subsequently become an appendix to a Historic Environment chapter within an Environmental Statement (ES) which will accompany an application for a Development Consent Order (DCO).
- 1.5 This document details the methods and staffing required for the intertidal fieldwork and reporting, which will adhere to the relevant Standard and Guidance documents published by the Chartered Institute for Archaeologists (CIfA).

The Study Site

- 1.6 The extent of the survey area is indicated on Figure 1.
- 1.7 The underlying basal geology across the majority of the survey areas comprises Carboniferous limestone of the Clwyd Limestone Group, with the boundary with the Warwickshire Group mudstones likely to be present within the eastern survey area. In terms of superficial deposits, tidal clays, sands and silts of Holocene date are anticipated within the intertidal survey areas.
- 1.8 The Traeth Designated Site of Special Scientific Interest (SSSI) is present within the central and eastern part of the survey area.

2 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

- 2.1 The following information is derived from the appropriate elements of the historic environment desk-based assessment for the project.
- 2.2 The general area of the Vale of Clwyd has a long history of human occupation. Excavation in several of the caves has produced evidence of early prehistoric habitation, in some cases dating as far back as the Lower Palaeolithic. At Pontnewydd Cave the early Neanderthal material represent the oldest hominin remains in Wales (recently dated to c. 230,000 BP), whilst other important material has been recovered from the Brasgyll, Galltfaenan, Cefn and Cae Gronw caves (*cf.* Aldhouse-Green *et al* 1996).
- 2.3 This very early material has survived within the caves and rock shelters in the higher parts of the limestone uplands. Subsequent advances and retreats of ice sheets have changed the lower-lying parts of the landscape on numerous occasions through to the ending of the most recent glacial episode at about 12,000 BP. As the ice sheet diminished, sea levels in the area started to rise quickly and much of what is currently dry land would have been inundated. Studies in the Liverpool Bay area indicate that the sea level reached a high stand (maximum peak) at about 2,300 BP before beginning to fall back again (Tooley 1978; 1985).
- 2.4 This process of sea level rise and fall was not a constant process; there would have been many periods of marine transgression and regression. During more stable times, land surfaces would have developed, only to be inundated and covered (and possibly eroded through subsequent regressive stages). Evidence for these sequences is in the form of Holocene peat deposits that have been found at depths of 10 m and 13 m below current ground level close to the mouth of the River Clwyd.
- 2.5 Most of the material found on the foreshore is broadly attributable to the Neolithic and Bronze Age periods. However, an antler mattock from here has been recently dated to c. 4,560 BC and it is increasingly clear that there was a considerable amount of activity in the area during the Mesolithic period (c. 8,500-4,000 BC) (Murphy 2002). The higher ground at Abergele is set on a ridge of Clwyd Limestone and would have remained above the sea level high stands; it probably represents the most seaward habitable land at such times.
- 2.6 Shell middens have been identified at Prestatyn, where consumption of mussels in the Mesolithic period suggest a rocky coastline and a subsequent change to a largely cockle-based consumption in the Neolithic indicates the development of sandy beaches.

3 OBJECTIVES AND RATIONALE OF THE INTERTIDAL HISTORIC ENVIRONMENT SURVEY

- 3.1 The principal objective of the intertidal historic environment survey is to establish whether any archaeological material and/or deposits of palaeoenvironmental interest survives within the two study areas at surface level.
- 3.2 The survey should aim to determine, as far as is reasonably possible, the location, form, extent, date, character, condition, significance and quality of any surviving archaeological remains and/or deposits of palaeoenvironmental interest, irrespective of period, that are liable to be threatened by the proposed development.
- 3.3 The survey should also record the nature and extent of any existing disturbance and intrusions that may have the potential to affect the degree of archaeological survival of buried deposits.

4 INTERTIDAL HISTORIC ENVIRONMENT SURVEY – SPECIFICATION

- 4.1 The overall objectives of the programme of intertidal survey are set out in Section 3. This section details the on-site methodologies, report format and other related details.
- 4.2 The area subject to the intertidal survey is set out in Figure 1.
- 4.3 The first stage of the survey would involve the use of an Unmanned Aerial Vehicle (UAV) to complete a photogrammetry survey of the of the two survey areas, piloted by a trained operative. The data collected would be processed in order to aid identification of any archaeological features of interest, including outcropping peat deposits.
- 4.4 Following the UAV survey, a walkover of the survey areas will be undertaken to more closely visually assess and record any features of interest identified by the UAV survey. The location, extent, and form of the features identified will be recorded through use of appropriate handheld cameras and GPS equipment.
- 4.5 Where possible peat outcrops are identified, subsequent testing of the peat deposits will be undertaken using a gouge auger in order for the depth of the peat to be recorded. Samples would also be taken of the peat to assess their level of preservation, with an associated assessment as to whether such samples would be suitable for further analysis. No intrusive sampling or testing of deposits will occur within the area defined by the Traeth SSSI due to the protection offered by its designation.
- 4.6 Human remains (if encountered) will not be disturbed. Such remains will be subject to a photographic record and their position recorded. The discovery of human remains will be reported to the local coroner.
- 4.7 Any finds covered by the provisions of the Treasure Act (1996, amended 2003) and Treasure (Designation) Order 2002, including gold and silver, will be moved to a safe place and reported to the coroner's office according to the procedures determined by the Act. They will also be reported to the local finds liaison officer from the Portable Antiquities Scheme. Where removal cannot be effected on the same working day as the discovery, suitable security measures will be taken to protect the artefacts from theft or damage.
- 4.8 Within six weeks of completion of the work the archaeological contractor will produce a report, copies of which are to be provided to RPS for circulation to the Developer, Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW), and the Clwyd-Powys Archaeological Trust (CPAT).

The report is to include, as a minimum, the following:

- a) HER search reference number;
- b) description of the methodology employed;
- c) a site location plan at an appropriate scale; a copy of the feature location plan at 1:1250 and more detailed plans as appropriate;
- d) a descriptive summary and interpretation of the archaeology within the survey areas;
- e) specialist assessment reports (if required);
- f) a table listing the features encountered;
- g) a consideration of the objectives and methodology used, including a confidence rating;
- h) appropriate photos of features encountered;

- i) HER summary sheet;
- j) a summary report to be included in the regional archaeology round up if appropriate.

- 4.9 The integrity of the site archive should be maintained. The archive of all records and finds must be prepared consistent with the principles set out in the guidelines produced by the RCAHMW/ National Monuments Record of Wales, and National Panel for Archaeological Archives in Wales.
- 4.10 The archive will include all materials recovered (or the comprehensive record of such materials) and all written, drawn and photographic records relating directly to the investigations undertaken. It will be quantified, ordered, indexed and internally consistent. It will also contain a site summary and brief written observations on the artefactual and environmental data.
- 4.11 United Kingdom Institute for Conservation guidelines for the preparation of excavation archives for long term storage (1990) will be followed. Arrangements for the curation of the site archive will be agreed in writing with the appropriate local museum and National Monuments Record of Wales, and details of such arrangements will be made by the archaeological contractor.
- 4.12 The site archive, including the digital data sets from the UAV survey, is to be deposited with appropriate local museum and National Monuments Record of Wales within 3 months of the completion of work. It will then become publicly accessible.
- 4.13 In addition, at the start of work (immediately before fieldwork commences) an OASIS online record <http://ads.ahds.ac.uk/projects/oasis/> must be initiated and key fields completed on Details, Location and Creators Forms. All appropriate parts of the OASIS online form must be completed for submission to the CPAT HER and National Monuments Record of Wales. This should include an uploaded .pdf version of the entire report (a paper copy should also be included with the archive). The OASIS process will be completed by the appointed archaeological fieldwork contractor.
- 4.14 Oxford Archaeology North will be engaged to undertake the fieldwork. The field team deployed by the archaeological contractor will include only full time professional archaeological staff. All staff should be experienced on similar sites.

Sources Consulted

General

Aldhouse-Green, S, Pettit, P and Stringer, S, (1996) 'Holocene humans at Pontnewydd and Cae Gronw caves', *Antiquity* 70, 444-7.

Chartered Institute for Archaeologists Code of Conduct 2020

MoRPHE Management of Research Projects in the Historic Environment The MoRPHE Project Managers' Guide 2009

MoRPHE Management of Research Projects in the Historic Environment PPN 3: Archaeological Excavation January 2008

Archaeological Archives Forum (Duncan H. Brown), *Archaeological Archives: a guide to best practice in creation, completion, transfer and collection* 2007

Murphy, K, (2002) 'The archaeological resource: chronological overview', in A Davidson (ed.), *The Coastal Archaeology of Wales*, CBA Research Report 131, 45-64.

Museum and Galleries Commission *Standards in the Museum Care of Archaeological Collections* 1992

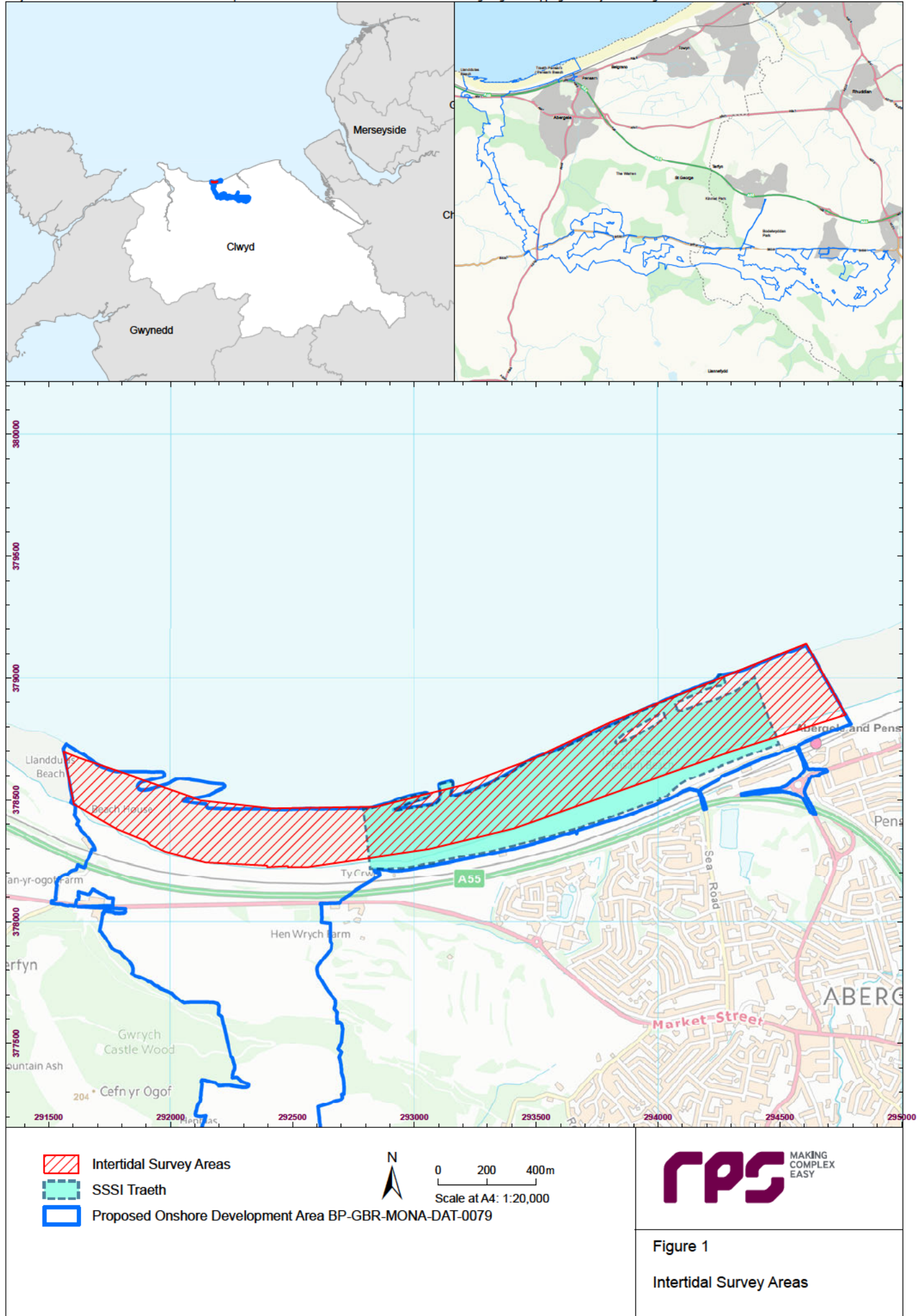
Society of Museum Archaeologists *Selection and Retention and Dispersal of Archaeological Collections* draft 1992

Society of Museum Archaeologists *Towards an Accessible Archaeological Archive. The Transfer of Archaeological Archives to Museums: Guidelines for Use in England, Northern Ireland Scotland and Wales* 1995

Tooley, M J, (1978) *Sea-level changes in north-west England during the Flandrian stage*, Oxford.

Tooley, M J, (1985) 'Sea-level changes and coastal morphology in North-West England' in R H Johnson (ed.), *The Geomorphology of North-West England*, Manchester, 94-121.

FIGURES





rpsgroup.com

APPENDIX B BIBLIOGRAPHY

Aldhouse-Green, S., Pettit, P. and Stringer, S., 1996 Holocene humans at Pontnewydd and Cae Gronw caves, *Antiquity*, **70**, 444-7

Chartered Institute for Archaeologists (CIfA), 2020 *Standard and guidance for the creation, compilation, transfer and deposition of archaeological archives*, Reading

CIfA, 2022 *Code of conduct: professional ethics in archaeology*, Reading

Historic England (HE), 2015 *Management of research projects in the historic environment: the MoRPHE project managers guide*, London

HE, 2017 *Understanding the Archaeology of Landscapes*, 2nd edn, Swindon

Murphy, K., 2002 The archaeological resource: chronological overview, in Davidson, A. (ed), *The coastal archaeology of Wales*, CBA Research Report, **131**, 45-64

National Panel for Archaeological Archives in Wales (NPAAW), 2019 *Archaeological archives: selection, retention and disposal guidelines for Wales* [Online], available at: <http://welshmuseumsfederation.org/uploads/online%20resources/National%20Archaeology%20standards%20wales%202017/natstandardsfinal2019.pdf> (accessed 26/01/2023)

Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW), 2015 *Guidelines for Digital Archives* [Online], available at: <https://rcahmw.gov.uk/wp-content/uploads/2016/09/RCAHMW-Guidelines-for-Digital-Archives.pdf> (accessed 26/01/2023)

Tooley, M, J., 1978 *Sea-level changes in North-West England during the Flandrian stage*, Oxford

Tooley, M, J., 1985 Sea-level changes and coastal morphology in North-West England in Johnson, R, H. (ed) *The geomorphology of North-West England*, Manchester, 94-121

APPENDIX C

SITE SUMMARY DETAILS

Site name:	Mona Offshore Wind Project Onshore Cable Route
Site code:	MOSW22
Grid Reference	SH 9159 7858 to SH 9471 7901
Type:	UAV and Walkover Survey
Date and duration:	18 th – 20 th October 2022; 3 days
Location of archive:	The archive is currently held at OA North, Mill 3, Moor Lane Mills, Moor Lane, Lancaster, LA1 1QD, and will be deposited with National Monuments Record, Royal Commission on the Ancient and Historical Monuments of Wales in due course.
Summary of Results:	<p>Oxford Archaeology (OA) North was commissioned by RPS to undertake an Unmanned Aerial Vehicle (UAV) and walkover survey of the site of the proposed landfall of the Mona offshore wind project cable route, between Llanddulas Beach (NGR: SH 9159 7858) and Pensarn Beach, Abergele (NGR: SH 9471 7901). The Mona offshore wind cable route currently has two proposed landfalls, as such in discussion with the archaeological consultant for the project, a survey of the intertidal zone was designed due to the potential for encountering significant peat deposits. The results of the survey are intended to initially support a Preliminary Environmental Information Report (PIER) and will subsequently become an appendix to a Historical Environment chapter within an Environmental Statement (ES) to accompany an application for a Development Consent Order (DCO). RPS produced a written scheme of investigation (WSI) for the UAV and walkover survey of the intertidal zone, and subsequently, commissioned OA North to undertake the necessary fieldwork, which was completed in three days between 18th and 20th October 2022.</p> <p>The survey area was fully surveyed by UAV and on foot during the three day survey, however, there was no evidence of significant archaeological remains or deposits on the surface of the intertidal zone. Although the presence of an unstratified lump of clayey peat suggests that there is survival of peat in the vicinity and that further palaeoenvironmental investigation, in the form of a borehole transect, would be required to identify it.</p>



**Head Office/Registered Office/
OA South**

Janus House
Osney Mead
Oxford OX2 0ES

t: +44 (0) 1865 263 800
f: +44 (0) 1865 793 496
e: info@oxfordarchaeology.com
w: <http://oxfordarchaeology.com>

OA North

Mill 3
Moor Lane
Lancaster LA1 1QD

t: +44 (0) 1524 541 000
f: +44 (0) 1524 848 606
e: [oanorth@oxfordarchaeology.com](mailto: oanorth@oxfordarchaeology.com)
w: <http://oxfordarchaeology.com>

OA East

15 Trafalgar Way
Bar Hill
Cambridgeshire
CB23 8SQ

t: +44 (0) 1223 850500
e: [oaeast@oxfordarchaeology.com](mailto: oaeast@oxfordarchaeology.com)
w: <http://oxfordarchaeology.com>



Chief Executive Officer
Ken Welsh, BSc, MCIFA
Oxford Archaeology Ltd is a
Private Limited Company, N^o: 1618597
and a Registered Charity, N^o: 285627

Appendix B: Bibliography

Aldhouse-Green, S., Pettit, P. and Stringer, S. (1996) Holocene humans at Pontnewydd and Cae Gronw caves. *Antiquity* 70. p. 444-7.

British Geological Survey (2023)

Chartered Institute for Archaeologists (2020) Standard and guidance for the creation, compilation, transfer and deposition of archaeological archives. Reading.

Chartered Institute for Archaeologists (2022) Code of conduct: professional ethics in archaeology. Reading.

Historic England (2015) Management of research projects in the historic environment: the MoRPHE project managers guide. London.

Historic England (2017) Understanding the Archaeology of Landscapes. 2nd edn. Swindon.

Murphy, K. (2002) The archaeological resource: chronological overview: In Davidson, A. (eds) The coastal archaeology of Wales. CBA Research Report, **131**. p. 45-64.

National Panel for Archaeological Archives in Wales (2019) Archaeological archives: selection, retention and disposal guidelines for Wales. Online, Available: <http://welshmuseumsfederation.org/uploads/online%20resources/National%20Archaeology%20standards%20wales%202017/natstandardsfinal2019.pdf> Accessed January 2023.

Royal Commission on the Ancient and Historical Monuments of Wales (2015) Guidelines for Digital Archives. Online, Available: <https://rcahmw.gov.uk/wp-content/uploads/2016/09/RCAHMW-Guidelines-for-Digital-Archives.pdf> Accessed January 2023.

Tooley, M, J. (1978) Sea-level changes in North-West England during the Flandrian stage. Oxford

Tooley, M, J. (1985) Seal-level changes and coastal morphology in North-West England: In Johnson, R, H. (eds) The geomorphology of North-West England. Manchester. p. 94-121.

Appendix C: Site Summary Details

Site name:	Mona Offshore Wind Project Onshore Cable Corridor
Site code:	MOSW22
Grid Reference	SH 9159 7858 to SH 9471 7901
Type:	UAV and Walkover Survey
Date and duration:	18th – 20th October 2022; 3 days
Location of archive:	The archive is currently held at OA North, Mill 3, Moor Lane Mills, Moor Lane, Lancaster, LA1 1QD, and will be deposited with National Monuments Record, Royal Commission on the Ancient and Historical Monuments of Wales in due course.
Summary of Results:	Oxford Archaeology (OA) North was commissioned by RPS to undertake an Unmanned Aerial Vehicle (UAV) and walkover survey of the proposed landfall of the Mona offshore wind project cable route, between Llanddulas Beach (NGR: SH 9159 7858) and Pensarn Beach, Abergele (NGR: SH 9471 7901).

A survey of the intertidal area was undertaken due to the potential for encountering significant peat deposits. RPS produced a Written Scheme of Investigation (WSI) (see Appendix A) for the UAV and walkover survey of the intertidal area, and subsequently, commissioned OA North to undertake the necessary fieldwork, which was completed in three days between 18 and 20 October 2022. The results of the survey support the Environmental Statement and are used to characterise the baseline environment in Volume 3, Chapter 5: Historic environment of the Environmental Statement.

The survey area was fully surveyed by UAV and on foot during the three day survey, however, there was no evidence of significant archaeological remains or deposits on the surface of the intertidal areal. Although the presence of an unstratified lump of clayey peat suggests that there is survival of peat in the vicinity.

Appendix D: Geoarchaeological Technical Report

MONA OFFSHORE WIND PROJECT

Environmental Statement

Appendix D: Geoarchaeological Technical Report

Reference Number: MOCNS-J3303-RPS-10117

Document Reference: F7.5.4

APFP Regulations: 5(2)(a)

February 2024

F01



Image of an offshore wind farm

MONA OFFSHORE WIND PROJECT

Document status					
Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
F01	Application	RPS	Mona Offshore Wind Ltd	Mona Offshore Wind Ltd	February 2024
Prepared by:			Prepared for:		
RPS			Mona Offshore Wind Ltd.		

Contents

1	GEOARCHAEOLOGICAL TECHNICAL REPORT	1
1.1	Introduction	1
1.2	Scope of the Report.....	1
1.3	Geoarchaeological background.....	3
1.3.1	Introduction.....	3
1.3.2	Pleistocene.....	3
1.3.3	Holocene	4
1.4	Site-specific surveys	5
1.4.2	Methodology.....	6
1.4.3	Results	6
1.5	Summary	6
1.6	References	7

Tables

Table 1.1: Summary of key desktop sources	3
Table 1.2: Summary of survey undertaken	5

Figures

Figure 1.1: Intertidal study area	2
-----------------------------------------	---

MONA OFFSHORE WIND PROJECT

Glossary

Term	Meaning
Applicant	Mona Offshore Wind Limited.
Mona Offshore Wind Project	The Mona Offshore Wind Project is comprised of both the generation assets and offshore and onshore transmission assets and associated activities.
Environmental Statement	The document presenting the results of the Environmental Impact Assessment (EIA) process for the Mona Offshore Wind Project.
Landfall	The area in which the offshore export cables make contact with land and the transitional area where the offshore cabling connects to the onshore cabling.

Acronyms

Acronym	Description
BGL	Below Ground Level
BGS	British Geological Survey
BP	Before Present
GI	Ground Investigation
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
NGR	National Grid Reference
OD	Ordnance Datum
UAV	Unmanned Aerial Vehicle

Units

Unit	Description
ka BP	Thousand years Before Present
km	Kilometre
kya	Thousand years ago
m	Metre
mya	Million years ago

1 Geoarchaeological Technical Report

1.1 Introduction

- 1.1.1.1 This geoarchaeological technical report forms an appendix to Volume 7, Annex 5.4: Intertidal survey report, of the Environmental Statement. The geoarchaeological technical report provides a review of the available geoarchaeological and palaeoenvironmental data for the intertidal area between Llanddulas Beach and Pensarn Beach. The report follows on from the Unmanned Aerial Vehicle (UAV) and walkover survey undertaken in October 2022 (see Volume 7, Annex 5.4: Intertidal survey report, of the Environmental Statement). The survey did not identify any significant archaeological remains or deposits within the intertidal area. There was no evidence of any peat outcroppings within the survey area; however, an unstratified lump of clayey peat was identified within the survey area, suggesting that there are peat deposits in the vicinity of the survey area.
- 1.1.1.2 Since the UAV and walkover survey in October 2022, the Mona Offshore Wind Project has committed to drilling under the intertidal area using trenchless techniques to connect the offshore export cables to the onshore export cables at the Landfall. The Landfall is located above Mean High Water Springs (MHWS) to the south of the A55. This will avoid open cut trenching through any potential peat deposits in the intertidal area.

1.2 Scope of the Report

- 1.2.1.1 The scope of the report focuses on the intertidal area of the Mona Offshore Wind Project between Mean Low Water Springs (MLWS) and MHWS (as shown on Figure 1.1).
- 1.2.1.2 The report comprises a desk-based review of available geoarchaeological and palaeoenvironmental data sources and results from ground investigations to provide further information on the presence of peat deposits.

MONA OFFSHORE WIND PROJECT

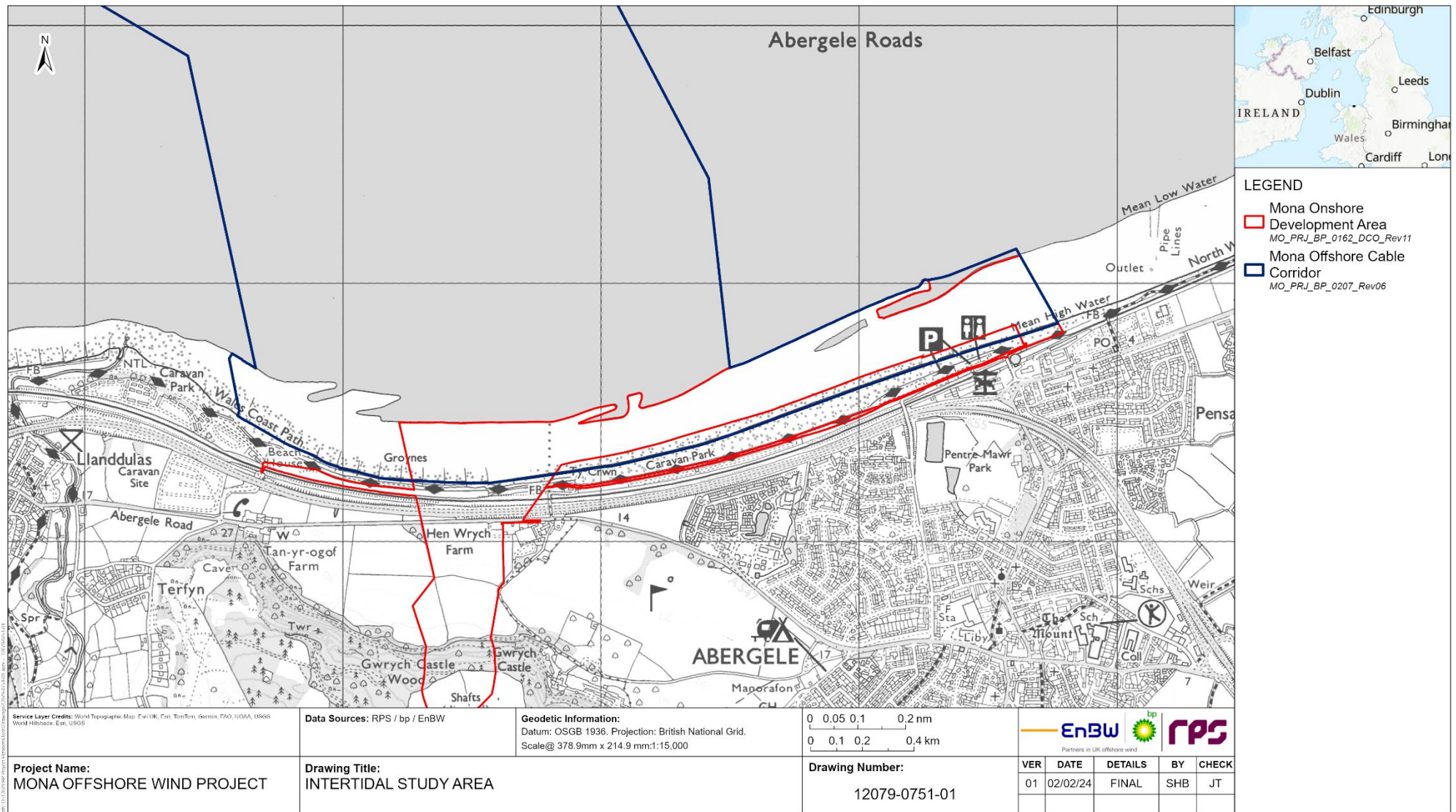


Figure 1.1: Intertidal study area

1.3 Geoarchaeological background

1.3.1 Introduction

- 1.3.1.1 Information on the geoarchaeological background within the intertidal area was collected through a desktop review of existing studies and datasets. These are summarised at Table 1.1 below.
- 1.3.1.2 The British Geological Survey (BGS) maps the bedrock as Clwyd Limestone Group, formed in the Carboniferous Period 359.2 to 299 million years ago (mya). This is overlain on the landward side by Devensian Till which outcrops at the surface to the south of the A55. The seaward side of the A55 is characterised by Storm Beach Deposits-Gravel and Marine Beach Deposits characterised by sand. The intertidal area lies at the edge of a large expanse of Tidal Flat deposits located to the east of Abergele, within the Vale of Clywd.

Table 1.1: Summary of key desktop sources

Title	Source	Year	Author
Mona Offshore Wind Project Onshore Cable Route Intertidal UAV and walkover Survey (see Volume 7, Annex 5.4: Intertidal survey report, of the Environmental Statement).	Oxford Archaeology	2022	Paul Dunn

1.3.2 Pleistocene

- 1.3.2.1 The bedrock geology of the intertidal area is dominated by carboniferous limestone. This is prone to cave formation and within the Vale of Clwyd several of these caves have produced evidence of early prehistoric activity, in some cases dating as far back as the Lower Palaeolithic (c.500-300 ka BP). At Pontnewydd Cave, 10 km to the south east of the Landfall, early Neanderthal material was recovered which represents the oldest hominin remains in Wales (recently dated to c. 230,000 BP), whilst other material has been recovered from the Brasgyll, Galltfaenan, Cefn and Cae Gronw caves (cf. Aldhouse-Green *et al.*, 1996).
- 1.3.2.2 With the onset of the Devensian glaciation (100-11.8 thousand years ago (kya)), the intertidal area was likely buried beneath the ice until the after the Last Glacial Maximum (25-11.8 kya) when the climate began to ameliorate sending the glaciers into retreat.
- 1.3.2.3 The wider area of the intertidal area was part of a now submerged palaeo-landscape first modelled by Coles (1998). Recent examination of geophysical data from the oil and gas industry has allowed a better understanding of the scale and topographic detail of this landscape (Fitch and Gaffney, 2011; Gaffney and Fitch, 2019). Most of the Liverpool Bay area was above the water in the Later Upper Palaeolithic period (12.9-10.5 ka BP) and was characterised by open tundra and river floodplains (Gaffney and Fitch, 2019, 50)
- 1.3.2.4 The lowlands are capped by glacial Till, formed by sub-glacial deposition and outwash derived from the Irish Ice Sheet during the Devensian. This is characterised by mixed clay sand and coarse-grained gravel and forms the edge of the Clwyd valley.

MONA OFFSHORE WIND PROJECT

1.3.3 Holocene

- 1.3.3.1 As the ice sheet retreated and the climate ameliorated in the early Holocene, sea level began to rise. However, this was not a linear process and was characterised by an initial rapid early rise followed by several phases of regression and transgression before reaching modern levels. Studies in the Liverpool Bay area indicate that the sea level reached a high stand (maximum peak) at about 2,300 BP before beginning to fall back again (Tooley, 1978; Tooley 1985; Huddart *et al.*, 1999). It is suggested from several investigators that contemporary sea levels were reached by the mid-Mesolithic (Tooley, 1978).
- 1.3.3.2 The Marine and Storm Beach deposits at the intertidal area represent more recent reworking of sediments and overlies extensive areas of peat and drowned forest. These peat deposits are periodically exposed, often following high energy storm events which strip the beach sands from the surface of the peat. These deposits have been previously recorded at Abergele, 1.5 km to the east of the site, and at Rhyl and Formby (Bibby, 1940; Thomas *et al.*, 2007; Burns, 2021). A number of archaeological artefacts and mammalian remains have been recovered from these peat deposits, ranging from the Mesolithic to the Bronze Age. In addition, footprints are often recorded in such deposits with the examples at Splash Point in Rhyl and Formby recording both human and animal prints (Bell, 2007; Burns, 2021; Burns *et al.*, 2022; YA, 2023,). Also recovered from the Rhyl deposits, a red deer antler mattock dating to the Mesolithic 5640 to 5360 cal BC (Bell, 2007).
- 1.3.3.3 However, despite frequent observations and larger studies, the extent and date of the submerged landscapes are still only partially understood. The expected sequence of these deposits around Rhyl is based on a study undertaken by Bell in 2007. This collated the known information and observations on the prehistoric land surfaces. The sequence established by Bell is as follows (from latest to earliest):
- Estuarine sediments
 - Upper peat with submerged forest, including oaks, deer and aurochs prints
 - Estuarine sediments with human and deer prints, possible context of Mesolithic mattock and polished axes
 - Lower peat and submerged forest of willow, possible context of flint artefacts reported in 1924
 - Estuarine sediments
 - Boulder Clay.
- 1.3.3.4 Work has been recently undertaken as part of the Rhyl East Coastal Defence Scheme, which has helped to further refine the sequence. This sequence is not closely dated; however, the Lower Peat Deposit, associated with a mattock, returned an age determination of 7600- 7300 BP. The base of the Upper Peat Deposit is dated to 6000-5500 BP, with the top of this layer dated to 1800-1200 BP. Analysis of the submerged land surfaces there has revealed a complex terrain, with evidence for submerged forests and palaeochannels. It has also been noted that archaeological and biological material is potentially associated with the estuarine clays as well as the peat.
- 1.3.3.5 The recent geoarchaeological monitoring and deposit modelling (YA, 2022a) confirmed glaciogenic sediment located primarily to the easternmost portion of the coastal sea defences, composed of glacial diamicton and a grey-brown gravel which was likely deposited by a high-energy subglacial meltwater channel. The subsequent

MONA OFFSHORE WIND PROJECT

estuarine sediments identified by Bell (2007; section 2.1.5) were not recorded. Overlying the glaciogenic sediment were two discrete deposits of peat, separated by grey silty clay. The uppermost of these two peat deposits was locally encountered at the present-day surface of the Rhyl foreshore. These two peat deposits correspond to the two peat deposits identified by Bell (2007). Subsequence dating of this most recent investigation corresponds closely with the work at Splash point dating the upper peats to c.6580 BP.

- 1.3.3.6 The deposits at Abergele have been less recently investigated and initial work carried out in the 1940's demonstrated poor pollen preservation in a *Phragmites* peat with *Tilia* and *Pinus* represented which suggested a sub-Boreal (4700-2700 BP) or Atlantic (2700 BP) age for the deposits (Bibby 1940). Subsequent PhD research at Pentre-Mawr Park, 1.9 km to the east of the intertidal area, undertook a hand auger transect which recorded a peat sequence from which 14 pollen samples were analysed (Bedlington 1995). The auger survey recorded at least three distinct peat horizons within the sequence. The basal peat, well-humified, was encountered 1.50 to -1.00 m OD with wood recorded at the base of the deposit. This was overlain by blue silt clay which in turn was interleaved with two subsequent woody peats, the upper most being 0.43 to -0.32 m OD. The most seaward core was more of an organic silt with reed remains visible.
- 1.3.3.7 The subsequent pollen analysis recorded *Quercus*, *Cyperaceae* and *Alnus* with the sedges and grassland species fluctuating with height. Here alder and oak are the dominant species.
- 1.3.3.8 These deposits were not directly dated but were related to a more inland peat sequence at Hendre Fawr to the south of Abergele with the basal deposit dated to 7080± 155 BP (Hv 17814). The upper most peat horizon was dated to 4345 ± 145 BP (Hv 17810). The intercalated peat and silts deposits represent alternating terrestrial and marine sequences reflecting the increasing and decreasing marine influence at both sites.
- 1.3.3.9 A recent study as part of preliminary works for an offshore wind farm at Rhyl Flats recorded an entirely glacial sequence although the data was of limited value due to the nature of sample collection and recording (Roberts 2006). This study determined a lack of preservation for offshore peat deposits and land surfaces and the area was considered to have a low archaeological potential.

1.4 Site-specific surveys

- 1.4.1.1 A summary of the surveys undertaken to inform the presence of peat deposits is outlined in Table 1.2 below.
- 1.4.1.2 This data, in addition to BGS borehole data, was also consulted using the online viewer.

Table 1.2: Summary of survey undertaken

Title	Extent of survey	Overview of survey	Survey contractor	Date
Mona Offshore Wind Project Onshore Cable Route Intertidal UAV and walkover Survey.	Between Llanddulas Beach (NGR: SH 9159 7858) and Pensarn Beach, Abergele (NGR: SH 9471 7901).	UAV and walkover of the proposed impact area carried out over three days. No evidence of significant archaeological remains. Asingle reworked clast of peat was recorded on the surface of the beach.	Oxford Archaeology - Paul Dunn	2023

MONA OFFSHORE WIND PROJECT

Title	Extent of survey	Overview of survey	Survey contractor	Date
Landfall Ground Investigation.	A transect from sea to landfall.	Engineering investigation of the landfall area. The purpose of the investigation was to inform the construction of the landfall	Wardell Armstrong	2023

1.4.2 Methodology

- 1.4.2.1 A deposit model was constructed using the results of the purposive window samples and existing BGS records. The modelling followed procedures set out within the Historic England Guidance for *Deposit Modelling and Archaeology* (Historic England, 2020). The data was entered into Rockworks in order to generate cross sections use linear correlations due to the limited amount of data available. The data is archived in an excel spreadsheet.

1.4.3 Results

- 1.4.3.1 A Ground Investigation (GI) survey was carried out in a single north south transect in the area of proposed Mona Landfall. A total of three window samples and two boreholes (Cable Percussion and Rotary) were carried out. The window samples reached a maximum depth of 6.55 m Below Ground Level (BGL) with the rotary and cable percussion locations reaching a maximum depth of 30.00 m BGL.
- 1.4.3.2 In addition, BGS data was also consulted, although the borehole log sheets lacked elevation data and therefore an arbitrary height of 14.00 m OD was ascribed in order to use the data within the model. These boreholes were recorded prior to the construction of the bypass (in 1963) and their original altitude is unknown.
- 1.4.3.3 A single transect was produced using the limited data available. This demonstrated the variability of the depth of each window sample and boreholes intervention. The seaward window samples demonstrated a very thin layer or recent beach sand, c.0.60 m, overlying a clayey till deposit. The base of this was not reached in these locations but the rotary core recorded the base of this unit at 22.10 m BGL/ -12.29m OD. This clayey till rests on a gravelly till, which was recorded in the onshore borehole and the BGS bypass borehole (SH87NW35).
- 1.4.3.4 No peat or other organic units were recorded in the purposive locations or the BGS data to the east and west of the study area. The closest recorded peat units are located 1.6 km to the east at Pentre Mawr Park, which correlates with the BGS mapping of Tidal Flat Deposits.
- 1.4.3.5 The UAV and walkover survey results are presented within Volume 7, Annex 5.4: Intertidal survey report, of the Environmental Statement.

1.5 Summary

- 1.5.1.1 This review of the geoarchaeological data available for the area of the intertidal area for the Mona Offshore Wind Project to the west of Abergele has demonstrated a lack of peat deposits within the footprint of the offshore export cable route. The purposive GI survey undertook a shallow window sample survey on the foreshore with deeper rotary/cable percussive boreholes to the landward end of the proposed impact zone. The window samples reached a maximum depth of 6.55 m BGL which recorded a sequence dominated by clayey till beneath a thin veneer of modern beach sand.

MONA OFFSHORE WIND PROJECT

- 1.5.1.2 The peat deposit investigated by Bibby (1940) and Bedlington (1995) is located 1.6 km to the west within an area mapped by the BGS as Tidal Flats that represent the edge of the Vale of Clwyd. The UAV and walkover survey carried out by Oxford Archaeology in 2022 also recorded no visible in situ peat deposits, although a clast of reworked peat was noted on the beach surface at the time of the survey. The precise location of this clast was not recorded so it is unclear if it lies within the intertidal area for the Mona Offshore Wind Project.
- 1.5.1.3 The location of the intertidal area is at the very western edge of the Vale of Clwyd and in an area of shallowly buried till which suggests that its position would have been on the very margins of peat accumulation. It is suggested that if peat were ever present at the site it has more than likely been eroded by subsequent tidal processes. The presence of a clast of peat on the modern beach surface suggests that this process of peat erosion is ongoing, and this material likely originated from further east and has been transported to the site by the tide.
- 1.5.1.4 On the available evidence, the intertidal area for Mona Offshore Wind Project is considered to have a low potential for the preservation of in situ peat deposits. The only scenario where peat is likely to be preserved is where undulations are present in the Till surface that may preserve more deeply buried deposits.

1.6 References

- Bedlington, D.J. (1995). Holocene sea level changes and crustal movements in North Wales and Wirral. Unpublished PhD thesis. University of Durham.
- Bell, M (Ed.). (2007). *Prehistoric coastal communities: The Mesolithic in Western Britain*. Council for British Archaeology Research Report (pp. 267–269). Council for British Archaeology: York.
- Bibby, H.C. (1940). The submerged forests at Rhyl and Abergele, North Wales. Data for the study of postglacial history III. *New Phytologist* May 1940.
- Burns, A, Woodward, J, Conneller, C and Reimer, P. (2022). Footprint beds record Holocene decline in large mammal diversity on the Irish Sea coast of Britain. *Nature Ecology and Evolution* vol 6 iss 10, pp1553-1563.
- Burns, A. (2021). The Mesolithic footprints retained in one bed of the former saltmarshes at Formby Point, Sefton Coast, North West England, In: Pastoors, A., Lenssen-Erz, T. (eds) *Reading Prehistoric Human Tracks*. Springer, Cham. https://doi.org/10.1007/978-3-030-60406-6_16
- Fitch, S and Gaffney, V. (2011). The West Coast Palaeolandscapes Survey. Historic England report no 1997.
- Gaffney, V and Fitch, S. (2019). *The West Coast Palaeolandscape Project In: Redknap M, Rees S and Aberg A (Eds.) Wales and the sea: 10,000 years of Welsh maritime history*. Tal-y-bont: Y Lolfa.
- Historic England. 2020. Deposit Modelling and Archaeology: Guidance for mapping buried deposits. Swindon. Historic England.
- Huddart, D, Roberts, G and Gonzalez, S. (1999). Holocene human and animal footprints and their relationships with coastal environmental change, Formby Point, NW England. *Quaternary International* vol 55, pp 29-4.
- Oxford Archaeology. (2023). Mona Offshore Wind Project Onshore Cable Route. Intertidal UAV and walkover survey. Oxford unpublished report L11474.
- Roberts, M.J. (2006). Rhyl Flats Offshore Wind Farm. Report on archaeological assessment of offshore site investigations. Giffords unpublished report no 13291.R05.

MONA OFFSHORE WIND PROJECT

Thomas, D., and Britnell, W. J. (2007). Nant Hall Road. In M. Bell (Ed.), *Prehistoric coastal communities: The Mesolithic in Western Britain*. Council for British Archaeology Research Report (pp. 267–269). Council for British Archaeology: York.

Tooley, M.J. (1978). *Sea-level changes: North-West England during the Flandrian Stage*. Oxford. Clarendon Press.

Tooley, M.J. (1982). Sea-level changes in northern England. *Proceedings of the Geologists Association*. 93, 43-51.

YA. (2022). Rhyl Coastal Defence Scheme: Geoarchaeological Monitoring Rhyl beach, Denbighshire, Wales. York Archaeology unpublished report 2022/164.