

TotalEnergies E&P North Sea UK Ltd

Culzean - Floating Offshore Wind Turbine Pilot Project

Appendix K: Archaeological Assessment of Geophysical Data

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Culzean Floating Offshore Wind Turbine

Archaeological Assessment of Geophysical Data

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Summary

Wessex Archaeology was commissioned by Xodus Group to assess geophysical data acquired in advance of the proposed Culzean Floating Offshore Wind Turbine Pilot Project .

This report consists of an assessment of marine geophysical survey data comprising sidescan sonar, multibeam echosounder and magnetometer data, acquired by Ocean Infinity between March and April 2023. The aim of this assessment is to identify any anomalies of archaeological potential within the study area, to further inform the planning process ahead of the proposed scheme.

A total of 57 seabed anomalies of archaeological potential were identified within the area of interest.

No anomalies were assigned an A1 archaeological rating (anthropogenic origin of archaeological interest), 18 were assigned an A2_h archaeological rating (Anomaly of likely anthropogenic origin but of unknown date; may be of archaeological interest or a modern feature), 37 were assigned an A2_l archaeological rating (Anomaly of possible anthropogenic origin but interpretation is uncertain; may be anthropogenic or a natural feature) and two were assigned an A3 archaeological rating (Historic record of possible archaeological interest with no corresponding geophysical anomaly).

As no anomalies of high archaeological potential were identified, no archaeological exclusion zones are recommended at this time. For anomalies classified as A2_h, A2_l and A3, avoidance is recommended in the first instance. Where this is not possible, it is recommended that, should any objects of archaeological potential be recovered during the proposed dredging programme, they be reported to the retained archaeological contractor via a pre-agreed reporting protocol (Protocol for archaeological discoveries).



Acknowledgements

This assessment was commissioned by Xodus Group, and their assistance throughout the project is acknowledged.

The survey data were acquired by Ocean Infinity and provided to Wessex Archaeology by Xodus Group and their assistance is acknowledged in this regard.



Culzean Floating Offshore Wind Turbine Pilot Project

Archaeological assessment of geophysical data

1 INTRODUCTION

1.1 Project background

- 1.1.1 Wessex Archaeology was commissioned by Xodus Group to undertake an archaeological assessment of geophysical data acquired within the proposed Culzean Floating Offshore Wind Turbine Pilot Project development.
- 1.1.2 The survey area is located in the Culzean Field, offshore North Sea (Figure 1).
- 1.1.3 The report consists of an assessment of geophysical survey data comprising sidescan sonar (SSS), multibeam echosounder (MBES) and magnetometer (Mag.) data sets.
- 1.1.4 Wessex Archaeology has previously undertaken a Scoping Report for the development (Wessex Archaeology 2023).
- 1.1.5 The study area is defined as a 2 km buffer around the proposed location of a wind turbine (and its associated moorings/anchors) and the proposed export cable route (Figure 1).
- 1.1.6 The geophysical study area is defined as the extents of the SSS data (Figure 1).

1.2 Aims and objectives

- 1.2.1 The aims and objectives of this assessment are:
 - confirm the presence of known or previously located marine sites of archaeological potential and to comment on their apparent character;
 - identify, locate and characterise hitherto unrecorded marine sites of archaeological potential;
 - comment on the effects of development on known archaeological sites; and
 - provide recommendations for archaeological mitigation.

1.3 Co-ordinate system

- 1.3.1 The survey data were acquired in WGS84 and converted to ED50 UTM31N, the results are presented in ED50 UTM31N.

2 METHODOLOGY

2.1 Data sources

- 2.1.1 A number of data sources were consulted during this assessment, including:
 - Geophysical survey datasets acquired by Ocean Infinity;

- Recorded wreck and obstruction data acquired via the United Kingdom Hydrographic Office (UKHO) and Canmore;
- Relevant background mapping from the area (admiralty charts received from MarineFIND);
- Client supplied survey reports (Ocean Infinity 2023).

2.2 Geophysical data – technical specifications

2.2.1 Geophysical data were acquired by Ocean Infinity onboard M/V *Deep Helder* between 26 March and 09 April 2023 (Ocean Infinity 2023). The survey area had a line spacing of approximately 100 m and a tighter line spacing (approximately 25 m) was used within the export cable. Further details on the equipment used is in Table 1.

Table 1 Summary of survey equipment

Survey Company	Survey Vessel	Data Type	Equipment	Data Format
Ocean Infinity	M/V <i>Deep Helder</i>	MBES	Kongsberg EM2040D (200-400 kHz)	.xyz
		SSS	Edgetech 4205 (300/600 kHz; 50 m range along export cable; 125 m and 75 m range within survey area)	.jsf
		Mag.	Geometrics G-882	.xls
		Positioning	POS MV 320 with Fugro G2 corrections	N/A

2.3 Geophysical data – processing

2.3.1 A number of datasets were assessed over the study area, each dataset was processed separately using the following software (Table 2).

Table 2 Software used for geophysical assessment

Dataset	Processing Software	Interpretation and rationalisation
MBES	QPS Fledermaus v8.5.2	ArcMap v10.8.1
SSS	CodaOctopus Survey Engine v8.6	
Mag.	Wessex Proprietary Software	

2.3.2 The MBES data were analysed to identify any unusual seabed structures that could be shipwrecks or other anthropogenic debris. The data were gridded at 1 m and analysed using QPS Fledermaus software, which enables a 3-D visualisation of the acquired data and geo-picking of seabed anomalies.

2.3.3 The .jsf SSS data files were processed using CodaOctopus Survey Engine Sidescan+ software. This allowed the data to be replayed with various gain settings in order to optimise the quality of the images. The data were interpreted for any objects of possible anthropogenic origin. This involves creating a database of anomalies within Coda by tagging individual features of possible archaeological potential, recording their positions and dimensions, and acquiring an image of each anomaly for future reference.



- 2.3.4 A mosaic of the SSS is produced during this process to assess the quality of the sonar towfish positioning. This process allows the position of anomalies to be checked between different survey lines and for the positioning to be further refined if necessary.
- 2.3.5 The form, size and/or extent of an anomaly is a guide to its potential to be an anthropogenic feature and therefore of archaeological interest. A single small but prominent anomaly may be part of a much more extensive feature that is largely buried. Similarly, a scatter of minor anomalies may be unrelated individual features, define the edges of a buried but intact feature, or may be all that remains as a result of past impacts from, for example, dredging or fishing. Assessment is made of such groups of anomalies during data interpretation to determine which of these alternatives is the most likely.
- 2.3.6 The Mag. data were processed using proprietary in-house magnetics software in order to identify any discrete magnetic contacts which could represent buried metallic debris or structures such as wrecks.
- 2.3.7 The software enables both the visualisation of individual lines of data and gridding of data to produce a magnetic anomaly map. The data were first smoothed to try and eliminate any small, recurring spiking. A trend was then fitted to the resulting data, and the trend values subtracted from the smoothed values. This was carried out to remove natural variations in the data (such as diurnal variation in magnetic field strength and changes in geology). The processed data were then gridded to produce a map of magnetic anomalies, and individual anomalies tagged based on the grid and individual profile lines. Images are taken in a similar process to that of the SSS data.
- 2.3.8 For the purposes of this assessment, any identified magnetic anomalies have been classified depending on their amplitude as small (5 nT to 49 nT), medium (50 nT to 99 nT), or large (>100 nT).

2.4 Geophysical data – data quality

- 2.4.1 Once processed, the geophysical data sets were individually assessed for quality and their suitability for archaeological purposes, and rated using the following criteria (Table 3).

Table 3 Criteria for assigning data quality rating

Data quality	Description
Good	Data which are clear and unaffected or only slightly affected by weather conditions, sea state, background noise or data artefacts. Seabed datasets are suitable for the interpretation of upstanding and partially buried wrecks, debris fields, and small individual anomalies. The structure of wrecks is clear, allowing assessments on wreck condition to be made. These data provide the highest probability that anomalies of archaeological potential will be identified.
Average	Data which are moderately affected by weather conditions, sea state and noise. Seabed datasets are suitable for the identification of upstanding and partially buried wrecks, the larger elements of debris fields and dispersed sites, and larger individual anomalies. Dispersed and/or partially buried wrecks may be difficult to identify. These data are not considered to be detrimentally affected to a significant degree.
Below Average	Data which are affected by weather conditions, sea state and noise to a significant degree. Seabed datasets are suitable for the identification of relatively intact, upstanding wrecks and large individual anomalies. Dispersed and/or partially buried wrecks, or small isolated anomalies may not be clearly resolved.
Variable	This category contains datasets where the individual lines range in quality. Confidence of interpretation is subsequently likely to vary within the study area.



- 2.4.2 The MBES data were rated as ‘Good’ using the above criteria. The data quality and resolution of 1 m was found to be of a good standard and suitable for archaeological interpretation of objects and debris over 1 m in size.
- 2.4.3 The SSS data have been rated as ‘Average’ using the above criteria table. Some of the data displayed occasional weather noise and cable snatching due to sea state and/or weather conditions. Some high frequency files did not achieve the full range of the survey area due to water depth, however cross lines and the low frequency files were used for full coverage. Overall, the data are considered suitable for archaeological interpretation.
- 2.4.4 The Mag. data have been rated as ‘Average’ using the above criterial table. There was some influence from background geology and weather noise visible which may have masked some smaller features. However, the data are considered suitable for archaeological interpretation.

2.5 Geophysical data – anomaly grouping and discrimination

- 2.5.1 The previous section describes the initial interpretation of all available geophysical datasets which were conducted independently of one another. This inevitably leads to the possibility of any one object being the cause of numerous anomalies in different datasets and apparently overstating the number of archaeological features in the exploration area.
- 2.5.2 To address this fact the anomalies were grouped together; allowing one ID number to be assigned to a single object for which there may be, for example, a UKHO record, a MBES anomaly, and multiple SSS anomalies.
- 2.5.3 Once all the geophysical anomalies and desk-based information have been grouped, a discrimination flag is added to the record in order to discriminate against those which are not thought to be of an archaeological concern. For anomalies located on the seabed, these flags are ascribed as follows (Table 4).

Table 4 Criteria discriminating relevance of identified features to proposed scheme

Overview classification	Discrimination	Criteria	Data type
Archaeological	A1	Anthropogenic origin of archaeological interest	MBES, SSS, Mag.
Archaeological	A2	Uncertain origin of possible archaeological interest	MBES, SSS, Mag.
Archaeological	A3	Historic record of possible archaeological interest with no corresponding geophysical anomaly	MBES, SSS, Mag.
Non-archaeological	U1	Not of anthropogenic origin	MBES, SSS, Mag.
Non-archaeological	U2	Known non-archaeological feature / Feature of non-archaeological interest	MBES, SSS, Mag.
Non-archaeological	U3	Recorded loss	MBES, SSS, Mag.
Non-impact	O1	Outside horizontal footprint of study area	MBES, SSS, Mag.
Non-impact	O3	Area subsequently cleared after data acquired, anomaly/object recovered	MBES, SSS, Mag.

- 2.5.4 The grouping and discrimination of information at this stage is based on all available information and is not definitive. It allows for all features of potential archaeological interest to be highlighted, while retaining all the information produced during the course of the geophysical interpretation and desk-based assessment for further evaluation should more information become available.
- 2.5.5 Any anomalies located outside of the defined study areas, either previously recorded in known databases (e.g. UKHO) or identified during this geophysical assessment, are deemed beyond the scope of the current assessment and are subsequently not included in this report.

3 SEABED FEATURES ASSESSMENT

3.1 Introduction

- 3.1.1 The geophysical data were assessed to identify features of archaeological potential relating to maritime and aviation activity. Due to the proximity of the survey area to the modern infrastructure, objects identified may represent modern features which would not be of interest from an archaeological perspective. However, as this cannot be confirmed without visual inspection, all features in in this report have been retained as a precautionary measure based on the fact there is some potential of them being of archaeological interest

3.2 Seabed features assessment results

- 3.2.1 The results of this assessment are collated in gazetteer format detailed in Annex I and illustrated in Figures 2 and 3.
- 3.2.2 A total of fifty-seven features have been identified as being of possible archaeological potential within the study area and are discriminated as shown in Table 5.

Table 5 Anomalies of archaeological potential within the study area

Archaeological discrimination	Quantity	Interpretation
A2_h	18	Anomaly of likely anthropogenic origin but of unknown date; may be of archaeological interest or a modern feature
A2_l	37	Anomaly of possible anthropogenic origin but the interpretation is uncertain; may be anthropogenic or a natural feature.
A3	2	Historic record of possible archaeological interest with no corresponding geophysical anomaly
Total	57	

- 3.2.3 Furthermore, these anomalies can be classified by probable type, which can further aid in assigning archaeological potential and importance (Table 6).

Table 6 Types of anomaly identified

Anomaly classification	Definition	Number of anomalies
Debris field	A discrete area containing numerous individual debris items that are potentially anthropogenic, and can include dispersed wreck sites for which no coherent structure remains	5
Debris	Distinct objects on the seabed, generally exhibiting height or with evidence of structure, that are potentially anthropogenic in origin	5

Linear debris	Distinct linear objects on the seabed, either straight or curved, generally exhibiting height or with evidence of structure, that are potentially anthropogenic in origin. May represent linear anthropogenic debris which can include, for example, lengths of rope or chain or abandoned fishing gear.	9
Seabed disturbance	An area of disturbance, occasionally containing objects of uncertain origin. May indicate wreck debris or other anthropogenic features, or items buried just below the seabed, but lacking any definite anthropogenic structures. Precise nature is uncertain.	10
Linear debris	Distinct linear objects on the seabed, either straight or curved, generally exhibiting height or with evidence of structure, that are potentially anthropogenic in origin. May represent linear anthropogenic debris which can include, for example, lengths of rope or chain or abandoned fishing gear.	9
Dark reflector	Individual objects or areas of high reflectivity, displaying some anthropogenic characteristics. Precise nature is uncertain	12
Mound	A mounded feature with height not considered to be natural. Mounds may form over wreck sites or other debris.	3
Depression	An area of disturbed seabed with depth. Potentially indicates scour around a buried feature or where a feature has been cleared.	3
Magnetic	Magnetic only anomaly without associated seabed surface expression. Have the potential to represent possible buried ferrous debris or buried wreck sites	8
Recorded obstruction	Position of a recorded obstruction (e.g. foul ground, fisherman's fastener recorded by the UKHO), but for which no associated feature has been identified within the current data set	2
Total		57

- 3.2.4 No anomalies of high archaeological potential (A1, Anthropogenic origin of archaeological interest). were identified within the study area.
- 3.2.5 A total of 18 anomalies have been classified as A2_h, which are features or areas with a higher probability of being anthropogenic in origin. However, due to the recent works already undertaken within the study area it is possible that some features are modern in origin.
- 3.2.6 A total of 37 anomalies have been classified as A2_l, which are possibly of anthropogenic origin but also may be natural features.
- 3.2.7 Two anomalies have been discriminated as A3 which are historic records of possible archaeological interest with no corresponding geophysical anomaly. These are both classified as recorded obstructions. Anomaly **70005** is the recorded position of a seabed obstruction in the UKHO database recorded as foul ground, first identified in 1994. The record was last amended on 18th January 2017 but no further information is available. No anomalous features were identified in geophysical data at this location and it has been retained as a precaution as any features may have since become buried in surrounding sediments.
- 3.2.8 Anomaly **70056** is the recorded position of an unidentified seabed obstruction in the UKHO database first identified in 2022. This position is situated outside of the geophysical study area but within the wider scope of work and so it has been retained as a precaution.
- 3.2.9 Some example images of anomalies identified in this survey can be found in Figure 3.



4 CONCLUSIONS AND RECOMMENDATIONS

- 4.1.1 The assessment of the geophysical data within the study area resulted in a total of 57 anomalies identified as being of possible archaeological interest. These are summarised as follows:
- a total of 18 were assigned an A2_h archaeological rating;
 - a total of 37 were assigned an A2_l archaeological rating;
 - two items, both recorded obstructions, were assigned an A3 archaeological discrimination;
- 4.1.2 No anomalies of high archaeological potential were identified, and no archaeological exclusion zones are recommended at this time.
- 4.1.3 For anomalies classified as A2_h and A2_l and A3, avoidance is recommended in the first instance. Where this is not possible, it is recommended that, should any objects of archaeological potential be recovered during any groundwork investigations, they be reported to the retained archaeological contractor via a pre-agreed reporting protocol (Offshore Renewables Protocol for Archaeological Discoveries (ORPAD) (The Crown Estate 2014)).



5 REFERENCES

The Crown Estate 2014 *Protocol for Archaeological Discoveries: Offshore Renewables Projects (ORPAD)*.

Ocean Infinity 2023 *Operations Report. TotalEnergies PWT Site Survey*. Document ref. 104728-TOT-OI-SUR-REP-OPERATRE

Wessex Archaeology 2023 *Culzean Floating Wind Pilot EIA Scoping Report*. Document ref. A-100811-S00-A-REPT-001



ANNEXES

Annex I Seabed features of archaeological potential

ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Anomaly type	External references
70000	Linear debris	430832	6339490	A2_h	13	0.1	0.1	-	A thin curvilinear dark reflector, that is on a northwest to southeast alignment, curving back on itself in a 'C' shape. It has a short, bright shadow. No anomalous features were identified in the MBES or Mag. data at this location. Interpreted as a possible short length of non-ferrous linear debris, such as a rope.	SSS	-
70001	Linear debris	430894	6339436	A2_h	23.5	0.3	0.1	-	A thin linear dark reflector, on a northwest to southeast alignment, with a short bright shadow. No anomalous features were identified in the MBES or Mag. data at this location. Interpreted as a possible short length of non-ferrous linear debris, such as a rope.	SSS	-
70002	Seabed disturbance	430983	6339652	A2_l	6.2	5.7	0.1	-	A seabed disturbance made up of up to four sub-rounded dark reflectors, measuring between 1 to 2 m across. Some of these reflectors have short bright shadows. No anomalous features were identified in the MBES or Mag. data at this location. Interpreted as a possible natural feature or may be possible partially buried non-ferrous debris.	SSS	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Anomaly type	External references
70003	Seabed disturbance	431033	6340483	A2_l	21.6	0.4	0.1	-	A linear dark reflector in a circular shape, bending back upon itself. It has a short bright shadow and appears hollow. Visible as a sub-rounded depression in the MBES dataset. No anomalous features were identified in the Mag. data at this location. Interpreted as a possible natural feature or may be possible partially buried non-ferrous debris.	SSS	-
70004	Debris	431121	6339563	A2_h	2.8	0.8	0.2	23	A sub-rounded dark reflector with a bright shadow and an elongate dark reflector on a roughly east to west alignment with a short bright shadow. Visible in the MBES data as a rounded mound. Associated with a broad, asymmetric dipole with peak and trough on one profile line in the Mag. data, although this Mag. may also be associated with debris field 70005, situated approximately 15 m north. Interpreted as ferrous debris.	SSS, Mag.	-
70005	Debris field	431117	6339578	A2_h	8.5	7.6	0.1	23	A group of dark reflectors comprising of an elongate dark reflector with a bright shadow, that measures 8.5 x 0.5 x 0.1 m on a roughly northwest to southeast alignment with a short bright shadow. To the west of this are small indistinct angular dark reflectors. Visible in the MBES dataset as a sub-rounded mound. Associated with a broad, asymmetric dipole with peak and trough on one profile line in the Mag. data, although this Mag. may also be associated with debris 70004, located approx. 15 m south. Interpreted as a ferrous debris field.	SSS, Mag.	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Anomaly type	External references
70006	Dark reflector	431237	6339315	A2_I	1.8	0.4	0.3	-	A sub-rounded dark reflector with a broad, bright shadow. No anomalous features were identified in the MBES or Mag. data at this location. Interpreted as a possible natural feature or may be possible non-ferrous debris.	SSS	-
70007	Seabed disturbance	431226	6338312	A2_I	8.5	7	0.1	-	Seabed disturbance made up of a curvilinear dark reflector, circle shaped in profile, with a short bright shadow. It surrounds an area of higher reflectivity. No anomalous features were identified in the Mag. data at this location. This location was not covered by the MBES dataset. Interpreted as a possible natural feature or may be possible partially buried non-ferrous debris.	SSS	-
70008	Recorded obstruction	431492	6338503	A3	-	-	-	-	The recorded position of an unidentified seabed obstruction, recorded as foul ground, at a depth of 90m first identified in 1994. The record was last amended on 18th January 2017 but no further information is available. Possibly indicative of wreckage or a submerged feature. No anomalous features were identified in geophysical data at this location. Retained in this gazetteer as a precaution but no recommended AEZ.	-	2528 (UKHO), 322112 (Canmore)
70009	Dark reflector	431454	6339985	A2_I	5.1	0.4	0.1	-	A linear dark reflector on a roughly east to west alignment with a short shadow. No anomalous features were identified in the MBES or Mag. data at this location. Interpreted as a possible natural feature or may be possible non-ferrous debris.	SSS	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Anomaly type	External references
70010	Dark reflector	431550	6338836	A2_I	3.3	0.2	0.1	-	An elongate dark reflector on a roughly east to west alignment, with a bright shadow. No anomalous features were identified in the MBES or Mag. data at this location. Interpreted as a possible natural feature or may be possible non-ferrous debris.	SSS	-
70011	Dark reflector	431628	6340093	A2_I	6.3	0.7	0.6	-	A sub-rounded dark reflector with a bright shadow. No anomalous features were identified in the MBES or Mag. data at this location. Interpreted as a possible natural feature or may be possible non-ferrous debris.	SSS	-
70012	Depression	431531	6340025	A2_I	21	9.3	-0.2	-	A distinct sub-rounded depression anomalous to the surrounding seabed. It is wider at the southwest end. No anomalous features were identified in the SSS or Mag. data at this location. Interpreted as a possible natural feature or may be possible non-ferrous debris.	MBES	-
70013	Seabed disturbance	431780	6339882	A2_I	15.3	9.9	0.2	-	A seabed disturbance comprising several sub-rounded and elongate dark reflectors, a few objects have small bright shadows and are in a circular arrangement on the seabed. Visible as a depression in the MBES data. No anomalous features were identified in the Mag. data at this location. Interpreted as a possible natural feature or may be possible partially buried non-ferrous debris.	SSS	-
70014	Dark reflector	431931	6340035	A2_I	1.9	1.4	0.2	-	A sub-rounded dark reflector with a bright shadow. No anomalous features were identified in the MBES or Mag. data at this location. Interpreted as a possible natural	SSS	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Anomaly type	External references
									feature or may be possible non-ferrous debris.		
70015	Linear debris	432226	6339741	A2_h	58.9	0.2	0.1	-	A slightly curvilinear dark reflector on a roughly north to south alignment, with a short bright shadow. The feature is indistinct in places. No anomalous features were identified in the MBES or Mag. data at this location. Interpreted as a possible long length of non-ferrous linear debris, such as a rope.	SSS	-
70016	Debris field	432223	6338965	A2_h	22	13.5	0.9	-	A distinct group of three sub-rounded dark reflectors with broad bright shadows and located in an area of high reflectivity. Identified in the MBES data as three sub-rounded mounds, each measuring approx. 4 meters across located in a depression. No anomalous features were identified in the Mag. data at this location. Interpreted as a non-ferrous debris field.	SSS, MBES	-
70017	Magnetic	432184	6338666	A2_l	-	-	-	26	A small asymmetric dipole with peak and trough on one profile line. No anomalous features were identified in the SSS or MBES data at this location. Interpreted as possible ferrous debris either buried or with no surface expression.	Mag.	-
70018	Debris	432260	6338528	A2_h	4	0.5	0.3	-	An elongate dark reflector on a northwest to southeast alignment, with a bright shadow. Visible in the MBES dataset as a sub-rounded depression with a small mound in the base. No anomalous features were	SSS	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Anomaly type	External references
									identified in the Mag. data at this location. Interpreted as non-ferrous debris.		
70019	Seabed disturbance	432302	6338512	A2_l	38.5	4.5	-0.1	-	A seabed disturbance visible as a linear depression, aligned approximately northwest to southeast. The north-western and southeastern edges of the depression are straight and it has an uneven base. No anomalous features were identified in the SSS or Mag. data at this location. Interpreted as a possible natural feature or may be possible partially buried non-ferrous debris.	MBES	-
70020	Linear debris	432373	6339482	A2_h	7.9	0.9	0.2	-	A thin slightly curvilinear dark reflector with a shadow on a roughly northwest to southeast alignment. It is thinner on its northern end, with a sub-rounded dark reflector attached on its southern end that measures approx. 0.9 m across, with a tapered shadow. No anomalous features were identified in the MBES or Mag. data at this location. Interpreted as a possible short length of non-ferrous linear debris.	SSS	-
70021	Seabed disturbance	432635	6340089	A2_l	5.7	2.3	0.1	-	A seabed disturbance comprising a curvilinear dark reflector on a roughly east to west alignment and several small rounded dark reflectors. No anomalous features were identified in the MBES or Mag. data at this location. Interpreted as a possible natural feature or may be possible partially buried non-ferrous debris.	SSS	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Anomaly type	External references
70022	Linear debris	432669	6339278	A2_h	55.7	0.7	0.1	-	A distinct curvilinear dark reflector with shadow, the feature appears coiled on the seabed. Also identified in the MBES data as three sub-rounded depressions. Likely related to anomaly 70023 situated 22 m south. No anomalous features were identified in the Mag. data at this location. Interpreted as a possible length of linear debris, such as a coiled rope.	SSS, MBES	-
70023	Debris field	432707	6339242	A2_h	48.9	12.1	0.1	-	A group of 10+ elongate and sub-rounded dark reflectors on multiple alignments and a linear dark reflector on a roughly northwest to southeast alignment, the feature is intermittent in places. Also identified in the MBES data as a curvilinear depression on an east to west alignment that curves to the northwest and is widest at the eastern extent. Likely related to anomaly 70022 situated 22 m north. No anomalous features were identified in the Mag. data at this location. Interpreted as a non-ferrous debris field.	SSS, MBES	-
70024	Mound	432669	6338182	A2_l	24.4	14.4	0.5	-	A large sub-angular mound with gently sloping sides and a flat peak, in a slight depression. Appears to be associated with a straight linear depression extending 100+m to the northeast, beyond the data extents. No anomalous features were identified in the SSS or Mag. data at this location. Interpreted as a possible natural feature or possible non-ferrous debris.	MBES	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Anomaly type	External references
70025	Dark reflector	432725	6339173	A2_l	2.6	1.3	0.3	-	An 'L'-shaped dark reflector with a tapered shadow. Slightly distorted in the data. No anomalous features were identified in the MBES or Mag. data at this location. Interpreted as a possible natural feature or possible non-ferrous debris.	SSS	-
70026	Debris	432823	6339420	A2_l	23.4	22.1	0.5	204	A large, sub-rounded mound with gently sloping sides and a highly uneven peak. Associated with a large asymmetric dipole with peak and trough on one profile line, also visible on other profiles in the Mag. data. This feature is situated approximately 25 m southeast of modern disturbance and is possibly associated, however it has been retained as a precaution. Interpreted as possibly modern ferrous debris.	MBES, Mag.	-
70027	Debris	432832	6339336	A2_h	2.9	0.5	0.1	-	A sub-rounded dark reflector with a bright shadow. Also visible as a sub-rounded mound in the MBES dataset. No anomalous features were identified in the Mag. data at this location. Interpreted as non-ferrous debris.	SSS, MBES	-
70028	Linear debris	432763	6339973	A2_h	8.5	6.7	0.2	-	A curvilinear dark reflector in a circular shape with a thin shadow, the feature appears to be coiled. Also identified in the MBES data as an uneven area of seabed visible as a depression with gently sloping sides and uneven base, small angular objects visible at base. No anomalous features were identified in the Mag. data at this location. Interpreted as a possible length of non-ferrous linear debris, such as a coiled length of rope.	SSS, MBES	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Anomaly type	External references
70029	Magnetic	432820	6339219	A2_l	-	-	-	28	A small asymmetric dipole with peak and trough on one profile line. No anomalous features were identified in the SSS or MBES data at this location. Interpreted as possible ferrous debris either buried or with no surface expression.	Mag.	-
70030	Magnetic	432861	6339206	A2_l	-	-	-	16	A small symmetric dipole with peak and trough on one profile line. No anomalous features were identified in the SSS or MBES data at this location. Interpreted as possible ferrous debris either buried or with no surface expression.	Mag.	-
70031	Seabed disturbance	432883	6339336	A2_l	12.1	4.7	0.3	-	A seabed disturbance made up of two dark reflectors in a depression, one elongate on a roughly north to south alignment, measuring approximately 3 x 0.8 m. The other is sub-rounded and measures 1 m across. Also identified in the MBES data as a sub-rounded mound with large depressions to its northwest and southeast. No anomalous features were identified in the Mag. data at this location. Interpreted as a possible natural feature or may be possible partially buried debris.	SSS, MBES	-
70032	Linear debris	432844	6340036	A2_h	10.4	0.6	0.2	-	An indistinct curvilinear dark reflector with a short bright shadow. Visible as a rounded depression in the MBES data. No anomalous features were identified in the Mag. data at this location. Interpreted as a possible short length of non-ferrous linear debris.	SSS	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Anomaly type	External references
70033	Mound	432926	6340192	A2_I	7	5.6	0.5	-	An isolated, sub-rounded mound with an elongate depression on its WNW edge. No anomalous features were identified in the SSS or Mag. data at this location. Interpreted as a possible natural feature or possible non-ferrous debris.	MBES	-
70034	Seabed disturbance	433240	6338681	A2_I	12.4	10.1	0.2	-	A seabed disturbance comprising two angular mounds, both measuring approx. 4 m across. Within a large depression or scour that is -0.2 m deep. Visible as an area of high reflectivity in the SSS data. No anomalous features were identified in the Mag. data at this location. Interpreted as a possible natural feature or may be possible partially buried non-ferrous debris.	MBES	-
70035	Magnetic	433294	6339042	A2_I	-	-	-	11	A small, broad asymmetric dipole with peak and trough on one profile line. No anomalous features were identified in the SSS or MBES data at this location. Interpreted as possible ferrous debris either buried or with no surface expression.	Mag.	-
70036	Depression	433422	6337792	A2_I	18.3	11.9	-0.3	-	A sub-rounded depression with two angular objects in the base. No anomalous features were identified in the SSS or Mag. data at this location. Interpreted as a possible natural feature or possible non-ferrous debris.	MBES	-
70037	Magnetic	433473	6339063	A2_I	-	-	-	9	A small, broad positive monopole with peak and trough on one profile line. No anomalous features were identified in the SSS or MBES data at this location. Interpreted as possible ferrous debris either buried or with no surface expression.	Mag.	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Anomaly type	External references
70038	Linear debris	433521	6339507	A2_h	26.5	0.3	0.1	9	A curvilinear dark reflector with a faint bright shadow. Associated with a small, broad asymmetric dipole with peak and trough on one profile line in the Mag. data. Visible as a curvilinear depression in the MBES data. Likely related to anomaly 70039 , located 16 m southeast. Interpreted as a possible length of partially ferrous linear debris.	SSS, Mag.	-
70039	Dark reflector	433531	6339494	A2_l	1.9	0.5	-	-	An elongate dark reflector on a roughly north to south alignment. Likely related to anomaly 70038 , located 16m to the northwest. No anomalous features were identified in the MBES or Mag. data at this location. Interpreted as a possible natural feature or may be possible debris.	SSS	-
70040	Seabed disturbance	433604	6339601	A2_l	43.6	17.4	-0.6	-	A seabed disturbance comprising three parallel linear depressions with scour to the WNW to ENE. They are deeper and more distinct on their WNW end. No anomalous features were identified in the SSS or Mag. data at this location. Interpreted as a possible natural feature, or may be related to modern activities or may be possible partially buried debris.	MBES	-
70041	Debris field	433521	6338510	A2_h	13.3	8.3	0.1	-	A group of multiple curvilinear dark reflectors, in a circular shape with short bright shadows and in a depression. With a single linear dark reflector coming off the west edge. No anomalous features were identified in the Mag. data at this location. This position was not covered by the MBES data. Interpreted as a non-ferrous debris field.	SSS	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Anomaly type	External references
70042	Dark reflector	433951	6339003	A2_l	2.4	1.3	0.7	-	A sub-rounded dark reflector with a tapered shadow. Visible as a mound in the MBES data. No anomalous features were identified in the Mag. data at this location. Interpreted as a possible natural feature or may be possible non-ferrous debris.	SSS	-
70043	Dark reflector	434086	6339062	A2_l	2.9	2.4	0.7	-	A distinct angular dark reflector with a broad tapered shadow. Observed in the MBES data as a rounded mound in a depression. No anomalous features were identified in the Mag. data at this location. Interpreted as a possible natural feature or may be possible non-ferrous debris.	SSS, MBES	-
70044	Debris	434101	6339072	A2_h	2.6	0.3	0.1	-	A distinct elongate dark reflector, on a roughly east to west alignment, with a bright shadow. No anomalous features were identified in the MBES or Mag. data at this location. Interpreted as non-ferrous debris.	SSS	-
70045	Mound	434258	6338901	A2_l	6.4	4.5	0.2	-	A distinct angular mound situated 13 m south of anomaly 70046 and may be associated. No anomalous features were identified in the SSS or Mag. data at this location. Interpreted as a possible natural feature or possible non-ferrous debris.	MBES	-
70046	Depression	434256	6338921	A2_l	12.2	5.9	-0.3	-	An elongate depression orientated north to south with relatively steep sides and flat base. Situated 13 m north of mound 70045 and may be associated. No anomalous features were identified in the SSS or Mag. data at this location. Interpreted as a possible natural feature or possible non-ferrous debris.	MBES	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Anomaly type	External references
70047	Debris field	434293	6338741	A2_h	10.6	8	0.1	-	A group of 10+ elongate and sub-rounded dark reflectors with bright shadows, the features all appear connected. Visible as a sub-rounded depression in the MBES data. No anomalous features were identified in the Mag data at this location. Interpreted as a non-ferrous debris field.	SSS, MBES	-
70048	Dark reflector	434247	6339371	A2_l	1.2	0.6	0.4	-	A sub-rounded dark reflector with a tapered shadow. Possibly related to anomaly 70049, situated 1 m north-west. No anomalous features were identified in the MBES or Mag. data at this location. Interpreted as a possible natural feature or may be possible non-ferrous debris.	SSS	-
70049	Dark reflector	434246	6339372	A2_l	1.1	0.2	0.5	-	A sub-rounded dark reflector with a tapered shadow. Possibly related to anomaly 70048, situated 1 m south-east. No anomalous features were identified in the MBES or Mag. data at this location. Interpreted as a possible natural feature or may be possible non-ferrous debris.	SSS	-
70050	Linear debris	434375	6339450	A2_h	6.5	0.2	0.1	-	A curvilinear dark reflector on a roughly north to south alignment with a short bright shadow. Possibly associated with anomaly 70051 situated 3 m east. No anomalous features were identified in the MBES or Mag. data at this location. Interpreted as a possible length of non-ferrous linear debris.	SSS	-



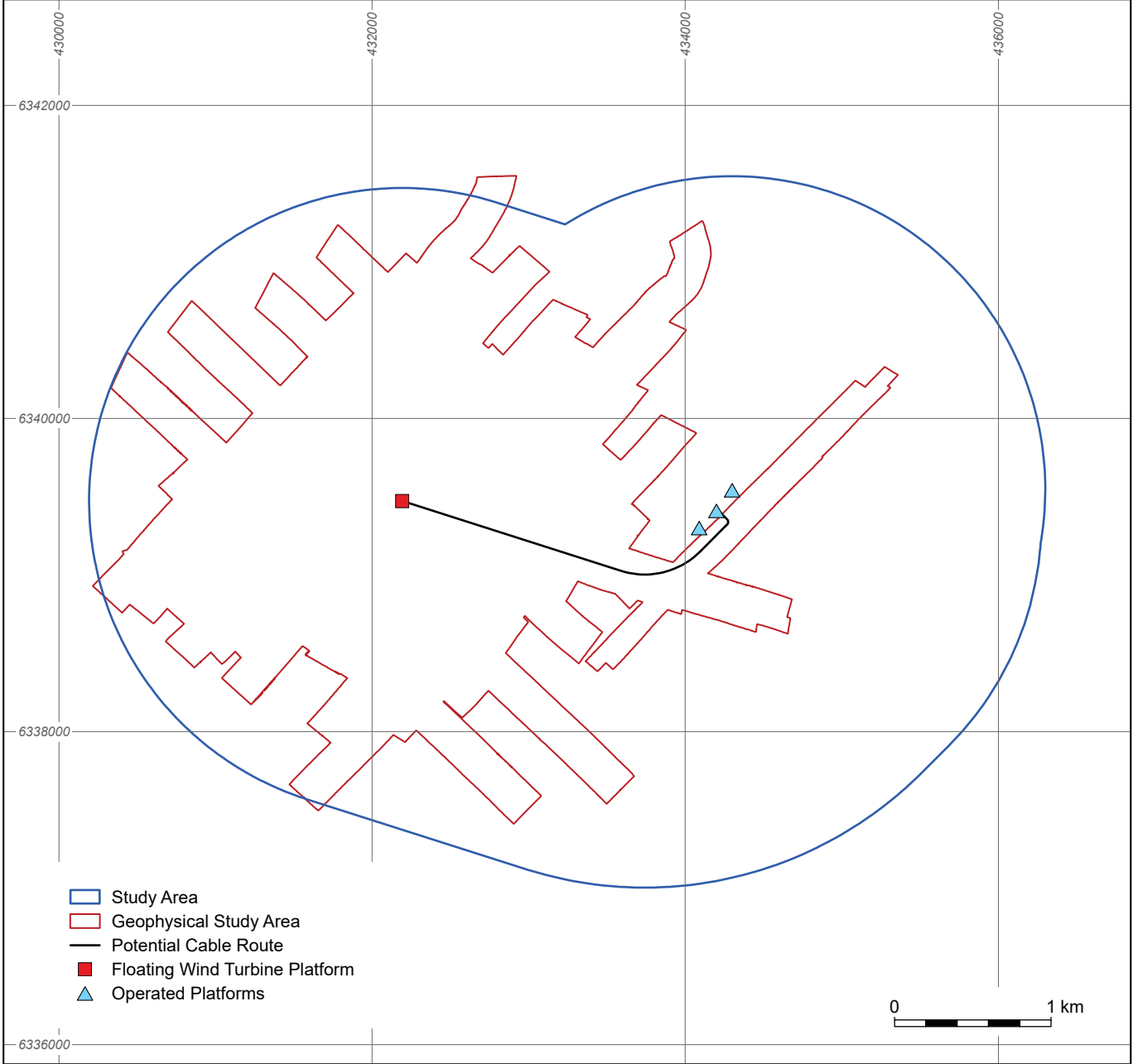
ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Anomaly type	External references
70051	Dark reflector	434379	6339449	A2_I	2.8	2	0.1	-	A 'T' shaped dark reflector with a short bright shadow, possibly multiple objects aligned but unclear in data. Possibly associated with anomaly 70050 situated 3 m west. No anomalous features were identified in the MBES or Mag. data at this location. Interpreted as a possible natural feature or may be possible non-ferrous debris.	SSS	-
70052	Magnetic	434387	6339325	A2_I	-	-	-	249	A large asymmetric dipole with peak and trough on one profile line. Situated 15 m southwest of modern infrastructure and may be related, however appears to be separate anomaly and so retained as a precaution. No anomalous features were identified in the SSS or MBES data at this location. Interpreted as possible ferrous debris either buried or with no surface expression.	Mag.	-
70053	Seabed disturbance	434392	6338661	A2_I	6.1	3.4	0.8	-	A seabed disturbance comprising several elongate and sub-rounded dark reflectors with bright shadows, measuring between 1 to 3 m across. Observed in the MBES data as a rounded depression with a possible object at the base, measuring approximately 2 x 2 x 0.1 m. No anomalous features were identified in the Mag. data at this location. Interpreted as a possible natural feature or may be possible partially buried non-ferrous debris.	SSS, MBES	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Anomaly type	External references
70054	Magnetic	434429	6338745	A2_I	-	-	-	44	A small, broad asymmetric dipole with peak and trough on one profile line. No anomalous features were identified in the SSS or MBES data at this location. Located nearby modern infrastructure and may be related. Interpreted as possible ferrous debris either buried or with no surface expression.	Mag.	-
70055	Magnetic	434447	6338689	A2_I	-	-	-	277	A large positive monopole with peak and trough on one profile line. No anomalous features were identified in the SSS data at this location. This position was not covered by the MBES data. Located nearby modern infrastructure and may be related. Interpreted as possible ferrous debris either buried or with no surface expression.	Mag.	-
70056	Recorded obstruction	434320	6339591	A3	-	-	-	-	The recorded position of an unidentified seabed obstruction first identified in 2022. Possibly indicative of wreckage or a submerged feature. This position was not covered by the geophysical survey data. Retained in this gazetteer as a precaution but no recommended AEZ.	-	95564 (UKHO)

1. Co-ordinates are in ED50 UTM31N
2. Positional accuracy estimated ± 10 m

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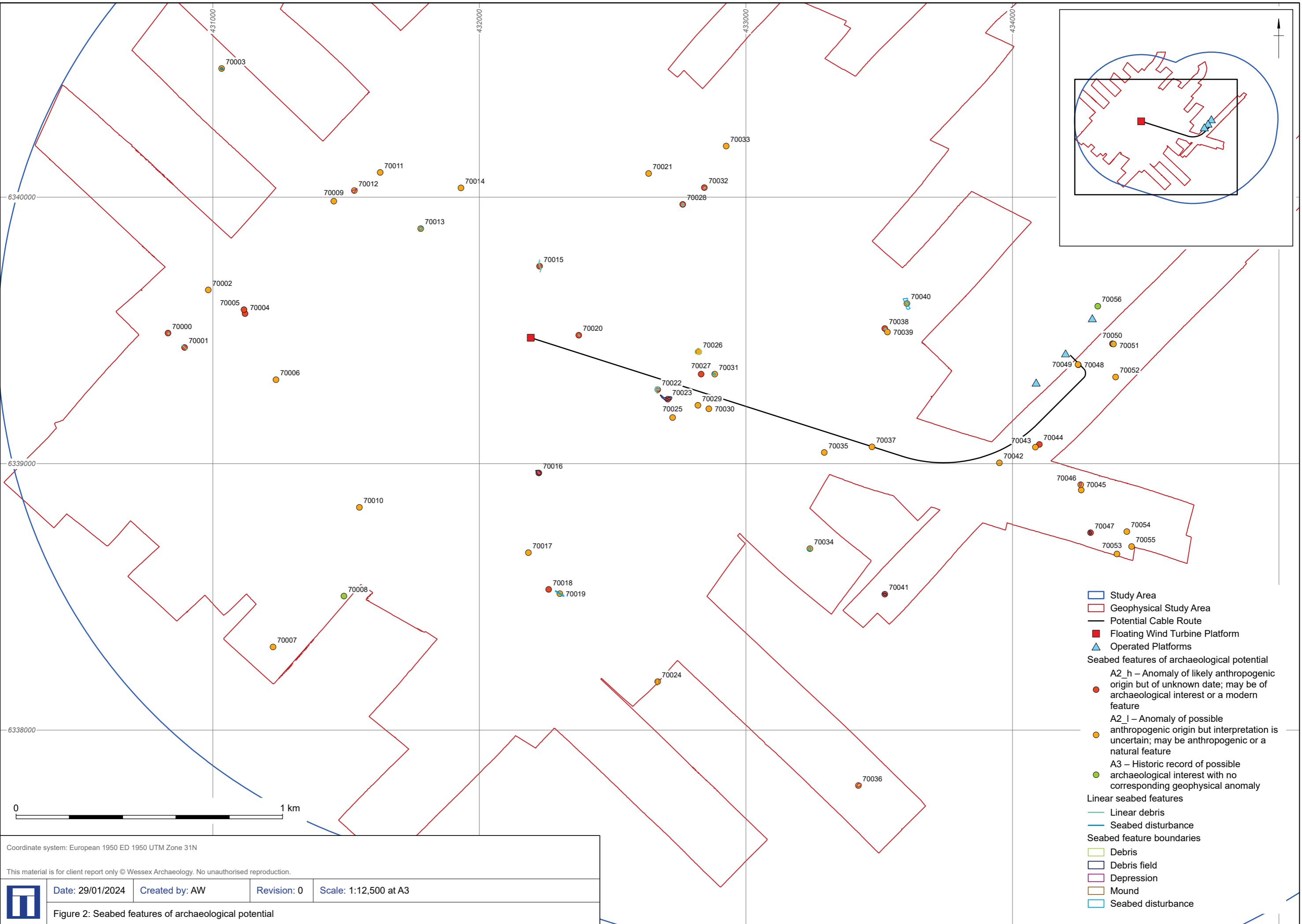


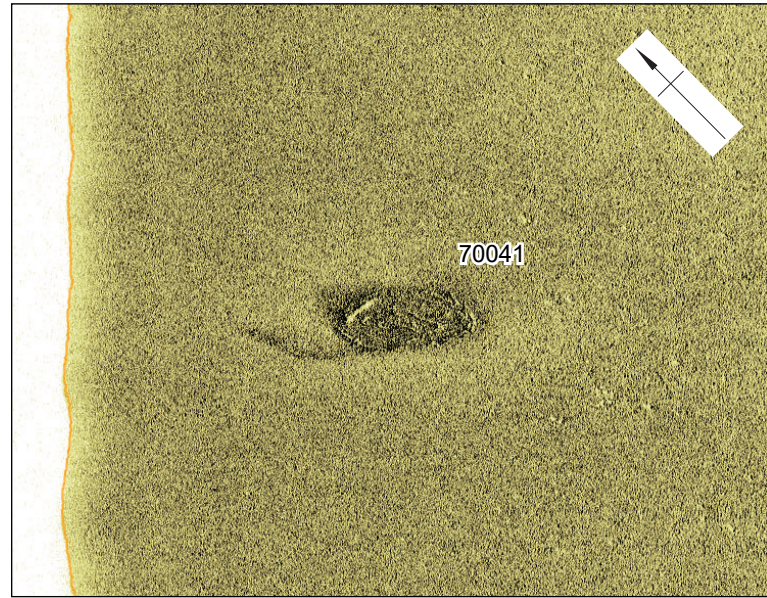
Coordinate system: European 1950 ED 1950 UTM Zone 31N
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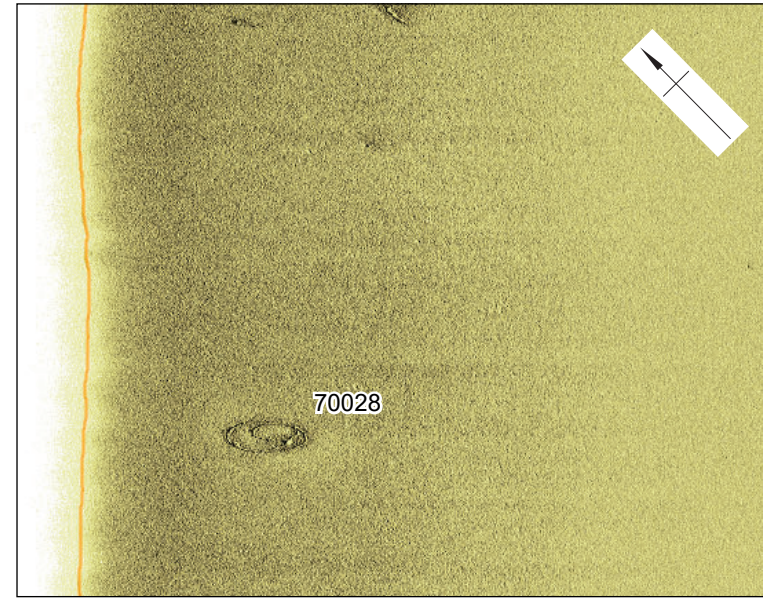
Figure 1: Geophysical study area



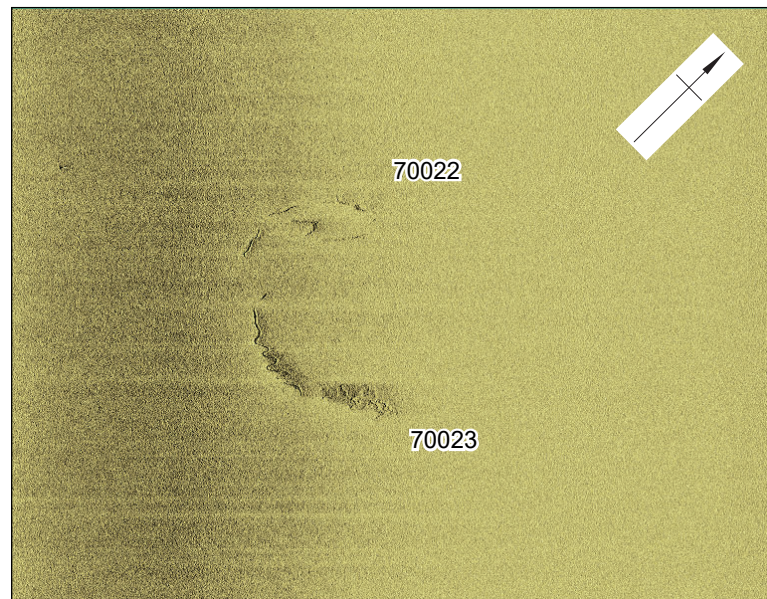




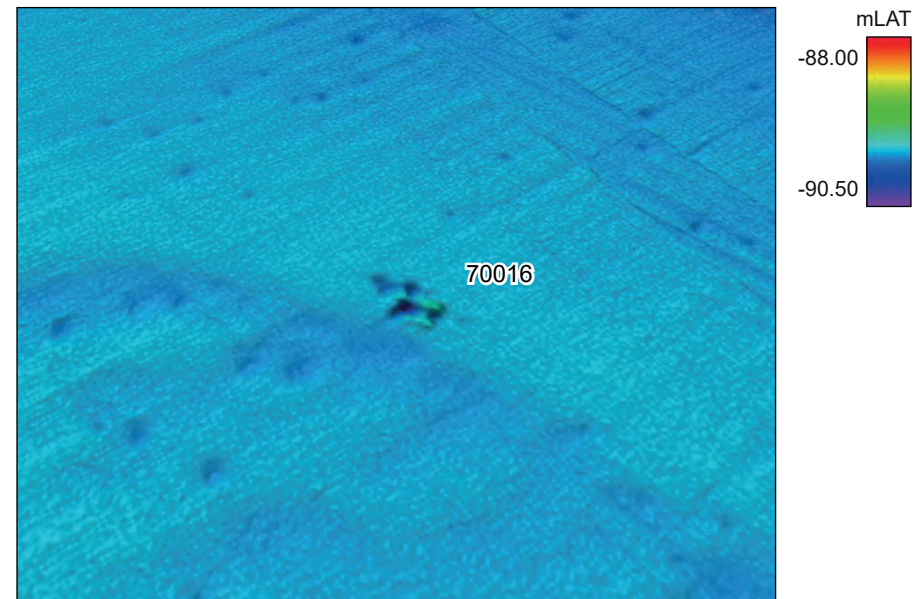
Sidescan sonar image of debris field **70041**, measuring 13.3 x 8.3 x 0.1 m



Sidescan sonar image of linear debris **70028**, measuring 8.5 x 6.7 x 0.2 m



Sidescan sonar image of linear debris **70022**, measuring 55.7 x 0.7 x 0.1 m and debris field **70023**, measuring 48.9 x 12.1 x 0.1 m



Multibeam echosounder image of debris field **70016**, measuring 22 x 13.5 x 0.9 m, looking north x1 vertical exaggeration





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