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Gunfleet Sands
Offshore Wind Farm



Archaeological Written Scheme of Investigation

Gunfleet Sands 1 and 2

August 2008

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GUNFLEET SANDS 1 AND 2 OFFSHORE WIND FARMS

ARCHAEOLOGICAL WRITTEN SCHEME OF INVESTIGATION

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August 2008

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GUNFLEET SANDS 1 AND 2 OFFSHORE WIND FARMS

ARCHAEOLOGICAL WRITTEN SCHEME OF INVESTIGATION

REF: 67760.05

1. INTRODUCTION

1.1. PROJECT BACKGROUND

1.1.1. Wessex Archaeology (WA) was commissioned by Gunfleet Sands Ltd to prepare an archaeological Written Scheme of Investigation (WSI) for the construction, operational and de-commissioning phases of the Gunfleet Sands 1 and 2 offshore wind farms. The proposed development area lies on and immediately adjacent to a sandbank known as Gunfleet Sands, which lies approximately six kilometres off the Essex coast, to the south-east of Clacton-on-Sea. One export cable will connect the wind farm to the grid, with landfall at Holland Haven.

1.2. DEVELOPMENT PROPOSAL

1.2.1. The wind farm will be developed in two phases, referred to as Gunfleet Sands 1 (GS1), which is located approximately six kilometres off the Essex Coast, and Gunfleet Sands 2 (GS2), which lies adjacent to the south-eastern edge of GS1. GS1 will involve the construction of 30 turbines and GS2 of up to 22 turbines, together covering an area measuring approximately 17.5km² (10km² for GS1 and 7.5km².for GS2). Subsequent 33/132kV underground cabling will connect the wind farm to the electricity network.

1.2.2. The GS1 and GS2 scheme elements are as follows:

- Up to 52 wind turbines;
- One offshore substation;
- A network of inter-array cables between the turbines;
- Up to two meteorological masts;
- One 132kV sea-armoured 3 core copper XLPE export cable from the wind farm to the shore;
- The cable landfall;
- An onshore connection within the grid station on Sladbury's Lane.

1.3. SCOPE

1.3.1. The WSI is based on recommendations made in the Gunfleet Sands Offshore Wind Farm Archaeological Assessment: Technical Report (WA 2002), and in the Marine Archaeology and Wrecks: Supplementary Assessment Data for GS2 (RPS 2007).

1.3.2. This WSI is being implemented as part of a programme of mitigation works outlined in the Gunfleet Sands 1 Environmental Statement (RPS 2005) and the Gunfleet Sands 2 Environmental Statement (RPS 2007).

1.3.3. GS1 is subject to the following relevant consent:

FEPA Licence 31919/06/0

9.25 The Licence holder shall not permit any development to commence as authorised by this licence until a protocol has been submitted to the Licensing Authority , which has been formally agreed with an Archaeologist representing the County Council adjacent to the site of works. This shall detail what action must be taken to protect any archaeological and shipwreck remains that were identified in the Environmental Statement submitted in support of the applications for consent of the works or any such artefacts which may be discovered during the course of progressing the development.

1.3.4. GS2 consent will be added as soon as consent is awarded.

1.3.5. Curatorial responsibility for the sub-tidal aspects of the proposed project (outside of the jurisdiction of the local planning authority) resides with English Heritage. Curatorial responsibility for those aspects of the scheme that occur within the jurisdiction of the local planning authority should be referred to the Essex County Council Heritage Conservation Group (ECCHC).

2. IMPLEMENTATION

2.1.1. The responsibility for implementing this WSI rests with Gunfleet Sands Ltd.

2.1.2. Gunfleet Sands Ltd will ensure that project personnel are aware of archaeological communication requirements and the appointment of onboard vessel representatives if required.

2.1.3. Gunfleet Sands Ltd will provide an Archaeological Communication Plan. Typically this will include details of contacts within Gunfleet Sands Ltd, all archaeological consultants and contractors, each nominated contact within the construction company(s) and the relevant archaeological curators. The plan will also include the projected timescale for all main construction activities for which there is a proposed archaeological response. The initial draft of the plan will be copied to English Heritage and ECCHC to enable confirmation of appropriate contacts within these organisations.

2.1.4. The Construction Companies will ensure that project personnel are aware of this WSI, any associated exclusion zones in force and the Finds Reporting Protocol.

2.1.5. Gunfleet Sands Ltd, or any archaeological body that they may appoint to manage the implementation of the Finds Reporting Protocol, will seek curatorial advice from English Heritage and the ECCHC.

2.1.6. All data obtained from the inter-tidal areas will be compiled in a format suitable for submission of Monument, Event and Source records for entry into the ECCHC Historic Environment Record (HER). All appropriate data pertaining to the historic environment obtained for the sub-tidal area of the proposed development will be compiled in a format suitable for transmission to the National Monuments Record (NMR).

3. KNOWN AND POTENTIAL ARCHAEOLOGY

3.1.1. During the archaeological assessment for GS1 (WA 2002) two study areas were defined in order to search for archaeological data. These were termed the Coastal Study Area (GS1 CSA) which addressed the terrestrial and foreshore extent of the

cable route, and the Marine Study Area (GS1 MSA) which addressed the southern end of the marine cable route and the GS1 wind farm footprint.

3.1.2. Within the GS1 CSA, 7 live wrecks and 19 documented losses were identified. A further 14 live wrecks and 1 documented point of loss were noted within the GS1 MSA. A geophysical survey of the GS1 MSA revealed 32 anomalies, of which 5 are likely to represent wrecks and the remainder are potentially anthropogenic in origin.

3.1.3. The supplementary assessment data (RPS 2007) defined its search within a Marine Study Area (GS2 MSA) which encompassed the footprint of the GS2 wind farm and a surrounding buffer of approximately 0.7 kilometres. The GS2 MSA also incorporated the southern half of the GS1 MSA defined for the GS1 wind farm (WA 2002), and as such there is a degree of repetition with regards to search results.

3.1.4. Within the GS2 MSA, 7 live wrecks and 1 documented loss were identified. A geophysical survey of the GS2 MSA produced 34 anomalies, of which 3 are most likely to represent wrecks and the remainder are potentially anthropogenic in origin.

3.1.5. The data retrieved by the archaeological assessments of GS1 and GS2 was collated, forming a single database of known wrecks, possible wrecks and geophysical anomalies within and around the wind farm and cable route development areas. Those which may be impacted by the developmental proposal were identified and assigned a unique numbering system from **WA 7001** to **WA 7080** (**Appendix I**).

3.1.6. The following sites and areas of archaeological potential were identified which may be affected by the wind farm development. These are considered within three main areas of development: the Marine Cable Route (MCR) the GS1 Wind Farm (GS1 WF) and the GS2 Wind Farm (GS2 WF).

Possible Archaeological Features	**MCR**	**GS1 WF**	**GS2 WF**
Known Wrecks	1	-	3
Geophysical Anomalies likely to be wrecks	1	5	-
Other Geophysical Anomalies	2	32	26

3.1.7. Geophysical anomalies which appear to refer to the same seabed feature have been grouped together and assigned a single **WA** number. Similarly, geophysical features which are in close proximity to one another and have a significant overlap in their buffer zone have been grouped under a single **WA** number.

3.1.8. There are a further 10 sites (**WA 7071-7080**), which although they lie outside the MCR, GS1 and GS2 wind farms, may be affected due to their close proximity to the development areas. These consist of 8 known wrecks, 1 possible wreck and 1 geophysical anomaly. Of the known wrecks 1 is an aircraft which is protected by the Protection of Military Remains Act (1986).

3.1.9. The National Monuments Record (NMR) locate recorded losses for which there is no confirmed position at certain arbitrary points around the coast – called Named Locations. Although no points of recorded losses are documented within the footprint of the GS1 and GS2 wind farms and associated cable route, there are two named locations for losses within the general vicinity of the wind farm areas; 'Off Clacton-on-Sea' and 'On Gunfleet Sands'. WWII aircraft comprise 9 of the losses documented for Off Clacton-on-Sea. In the event that a military aircraft was found within the wind farm development area, it would be immediately protected by the

Protection of Military Remains Act (1986). These documented losses suggest the possibility for hitherto unknown wrecks within the development vicinity.

3.1.10. The archaeological assessment of the coastal study area (WA 2002) revealed 102 sites dating from the Palaeolithic to the Modern period. These sites suggest activity within the area from the Palaeolithic period onwards. As such, there is potential for the survival of submerged landscape evidence and prehistoric sites and finds within the wind farms and cable route areas. Furthermore, there is the possibility for unknown and undocumented wrecks from various periods which may date to the Neolithic onwards, when the area was inundated.

4. ANTICIPATED IMPACTS

4.1. INTRODUCTION

4.1.1. The development area is considered to be an area of high archaeological potential. Any installation and subsequent works that disturb the seabed within the GS1 and GS2 wind farms and along the export cable route therefore have the potential to negatively impact archaeological deposits. In addition to the known wrecks (see Section 3), these deposits include currently unknown prehistoric sites and land surfaces from the Palaeolithic to the Neolithic and unknown maritime remains (wrecks and debris) from the Neolithic to the present. Modern aircraft remains may also be present.

4.1.2. The most obvious way in which these archaeological deposits could be negatively impacted during installation is by direct impact damage, for example from the dropping of anchors, the use of grapnels or piling. However, there are a number of other ways in which they could be negatively impacted. These impacts may occur immediately or may be long term post-installation processes, such as scouring. They may be summarised as follows:

- Displacement, which disturbs the context of the archaeological deposit (the relationship between the structures or artefacts that make up the deposit and their surroundings) and thereby reduces the amount of archaeological information that can be gained from it;
- Erosion of the deposit or surrounding/covering seabed, resulting in damage and possibly prompting further erosion or instability
- Destabilisation, resulting in accelerated deterioration of the deposit through corrosion, erosion, etc.

4.2. OFFSHORE WIND FARM

4.2.1. Turbine foundation installation is invasive and is likely to have a negative impact upon archaeological deposits of all types, including submerged prehistoric land surfaces or shipwreck material, in the foundation footprints. The severity of the impact will depend upon the horizontal and vertical extent of the footprint and therefore the foundation type chosen. Destruction or removal of archaeological deposits within the footprint is probably inevitable but the impacts are likely to be localised around each foundation.

4.2.2. There will be additional impacts on surface deposits from construction activities such as the deployment of spud feet and anchors.

4.2.3. It should be borne in mind that the worst case scenario footprint of the foundations is likely to represent less than 1% of the overall area of the GS1 and GS2 wind farms. Therefore the overall scale of the impact from the foundations themselves is likely to be very small.

4.2.4. The foundation concept proposed for GS1 and GS2 are drilled monopile foundations, steel cylinders with a diameter of 4.5m to 5m, which will be driven into the seabed to a maximum depth of 38m. The monopole foundations may require additional scour protection. This will be addressed by the lowering of mats on the location around the base of the pile or by the dumping of loose rock or rough gravel on the seabed around the foundation. This is likely to have a limited additional impact on surface and shallow deposits in the immediate vicinity of the foundation.

4.2.5. The inter-turbine cables will be installed by using one of three methods; ploughing, jetting or trenching. The impact footprint will form a narrow corridor along the cable route as laid and will probably be limited to a zone no greater than the width of the plough. The depth of the impact will depend upon the depth of burial required. The inter-turbine cables are proposed to be buried at a maximum of 3m depth. However, only surface or shallow buried (probably less than 1.5m) archaeological deposits are likely to be affected.

4.2.6. In addition, debris clearance in and around each footprint and along the inter-turbine cable routes may result in the destruction or removal of surface and shallow buried archaeological deposits. The depth of the impact will depend upon the equipment used.

4.2.7. Marine operations ancillary to installation are also likely to impact upon surface or shallow buried archaeological deposits. The use of mooring anchors for positioning installation and support vessels will create the following potential impacts:

- Impact damage and possibly displacement as anchors are dropped during positioning or repositioning by anchor handlers;
- Seabed scarring and impact damage from the movement of anchors as cables are pulled taught;
- Seabed scarring from the movement of cables under load.

4.2.8. The extent and seriousness of the impact damage and seabed scarring depends upon a number of factors, including:

- Vessel size and type and the number of anchors used;
- Anchor size, type and weight;
- Nature of the seabed sediment;
- Load placed upon the vessel and hence anchors by prevailing weather and currents;
- Vessel and anchor handler crew skill.

4.2.9. The use of a jack-up barge or similar vessel is likely to have the following impacts upon surface or shallow buried archaeological deposits:

- Impact damage and possible displacement caused by spud feet (the degree of impact will depend upon the number of the spuds and the size of their footprint and depth of penetration);
- Similar impacts to the above from the use of additional anchors;
- Destruction and/or displacement during debris clearance of the anticipated spud footprints.

4.2.10. The use of dynamically positioned (DP) vessels is likely to minimise the negative impact of any installation operations upon any archaeological deposits present, as the deployment of spud feet and the use of anchors will not be required. It is assumed for the purposes of this discussion that DP vessels will not be used where the water depth is sufficiently shallow to create the risk of significant scouring from the operation of DP thrusters.

4.3. SUBMARINE CABLE ROUTE

4.3.1. Any scheme activities that disturb the seabed may have a negative impact upon a variety of archaeological deposits along the route of the submarine export cables.

4.3.2. The cable installation is expected to be buried with a plough at a depth of approximately two metres, extending down to three metres where necessary. This will be confirmed in a burial assessment, which will be completed once permission for the wind farm development has been obtained. Typically cables are laid from a lay barge (self propelled or supported by tug or anchor barge) and simultaneously buried by ploughing, trenching or jetting.

4.3.3. Each of these techniques are likely to have a negative impact upon surface and shallow buried archaeological deposits. The impact will manifest itself as direct impact damage, displacement or erosion, as described above. The impact will be localised, but surface and near surface deposits may be impacted for the full width of the plough, trenching or jetting machine.

4.3.4. If the cable-lay vessel is positioned and moved by means of an anchor pattern, there is a risk of additional impacts. The zone of potential impact from anchoring is likely to be at some distance from the cable-lay vessel and will depend upon the length of anchor cable required. Surface and shallow buried deposits in the path of the anchors will be vulnerable to damage and/or displacement.

5. RESPONSIBILITIES AND COMMUNICATION

5.1.1. Gunfleet Sands Ltd may retain the services of a suitably qualified and experienced archaeological contractor (hereafter the Retained Archaeologist) to ensure the effective implementation of the WSI and other contractual commitments in relation to archaeology.

5.1.2. Interaction with the Archaeological Curators, English Heritage and the ECCHC, will be administered by Gunfleet Sands Ltd, advised by the Retained Archaeologist.

5.1.3. The Archaeological Curators are: Dr Chris Pater, English Heritage Maritime Archaeology Team, Fort Cumberland, Portsmouth; and Adrian Gascoyne, Senior Historic Environment Officer, Essex County Council Heritage Conservation Group.

5.1.4. In relation to the implementation of the WSI the Retained Archaeologist will report to Gunfleet Sands Ltd.

5.1.5. Interaction with the Construction Team will be administered by Gunfleet Sands Ltd, advised by the Retained Archaeologist.

5.1.6. Gunfleet Sands Ltd will advise the Retained Archaeologist of their requirements or responsibilities under any Environmental Management Plan and the Construction Method Statement produced for the project.

5.1.7. The responsibilities of the Retained Archaeologist will include:

- Maintaining, reviewing and updating this WSI, as required;
- Advising Gunfleet Sands Ltd's Contractor(s) which elements warrant archaeological involvement;
- Advising Gunfleet Sands Ltd's Contractor(s) in the course of evaluating scope of work specifications on their capacity to meet archaeological requirements;
- Advising Gunfleet Sands Ltd on the necessary interaction with third parties with archaeological interests, including the Archaeological Curators;
- Advising Gunfleet Sands Ltd on the implementation of generic archaeological requirements applicable to all construction activities;
- Advising Gunfleet Sands Ltd on Method Statements for archaeological investigations;
- Preparing Method Statements for all archaeological activities;
- Ensuring that Gunfleet Sands Ltd copies Method Statements to the Archaeological Curators for approval;
- Implementing and monitoring the Protocol for Reporting Finds of Archaeological Interest;
- Monitoring the work of and liasing with the Archaeological Contractor/s where this is not the Retained Archaeologist;
- Monitoring the preparation and submission of Archaeological Reports as appropriate and making them available to the Archaeological Curators;
- Preparing provisions for the management of the project archives in consultation with an appropriate Museum; and
- Advising Gunfleet Sands Ltd on final arrangements for analysis, archive deposition, publication and popular dissemination.

5.1.8. Where Method Statements, reports or other deliverables are submitted by Gunfleet Sands Ltd to the Archaeological Curators, their agreement / acceptance will be assumed if no contrary response is received within a reasonable period.

5.1.9. All Contractors engaged in the construction of the project shall:

- Familiarise themselves with the generic requirements of the WSI and make them available to their staff;
- Obey legal obligations in respect of 'wreck' and 'treasure' under the Merchant Shipping Act 1995 and the Treasure Act 1996 respectively;
- Respect constraint maps and Archaeological Exclusion Zones;
- Assist and afford access to archaeologists employed by Gunfleet Sands Ltd;
- Inform the Retained Archaeologist of any environmental constraint or matter relating to health, safety and welfare of which they are aware that is relevant to the archaeologists' activities; and
- Implement the Protocol for Reporting Finds of Archaeological Interest.

6. ARANGEMENTS FOR MONITORING AND REVIEWING THE WSI

6.1. MONITORING AND REVIEWING THE WSI

6.1.1. The aim of the WSI is to put in place the archaeological mitigation measures set out in the Archaeological Assessments (WA 2002; RPS 2007) compiled as part of the Environmental Statement for the project.

6.1.2. The objectives of the WSI are as follows:

- To fulfil the requirements in the FEPA licence for an archaeological protocol;
- To establish the exact position and extent of any Archaeological Exclusion Zones;
- To ensure that any geophysical and geotechnical investigations in the development phase of the project are subject to archaeological input, review, recording and sampling;
- To ensure archaeological involvement in any diver and/or ROV obstruction surveys in the development phase of the project;
- To propose measures for the mitigation of archaeological remains encountered during further geotechnical sampling or investigations, or during the construction work associated with the project; and
- To establish the reporting and archiving requirements for the archaeological works undertaken in the development phase and during construction of the wind farm.

6.1.3. During the development of the project, the Retained Archaeologist will advise Gunfleet Sands Ltd as to the potential requirements for archaeological investigations as outlined in the WSI. Appropriate method statements will be prepared for each element in line with the requirements of the WSI and will be submitted to English Heritage and ECCHC for approval.

6.1.4. These method statements will include provision for the Archaeological Curators to monitor the progress of the archaeological investigations, as appropriate to that element; be that through site visits or meetings with Gunfleet Sands Ltd, the Contractor(s) and the Retained Archaeologist.

6.1.5. Provision will be made for the WSI to be revised as appropriate should elements of the project change or particular archaeological issues come to light. Any revisions will be prepared by the Retained Archaeologist and submitted to Gunfleet Sands Ltd who will ensure they are submitted to and approved by the relevant Archaeological Curator(s).

6.1.6. The performance of the WSI will be monitored through the provision of a series of archaeological reports prepared to inform on the results of various activities undertaken under its auspices. These include a review of new geophysical, geotechnical and environmental data; the results of any inter-tidal cable installation watching brief and the implementation of the Protocol for Reporting Finds of Archaeological Interest during submarine cable installation. These reports will be submitted to Gunfleet Sands Ltd who will ensure their dissemination to English Heritage and ECCHC.

6.1.7. The responsibility for ensuring the implementation of the Protocol for Reporting Finds of Archaeological Interest rests with Gunfleet Sands Ltd, who will ensure that its agents and contractors are contractually bound to implement the protocol.

6.1.8. Gunfleet Sands Ltd and the Retained Archaeologist will agree the system for archaeological reporting.

6.1.9. English Heritage and the ECCHC will be notified four weeks in advance by Gunfleet Sands Ltd of work timetables and the commencement of any work on site that may impact on the archaeology and will be informed at this time of the name and contact details for the Retained Archaeologist.

6.1.10. A programme of monitoring visits (if deemed appropriate) by English Heritage and/or the ECCHC and Gunfleet Sands Ltd will be agreed in advance of the commencement of work on site.

6.1.11. During any site evaluation/investigation or construction work that has the potential to impact on the archaeology the Retained Archaeologist may liase directly with English Heritage and the ECCHC with regard to site monitoring and reporting. Gunfleet Sands Ltd will be kept informed of all contact between the Retained Archaeologist and the Archaeological Curators.

7. ENVIRONMENTAL MANAGEMENT

7.1.1. Gunfleet Sands Ltd will ensure that the Retained Archaeologist is made aware of the relevant requirements of any Environmental Management Plan (EMP) that is put in place.

7.1.2. The Retained Archaeologist will ensure that any Method Statements prepared to meet the requirements of the WSI are compliant with the requirements of the EMP.

8. HEALTH AND SAFETY

8.1.1. Gunfleet Sands Ltd will ensure that the Retained Archaeologist is made aware of the relevant requirements of all Health and Safety Plans that are put in place.

8.1.2. The Retained Archaeologist will ensure that any method statements prepared to meet the requirements of the WSI are compliant with the requirements of Gunfleet Sands Ltd's Health and Safety Plans for the project.

8.1.3. Health and Safety considerations will be of paramount importance in conducting all fieldwork. Safe working practices will override archaeological considerations at all times.

8.1.4. All work will be carried out in accordance with the Health and Safety at Work etc. Act 1974 and the Management of Health and Safety Regulations 1992, and all other relevant Health and Safety legislation, regulations and codes of practice in force at the time.

8.1.5. If there is a need for any Archaeological Contractors they will supply the Retained Archaeologist with Risk Assessments in advance of any work. The Retained Archaeologist will in turn supply Gunfleet Sands Ltd with copies of archaeological Risk Assessments before the commencement of any fieldwork. Risk Assessments will be read and acknowledged by all members of archaeological staff involved in the fieldwork.

8.1.6. Risk Assessments will incorporate an interface document between the Health and Safety system of the Archaeological Contractor/s and that of the construction/installation contractor/s.

9. SCHEME OF INVESTIGATIONS

9.1. OVERVIEW

9.1.1. The mitigation measures defined in this document relate to the GS1 and GS2 wind farms and the submarine export cable route.

9.1.2. The methodology for turbine installation and laying sub-sea cables does not generally support a watching brief. The mitigation measures proposed below are therefore, considered to be the most effective means of reporting currently unknown archaeological information for the GS1 and GS2 wind farm development area and export cable route. This WSI is supported by a Protocol for Reporting Finds of Archaeological Interest that will address any chance finds.

9.1.3. These mitigation measures rely on the availability of good geophysical and geotechnical data and analysis of suitable core samples and geophysical data.

10. ARCHAEOLOGICAL EXCLUSION ZONES

10.1. INTRODUCTION

10.1.1. Exclusion Zones will be the principle means used to preserve *in situ* any features or deposits of known or potential archaeological interest. All of the Exclusion Zones listed in this document are based on information available at the time of the compilation of the archaeological assessment for GS1 (WA 2002) and the supplementary archaeological assessment for GS2 (RPS 2007). They may be subject to change if further information becomes available.

10.1.2. The Exclusion Zones outlined below are fixed, however provision is made below for their alteration, following appropriate archaeological investigation and consultation, should this become necessary before or during construction.

10.1.3. In June 2008 additional geophysical data was subject to archaeological analysis (WA 2008). 18 Exclusion Zones were reviewed and the results of this have been added to **Appendix I**.

10.2. LOCATION AND EXTENT OF EXCLUSION ZONES

10.2.1. Archaeological Exclusion Zones were implemented around the confirmed wreck sites and those geophysical anomalies that are potentially anthropogenic in origin that were identified during the desk-based assessments. These sites are all listed in **Appendix I**.

10.2.2. The original list of 80 exclusion zones was formed by placing a 75m buffer around the extents of the known and possible wrecks (**WA 7002**, **WA 7005, WA 7006, WA 7008, WA 7043** and **WA 7044**). In addition there are a large number of geophysical anomalies, identified during the desk-based assessment, for which the available evidence suggests that there could be archaeology present on the seabed. Exclusion zones comprising a circle with a radius of 75m have been implemented

around all geophysical anomalies. All these exclusion zones may be subject to alteration and possibly removal in the manner outlined below.

10.2.3. In three cases (**WA 7001, WA 7009** and **WA 7042**) the extent and orientation of a wreck site is not clear and it has not been possible to buffer the sites in the manner adopted for the other wrecks. In these instances it is proposed that the exact shape of the exclusion zones be refined by a review of the existing geophysical data, as described below.

10.2.4. All exclusion zones for the wind farm area and cable route corridor are illustrated in **Figure 1**, including zones removed following review. The figure shows exclusion zones around all known wrecks and anomalies. There were no known sites along the un-illustrated inshore section of the Marine Cable Route.

10.2.5. These Exclusion Zones will apply to construction works, vessel mooring and any other activities that may disturb the seabed during the installation of the wind farm. The locations, extent and conditions applicable to the Exclusion Zones will be made available to all relevant parties.

10.3. ESTABLISHING NEW EXCLUSION ZONES

10.3.1. If new finds of archaeological importance come to light during the course of construction they may be subject to the implementation of additional Exclusion Zones.

10.3.2. English Heritage and ECCHC will be consulted on the need for, and the design (position, extent) and implementation of any new Exclusion Zones.

10.4. ALTERING EXCLUSION ZONES

10.4.1. Exclusion Zones may be altered (enlarged, reduced, moved or removed) as a result of further data assessment and a range of measures up to and including archaeological field evaluation. Further data assessment may include archaeological analysis of the new geophysical data covering those areas that are subject to Exclusion Zones. Archaeological field evaluation may include suitable high-resolution marine geophysical survey, and/or survey by diver/ROV.

10.4.2. The alteration of Exclusion Zones will only be undertaken following consultation with English Heritage and ECCHC. Following alteration, a new plan giving details of the Exclusion Zones will be drawn up and issued to each nominated point of contact.

10.5. MONITORING OF EXCLUSION ZONES

10.5.1. Development related activities shall not be undertaken within an Exclusion Zone. If activities are shown to have been undertaken within any zone, the construction contractor responsible will ensure that the consenting authority is aware of the incident and seek archaeological advice from the archaeological curatorial authority. A monitoring programme will check the integrity of the Archaeological Exclusion Zones to determine if they have been affected by the development.

10.5.2. The monitoring programme will report on the integrity and validity of the Exclusion Zones and will make recommendations regarding amendment of the extent, removal and/or creation of new zones. A total of four monitoring visits are proposed during the construction phase of the project, the exact timing of which is still to be

decided. These visits will take the form of an appropriately qualified archaeologist visiting a selected construction vessel and inspecting the vessels Electronic Monitoring System (EMS), and reviewing the survey data for the construction activity areas in relation to the plot of Exclusion Zones.

10.5.3. On completion of the construction phase, a report will be compiled on the effectiveness of the Exclusion Zones, any alterations to them, and the results of monitoring.

11. MARINE GEOPHYSICAL SURVEY

11.1. INTRODUCTION

11.1.1. The analysis of geophysical data enables the recovery of archaeological data concerning both submerged prehistoric landscapes and wrecks or wreck-related features. This data may be used to enhance the archaeological record, or to alter (enlarge, reduce, move or remove) existing Exclusion Zones.

11.1.2. An assessment of the geophysical survey data was conducted by WA (2002) during the production of the archaeological assessment for GS1 and by RPS (2007) during the production of the supplementary archaeological assessment for GS2. This involved:

- A review of sidescan sonar, sub-bottom and magnetic data within the footprint of the GS1 and GS2 wind farms;
- A review of sidescan sonar and magnetic data within a 600m wide corridor along the line of the inter-array cable route.

11.2. PLANNING FURTHER GEOPHYSICAL SURVEYS

11.2.1. If any further geophysical surveys are conducted they will include archaeological input at the planning stage so that archaeological considerations can be taken into account.

11.2.2. The archaeological input will take the form of advice from an appropriately qualified marine archaeologist on the following points:

- Available details of sites and/or anomalies identified in the desk-based assessment;
- Archaeological potential of areas where no existing sites and/or anomalies are yet known;
- Geophysical sources/equipment;
- Methodologies, including spacing and orientation of lines and cross lines;
- Source/equipment settings;
- Requirements for post-processing, interpreting and archiving resulting data.

11.2.3. An outline of typical archaeological survey and data specifications is presented in **Appendix II**.

11.3. UNDERTAKING FURTHER GEOPHYSICAL SURVEYS

11.3.1. Consideration will be given to having a suitably experienced archaeologist contracted on a consultancy basis during the collection of the data. The archaeologist would advise on the suitability for archaeological purposes of the

data being acquired, and be able to propose minor changes to the survey method, settings, etc. in order to optimise archaeological results, and thereby reduce the need for repeat surveys.

11.4. ARCHAEOLOGICAL INTERPRETATION OF FURTHER GEOPHYSICAL DATA

11.4.1. New survey data will be submitted for review by an appropriately qualified archaeologist. This review will only be undertaken in areas:

- Not covered by the assessments for GS1 and GS2 (WA 2002 and RPS 2007);
- Where there are known sites and/or geophysical anomalies.

11.4.2. If any further items of interest are identified English Heritage and ECCHC will be consulted prior to any changes to the Exclusion Zones.

11.4.3. Any further geophysical survey data should be interpreted by a suitably experienced archaeologist. Data sources with the potential for identifying archaeological remains are as follows:

- **Sidescan** survey may identify wrecks and other related debris of all periods that lie (at least in part) above the surface of the seabed;
- **Magnetometer** survey may identify wrecks and other related debris of all periods (though principally post-medieval and modern) on the surface of and under the seabed;
- **Boomer** and/or **Chirp** (hereafter termed **seismic**) survey may identify features and deposits that relate to the topography of an area prior to its burial and inundation during the prehistoric period, and buried objects such as wrecks (note: seismic data has to be calibrated with bathymetric data to enable the calculation of absolute heights);
- **Bathymetry** may be used to characterise wrecks and other related debris of all periods that lie (at least in part) on the surface of the seabed.

11.4.4. Archaeological interpretation should include:

- Examination of sidescan, magnetometer and, if available multibeam and seismic data for areas within the vicinity of known wreck sites and previously identified geophysical anomalies;
- Examination of sidescan, magnetometer and, if available multibeam and seismic data within areas that will be subject to scheme impacts in order to identify any as yet unknown wreck remains;
- If available, seismic data should be assessed in order to plot the general trend of the sub-surface sediments with archaeological potential;
- Following the initial assessment, further detailed interpretation of seismic data should be undertaken within those areas that will be subject to scheme impacts.

11.4.5. The archaeological results of any further geophysical survey will be compiled as a report, which will include likely requirements (if any) for further archaeological work. The results of the archaeological analysis of geophysical survey data will be reported to English Heritage and ECCHC.

12. MARINE GEOTECHNICAL SURVEY

12.1. INTRODUCTION

12.1.1. Analysis of borehole and vibrocore samples will enable the recovery of archaeological data relating to submerged terrestrial prehistoric archaeology within the development area, which will enable the production of a Quaternary deposit model relating to evidence of the submerged terrestrial prehistoric environment.

12.2. PLANNING FURTHER GEOTECHNICAL SURVEYS

12.2.1. If any further geotechnical surveys are conducted they will include archaeological input at the planning stage so that archaeological considerations can be taken into account.

12.2.2. This input will take the form of advice from an appropriately qualified archaeologist on measures to optimise archaeological results from the planned survey, including:

- Available details of those areas of potential identified during the desk-based assessment;
- Requirements for the archaeological description and sub-sampling of geotechnical cores and samples.

12.3. ARCHAEOLOGICAL USE OF GEOTECHNICAL DATA

12.3.1. A typical scheme of investigations for the archaeological use of geotechnical data is set out in **Appendix III**.

13. DIVER/ROV OBSTRUCTION SURVEYS

13.1. INTRODUCTION

13.1.1. Archaeological diver and/or ROV surveys can be employed in order to gather archaeological data concerning wreck sites and geophysical anomalies. This data may be used to enhance the archaeological record, or to alter (enlarge, reduce, move or remove) existing Exclusion Zones.

13.1.2. The only circumstances whereby diver/ROV surveys may be required for archaeological purposes are: where it is not possible to protect an archaeological site through the implementation of an Archaeological Exclusion Zone; or where visual clarification is sought in order to alter an Archaeological Exclusion Zone.

13.1.3. No diver or ROV survey data was assessed during the desk-based assessment phase of the project, If and when these are undertaken the archaeological requirements will be agreed following consultation with English Heritage and ECCHC. Outline archaeological requirements are presented in **Appendix IV**.

13.1.4. Data collected during pre-construction grapnel runs to clear the cable routes of obstructions will be reviewed after the event by an appropriately qualified archaeologist. This will include any video data and the location and nature of any obstructions encountered.

13.1.5. The results of this study will be reported to English Heritage and ECCHC.

14. FINDS REPORTING PROCEDURE

14.1. SCOPE

14.1.1. A Protocol for Reporting Finds of Archaeological Interest will address the reporting of finds of archaeological material, recovered from the intertidal and subtidal areas during the construction of the wind farms. A draft copy of the Protocol is included in **Appendix VI**, it will also be produced as a stand-alone document for use on-board the construction vessels.

14.1.2. The relevant staff on all construction vessels will be informed of the Protocol, details of the find types that may be of archaeological interest, and the potential importance of any archaeological material encountered.

14.1.3. Provision will be made by Gunfleet Sands Ltd, in accordance with the Protocol, for the prompt reporting/recording of archaeological remains encountered, or suspected during works to English Heritage and ECCHC. If the find is 'wreck' within the meaning of the Merchant Shipping Act (1996) then a report will also be made to the Receiver of Wreck. If the find is 'treasure' within the meaning of the Treasure Act (1996) then a report will also be made to the Coroner.

14.1.4. The response to reported finds is set out in the Protocol. At the end of the construction phase a report will be prepared on the results of the Protocol.

15. REPORTING AND ARCHIVING

15.1.1. As stated in each section above, each element of work will give rise to a note or a report. As indicated, upon completion of construction a final archaeological report will also be prepared to synthesise the results of the various investigations. The final archaeological report will address the following themes:

- Maritime sites and finds;
- Palaeo-geography and prehistoric archaeology.

15.1.2. If significant archaeological sites and finds are recorded then this final report will be preceded by an assessment report that establishes the value of the recorded archaeology and provides a costing for analysis, publication and archiving (including deposition of archive). Decisions regarding the level of publication required will be taken following consultation with English Heritage and ECCHC.

15.1.3. For the offshore components of the project the final archaeological report should be archived with the NMR. An OASIS form will, if possible, be produced for the whole project, and all copies of any reports generated (e.g. geophysical, and geotechnical data analysis) should be attached as data files. A hard copy of the final archaeological report and notification of the completion of the OASIS form will also be sent to the most appropriate local HER.

16. REFERENCES

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Wessex Archaeology, 2002, 'Gunfleet Sands Offshore Wind Farm, Archaeological Assessment: Technical Report'. Unpublished report. Ref: 51167.02.

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APPENDIX I: EXCLUSION ZONES FOR KNOWN WRECKS, POSSIBLE WRECKS AND GEOPHYSICAL ANOMALIES

Highlighted Exclusion Zones are those subject to review in June 2008.

WA ID	STATUS	UTM31 E	UTM31 N	NAME/TYPE	DESCRIPTION	SOURCE
7001	75m Archaeological Exclusion Zone	377195	5735375	*Ability*	293 tonne mined British motor barge, broken up and lying in a trough in an undulating seabed. Sunk 1940. Recorded by the UKHO as Foul Ground.	UKHO 14424; NMR 908085; **WA 2010**
7002	Exclusion Zone removed after data review	377121	5735052	Possible Wreck	Not detected in 2008 data.	**WA 3031**
7003	75m Archaeological Exclusion Zone	376777	5735934	Geophysical Anomaly	Small hard reflector 5x3m. Possible debris or geological feature.	**WA 3029**
7004	75m Archaeological Exclusion Zone	377000	5735037	Geophysical Anomaly	Small hard reflector with height 3x3x0.3m. Possible piece of debris or geological feature.	**WA 3030**
7005	75m Archaeological Exclusion Zone	377676	5733074	Possible Wreck	Wreck, probable barge. Large boat shaped hard reflector with height 30x7x0.3m.	**WA 3004**
7006	75m Archaeological Exclusion Zone	377644	5733170	Possible Wreck	Wreck of a possible sailing boat. Hard boat shaped reflector with height 25x5x1.5m.	**WA 3008**
7007	75m Archaeological Exclusion Zone	376290	5733438	Possible Wreck	Possible small wreck or geological feature. Hard rectangular reflector with surrounding disturbed seabed 8x4m.	**WA 3027**
7008	75m Archaeological Exclusion Zone	376892	5732934	Possible Wreck	Probable wreck, possible 19th century barge. Blunt stern boat shape with pointy bow 14x7m.	**WA 3009**

WA ID	STATUS	UTM31 E	UTM31 N	NAME/TYPE	DESCRIPTION	SOURCE
7009	75m Archaeological Exclusion Zone	376237	5732002	Possible Wreck	Possible wreck. Magnetic anomaly and sub-bottom contact 4.03m depth from seabed. Alongside 2m long object.	RPS 316; Magnetic Anomaly No.s M85 and M86; Sub Bottom Target No. G1-121
7010	75m Archaeological Exclusion Zone	376938	5732826	Geophysical Anomaly	Probable geological feature. Dashed hard reflectors 85x4m.	**WA 3006**
7011	75m Archaeological Exclusion Zone	377216	5732899	Geophysical Anomaly	Area of scarring indicated by linear medium reflectors 35x10m and possible debris or geological feature indicated by area of disturbed seabed 25x25m.	**WA 3007; WA 3005**
7012	75m Archaeological Exclusion Zone	375262	5731238	Geophysical Anomaly	Magnetic Anomaly. Nothing observed on SSS	RPS 310; Magnetic Anomaly No. M78.
7013	Archaeological Exclusion Zone reduced to 25m after data review	374975	5732257	Geophysical Anomaly	Probable debris. Linear dark reflector 5.0x0.1m with object with height at end 1.8x0.5x0.1m.	**WA 3019; WA6000**
7014	Exclusion Zone removed after data review	376200	5731277	Geophysical Anomaly	Not detected in 2008 data but the original anomaly was a magnetic contact that may indicate buried remains.	RPS 315; Magnetic Anomaly No. M84
7015	75m Archaeological Exclusion Zone	376081	5731477	Geophysical Anomaly	Minor debris	RPS 314; Magnetic Anomaly No. M83
7016	75m Archaeological Exclusion Zone	375741	5731498	Geophysical Anomaly	2m long object	RPS 313; Magnetic Anomaly No. M82
7017	75m Archaeological Exclusion Zone	375527	5731494	Geophysical Anomaly	Minor Debris. Sub Bottom contact 4.24m depth from seabed.	RPS 312; Magnetic Anomaly No. M80; Sub Bottom Target No. G1-128

WA ID	STATUS	UTM31 E	UTM31 N	NAME/TYPE	DESCRIPTION	SOURCE
7018	75m Archaeological Exclusion Zone	375466	5731568	Geophysical Anomaly	Nothing observed on SSS. Sub Bottom contact 3.69m depth from seabed.	RPS 311; Magnetic Anomaly No. M79; Sub-Bottom Target No. G1-117.
7019	75m Archaeological Exclusion Zone	376502	5732592	Geophysical Anomaly	Possible partially buried debris or geological feature indicated by small hard reflective patch 3x3m and possible debris or geological feature indicated by linear hard reflector on uniform seabed 5x2m.	**WA 3021; WA 3022**
7020	75m Archaeological Exclusion Zone	376105	5733225	Geophysical Anomaly	Probable geological feature. 2 small hard reflectors 2x2m.	**WA 3001**
7021	75m Archaeological Exclusion Zone	376301	5731855	Geophysical Anomaly	Minor Debris.	RPS 318; Magnetic Anomaly No. M87
7022	75m Archaeological Exclusion Zone	376379	5732064	Geophysical Anomaly	Magnetic Anomaly. Nothing Observed on SSS.	RPS 319; Magnetic Anomaly No. M88
7023	Removal of Exclusion Zone recommended – no curatorial response	376696	5732805	Geophysical Anomaly	Two small dark reflectors, individually measuring 1.1x0.3m and 0.3x0.3m. Possible debris or geological feature.	**WA 3020; WA 6001**
7024	75m Archaeological Exclusion Zone, moved after data review	376592	5733120	Geophysical Anomaly	Area containing several dark reflectors, some with height. 22.7x21.4m. Possible debris.	**WA 3003; WA 6002**
7025	75m Archaeological Exclusion Zone	377137	5733123	Geophysical Anomaly	Possible metal debris. Hard reflector near a mag anomaly 3x3m.	**WA 3010**

WA ID	STATUS	UTM31 E	UTM31 N	NAME/TYPE	DESCRIPTION	SOURCE
7026	75m Archaeological Exclusion Zone	377373	5732788	Geophysical Anomaly	Possible geological feature. Medium hard rectangular reflector, seen on 1 line only 15x5m.	**WA 3026**
7027	75m Archaeological Exclusion Zone	377425	5732623	Geophysical Anomaly	Possible geological feature or debris cluster indicated by hard reflectors associated with mag anomaly.	**WA 3016**; RPS 320; RPS 321; Magnetic Anomaly No.s M92 and M93; SSS Target IDs S132 and S134.
7028	Removal of Exclusion Zone recommended – no curatorial response	-	-	Geophysical Anomaly	Two items of debris connected by a linear feature, possibly a rope 58.1x1.2m. Non-archaeological.	**WA3015; WA 6003**
7029	75m Archaeological Exclusion Zone	377343	5733081	Geophysical Anomaly	Possible metal debris or geological feature. Hard reflector associated with mag anomaly 3x3m.	**WA 3023**
7030	75m Archaeological Exclusion Zone	377156	5733494	Geophysical Anomaly	Probable debris area or geological feature. Area with scattered hard reflectors 25x20m.	**WA 3002**
7031	75m Archaeological Exclusion Zone	377329	5734054	Geophysical Anomaly	Possible geological feature or large buried debris. High reflectivity area with associated mag anomaly 12x10m.	**WA 3017**
7032	75m Archaeological Exclusion Zone	377610	5733315	Geophysical Anomaly	Possible metal debris. Hard reflector near a mag anomaly 3x3m.	**WA 3012**
7033	Exclusion Zone removed after data review	377519	5733267	Geophysical Anomaly	Not seen in the sidescan data but the original site included a magnetic contact that may indicate buried remains.	**WA 3011**

WA ID	STATUS	UTM31 E	UTM31 N	NAME/TYPE	DESCRIPTION	SOURCE
7034	75m Archaeological Exclusion Zone	377937	5733526	Geophysical Anomaly	Possible geological feature or debris area. Area of disturbed seabed with hard reflectors 10x8m.	**WA 3024**
7035	Removal of Exclusion Zone recommended – no curatorial response	-	-	Geophysical Anomaly	Nothing seen in 2008 data review.	**WA 3018**
7036	75m Archaeological Exclusion Zone	378677	5734051	Geophysical Anomaly	Possible cluster of debris indicated by area of 3 hard linear reflectors 14x7m and possible large debris, or geological feature indicated by large medium reflector near mag anomaly 10x7m.	**WA 3013; WA 3014**
7037	75m Archaeological Exclusion Zone	379211	5733923	Geophysical Anomaly	Possible debris or geological feature. Indicated by area of small reflectors in alignment near mag anomaly 10x4m and 4 small hard reflectors in alignment near mag anomaly 10x3m.	**WA 3025**; **WA 3028**; RPS 322; Magnetic Anomaly No. M95; SSS Target ID S75
7038	75m Archaeological Exclusion Zone	379390	5733730	Geophysical Anomaly	One anomaly with nothing observed on SSS. Two 2m long objects.	RPS 323; RPS 324; RPS 325; Magnetic Anomaly No.s M97, M98 and M99
7039	Archaeological Exclusion Zone reduced to 20m after data review	379504	5733150	Geophysical Anomaly	Not detected but the original anomaly was a sub-bottom contact that may indicate buried remains.	Sub Bottom Target No. G2-2
7040	75m Archaeological Exclusion Zone	376601	5733599	Geophysical Anomaly	Debris.	RPS 309; Magnetic Anomaly No. M27
7041	Archaeological Exclusion Zone reduced to 10m after data review	377962	5732231	Geophysical Anomaly	Not detected but the original anomaly was a sub-bottom contact that may indicate buried remains.	Sub Bottom Target No. G2-1

WA ID	STATUS	UTM31 E	UTM31 N	NAME/TYPE	DESCRIPTION	SOURCE
7042	75m Archaeological Exclusion Zone	381840	5733904	Unidentified Wreck	Unidentified Wreck of unknown period.	UKHO 14809; NMR 802185; RPS 201
7043	Exclusion Zone removed after data review	380281	5733693	Unidentified Wreck	Not detected.	UKHO 14988; NMR 802173; **WA 2013**
7044	75m Archaeological Exclusion Zone	379824	5733055	Unidentified Wreck	Unidentified wreck, 30 m long, lying within its own scour.	UKHO 14409; NMR 802148; **WA 2017**; RPS 304; Magnetic Anomaly No. M101; SSS Target IDs S102 and S104.
7045	75m Archaeological Exclusion Zone	381200	5734163	Geophysical Anomaly	2m long object.	RPS 306; Magnetic Anomaly M104
7046	Exclusion Zone removed after data review	380979	5734030	Geophysical Anomaly	Not detected but the original anomaly consisted of a magnetic and sub-bottom contact that may indicate buried remains.	RPS 305; Magnetic Anomaly M102; Sub Bottom Target No. G2-3
7047	75m Archaeological Exclusion Zone	380776	5734059	Geophysical Anomaly	Minor Debris	RPS 301; RPS 302; Magnetic Anomaly No.s M14 and M15.
7048	75m Archaeological Exclusion Zone	381190	5733444	Geophysical Anomaly	Debris 2.55x0.3x1.2m.	SSS Target ID S82
7049	Archaeological Exclusion Zone reduced to 25m after data review	380940	5733463	Geophysical Anomaly	Not detected but curator wants the EZ retained.	SSS Target ID S81

WA ID	STATUS	UTM31 E	UTM31 N	NAME/TYPE	DESCRIPTION	SOURCE
7050	75m Archaeological Exclusion Zone	380388	5733088	Geophysical Anomaly	Debris 1.3x0.8x0.1m.	SSS Target ID S99
7051	75m Archaeological Exclusion Zone	380169	5733225	Geophysical Anomaly	Debris 5x1x0.6m.	SSS Target ID S89
7052	75m Archaeological Exclusion Zone	379977	5733125	Geophysical Anomaly	Debris 1.2x0.4x0.1m and 3x0.8x0.3m.	SSS Target IDs S94 and S98
7053	75m Archaeological Exclusion Zone	379997	5732643	Geophysical Anomaly	Debris 3.1x0.5x0.2m.	SSS Target ID S131
7054	75m Archaeological Exclusion Zone	379836	5732571	Geophysical Anomaly	Area of debris 8x4m.	SSS Target ID S136
7055	75m Archaeological Exclusion Zone	379487	5732370	Geophysical Anomaly	Debris 0.8x0.5x0.1m and 1x0.5x0.2m.	SSS Target IDs S146 and S147
7056	75m Archaeological Exclusion Zone	378995	5732570	Geophysical Anomaly	Debris 1.3x0.9x0.1m.	SSS Target ID S137
7057	75m Archaeological Exclusion Zone	379185	5732262	Geophysical Anomaly	Debris 1x0.3x0.2m and 1.6x0.7x0.1m.	SSS Target IDs S148 and S150

WA ID	STATUS	UTM31 E	UTM31 N	NAME/TYPE	DESCRIPTION	SOURCE
7058	Removal of Exclusion Zone recommended – no curatorial response	-	-	Geophysical Anomaly	Not detected.	SSS Target ID S155
7059	Exclusion Zone removed after data review	378950	5732209	Geophysical Anomaly	Hard reflector 3.5x0.9m in an area containing many such small features. Probably geological.	SSS Target ID S151; **WA 6004**
7060	75m Archaeological Exclusion Zone	378394	5732114	Geophysical Anomaly	Debris 2x1x0.2m.	SSS Target ID S153
7061	75m Archaeological Exclusion Zone	377884	5732021	Geophysical Anomaly	Sub bottom contact 1.27m depth from seabed.	Sub Bottom Target No.G2-6
7062	75m Archaeological Exclusion Zone	377737	5731714	Geophysical Anomaly	Debris 4.5x0.8x0.3m. Sub bottom contact 1.75m depth from seabed.	SSS Target ID S159; Sub Bottom Target No. G2-10
7063	Removal of Exclusion Zone recommended – no curatorial response	-	-	Geophysical Anomaly	Not detected.	SSS Target ID S161
7064	75m Archaeological Exclusion Zone	377395	5731500	Geophysical Anomaly	Sub bottom contact 1.68m depth from seabed.	Sub Bottom Target No. G2-9
7065	75m Archaeological Exclusion Zone	376776	5731227	Geophysical Anomaly	Sub bottom contact 1.31m depth from seabed.	Sub Bottom Target No. G2-8

WA ID	STATUS	UTM31 E	UTM31 N	NAME/TYPE	DESCRIPTION	SOURCE
7066	Exclusion Zone removed after data review	376653	5731006	Geophysical Anomaly	Not detected but the original anomaly was a sub-bottom contact that may indicate buried remains.	Sub Bottom Target No. G2-11
7067	75m Archaeological Exclusion Zone	376631	5730550	Geophysical Anomaly	2m long object.	RPS 303; Magnetic Anomaly No. M100
7068	75m Archaeological Exclusion Zone	376221	5730938	Geophysical Anomaly	Sub bottom contact 1.61m depth from seabed.	Sub Bottom Target No. G2-7
7069	75m Archaeological Exclusion Zone	375964	5730946	Geophysical Anomaly	Sub bottom contact 3.8m depth from seabed.	Sub Bottom Target No. G2-4
7070	Archaeological Exclusion Zone reduced to 25m after data review	375972	5730601	Geophysical Anomaly	Not detected but curator wants the EZ retained.	SSS Target ID S162
7071	75m Archaeological Exclusion Zone	374714	5732809	*Tam O Shanter* (part)	British barge wire swept in 1959, but not located since 1974.	UKHO 14403; **WA 2021**
7072	75m Archaeological Exclusion Zone	374478	5732598	*Tam O Shanter* (part)	British barge wire swept in 1959, but not located since 1974.	UKHO 14402; **WA 2022**
7073	75m Archaeological Exclusion Zone	374418	5732445	Piper Cherokee G-BBIE	Aircraft ran short of fuel and ditched, with four people on board.	UKHO 14400; **WA 2023**
7074	75m Archaeological Exclusion Zone	375652	5733496	Unidentified Wreck	Unidentified wreck, 25 m long, almost completely buried in a sandbank.	UKHO 14905; NMR 802159; **WA 2016**

WA ID	STATUS	UTM31 E	UTM31 N	NAME/TYPE	DESCRIPTION	SOURCE
7075	75m Archaeological Exclusion Zone	379555	5733835	Unidentified Wreck	Large unidentified wreck (50 m), with mast showing at high water, lying on slightly sloping seabed adjacent to a deep scour.	UKHO 14415; NMR 859184; **WA 2011**
7076	75m Archaeological Exclusion Zone	380015	5733793	Unidentified Wreck	50 m long wreck, wire swept clear to 3.5 m depth.	UKHO 14986; NMR 802179; WA 2012
7077	75m Archaeological Exclusion Zone	379701	5733490	Unidentified Wreck	Unidentified wreck, 35.1 m long.	UKHO 14985; NMR 802166; **WA 2015**
7078	75m Archaeological Exclusion Zone	379665	5733615	Unidentified Wreck	Unidentified wreck, 40 m long, with magnetic signal.	UKHO 14984; NMR 802170; **WA 2014**
7079	75m Archaeological Exclusion Zone	374404	5731889	Possible Wreck	Undefined seabed feature.	UKHO 14397; **WA 2024**
7080	75m Archaeological Exclusion Zone	375101	5731118	Geophysical Anomaly	Magnetic Anomaly. No data.	RPS 326; Magnetic Anomaly No. M105

APPENDIX II: ARCHAEOLOGICAL INPUT INTO FURTHER MARINE GEOPHYSICAL SURVEYS

Further surveys should be informed by such archaeological desk-based information as is available at the time of the survey. In designing the survey consideration should be given to specifications (e.g. line spacing and equipment used) to ensure the adequate detection of archaeological material.

Surveys should be carried out to a single datum and co-ordinate system, such as WGS84 UTM. All survey data – including navigation (position, heading and velocity) – should be acquired digitally in industry-standard formats. Care should be taken to maintain the orientation and attitude of sensors on line. Track-plots should be corrected for layback (including catenary effects) and made available in digital (GIS) form.

Once the surveys have been processed to meet their primary objectives, the survey data – together with factual reports – should be made available in digital formats to an appropriately qualified marine archaeologist for archaeological analysis and interpretation.

Sidescan sonar survey should be carried out at frequency, range and gain settings capable of resolving all objects that are 0.5m and above throughout the survey area. Preferably, line spacing should be equal to or less than the effective range, and no more than 1.75x the effective range. Where the sites and anomalies listed in Section 3 above fall with or close to the scheme impacts they should be 'boxed' by at least two and preferably four lines along and across the principal axis of the anomaly. These lines should be offset so that the anomaly does not lie immediately beneath the fish, and run at optimal frequency and range settings for imaging the anomaly. For archaeological purposes, true sidescan is preferable to multibeam pseudo-sidescan. Sidescan sonar data should be made available in the form of raw, un-mosaiced files in a suitable proprietary format.

Magnetometer survey should be carried out using a caesium gas or equivalent system capable of resolving anomalies of 5 nanoTeslas and above. Lines can be run in conjunction with other sensors (i.e. on the same line spacings and orientations) but provision should be made to run additional lines and cross-lines across the sites and anomalies listed in Section 3 above. Magnetometer data should be made available as cleaned, de-spiked text (x,y,z) files for each line, including layback.

Sub-bottom survey should be carried out using a source capable of resolving internal structures to the full depth of anticipated scheme impacts within Quaternary deposits. Line and cross-line spacings and orientations should be sufficient to resolve the extents and characteristics of the principal Quaternary deposits. A single beam echosounder should be run in conjunction with the sub-bottom survey; the first reflector (seabed) should be levelled with reference to a tide gauge. Sub-bottom data should be made available in a suitable proprietary format.

Multibeam survey should be carried out using a system capable of achieving an effective cell/bin size better than 1m. Use of a beam-forming system is preferred. Where an anomaly of apparent archaeological potential is identified, an additional single slow pass should be carried out at the highest possible ping rate. Single beam and multibeam data should be made available as de-spiked and tidally-corrected text (x,y,z) files for each line, in addition to any gridded/rendered surfaces.

APPENDIX III: GEOTECHNICAL ASSESSMENT STAGES

The archaeological analysis of the geotechnical data will occur in a number of stages to produce a Quaternary deposit model from which areas of archaeological potential can be identified. These are as follows:

Stage 1: Planning
Desk-based archaeological assessment of core logs generated by geotechnical contractors. This assessment will establish the likely presence of horizons of archaeological interest and broadly characterise them, as a basis for deciding what Stage 2 archaeological recording is required. The Stage 1 report will state the scale of Stage 2 work proposed.

Stage 2: Coring and Recording
Archaeological recording of selected retained or new cores. This will entail the splitting of the cores, with half of each core being cleaned and recorded. The Stage 2 report will state the results of the archaeological recording and will indicate whether any Stage 3 work is warranted.

Stage 3: Sampling and Assessment
Sub-sampling and palaeo-environmental assessment (pollen, diatoms and foraminifera). Sub-samples will be taken from one core-half, with the other core-half retained intact should further sub-sampling be required. Assessment will comprise laboratory analysis of the samples to a level sufficient to enable the value of the palaeo-environmental material surviving within the cores to be identified. Sub-samples will also be taken and retained at this stage in case radiocarbon dating is required during Stage 4. The Stage 3 report will set out the results of each laboratory assessment together with an outline of the archaeological implications of the combined results, and will indicate whether any Stage 4 work is warranted.

Stage 4: Analysis and Dating
Full analysis of pollen, diatoms and/or foraminifera assessed during Stage 3. Typically, Stage 4 will be supported by radiocarbon dating of suitable sub-samples. Stage 4 will result in an account of the successive environments within the coring area, a model of environmental change over time, and an outline of the archaeological implications of the analysis.

Reporting
If the archaeological results are sufficiently significant so as to warrant it, a final report covering all aspects of the palaeo-topography and prehistory of the area affected by the development will be compiled after the last phase of analysis. If the archaeological results are less significant then the relevant Stage Reports will constitute the final documents on the geotechnical work.

If required, the final report will include relevant data generated by the desk-based assessment, and if undertaken the foreshore coring and terrestrial watching brief. It will include a full assessment of the available seismic data, undertaken in order to place the results of the core recording and analysis within the context of the broad pattern of deposits within the area.

APPENDIX IV: ARCHAEOLOGICAL INPUT INTO DIVER/ROV SURVEYS

Diver/ROV surveys may be undertaken primarily for archaeological purposes by an appropriately qualified marine archaeologist. In such cases, planning for the survey should follow normal archaeological procedures.

Any diver/ROV surveys undertaken primarily for engineering, ecological or other non-archaeological purposes should include archaeological input at the planning stage so that archaeological considerations can be taken into account.

For diver/ROV surveys archaeological input will take the form of advice from an appropriately qualified marine archaeologist on measures to optimise archaeological results from the planned survey, including:

- Available details of sites and/or anomalies identified in the desk-based assessment;
- Archaeological potential of areas where no existing sites and/or anomalies are yet known;
- Type and level of diver/ROV positioning, voice recording and video/still recording;
- Clear guidance on the types of sites and finds that are to be reported and recorded.

Consideration should be given to having an archaeologist (or archaeological team) present during any diver or ROV surveys, either as an observer(s) or participating diver(s) to optimise archaeological results and thereby reduce the need for repeat survey.

REVIEW OF DATA COLLECTED BY DIVER/ROV SURVEYS

Following the completion of the diver/ROV survey all data, including video footage will be reviewed by an appropriately qualified archaeologist.

This review will identify any sites that are potentially of archaeological interest – typically this will involve the identification of vessel remains, rather than just stray artefacts. The report will identify those sites and/or geophysical anomalies that are of sufficient archaeological interest to warrant further investigation. It will also identify those sites that are no longer of archaeological interest, and hence may be removed from the list of Archaeological Exclusion Zones.

This phase of work will constitute a Level 1 Archaeological Wreck Record (see **Appendix V**).

ARCHAEOLOGICAL SITE ASSESSMENT

If the review of data collected by diver/ROV survey identifies any sites of archaeological interest that will be subject to impact during construction then Gunfleet Sands Ltd will consult with English Heritage and ECCHC to determine if a Level 2 Archaeological Wreck Survey (see **Appendix V**) will be required.

A Level 2 Archaeological Wreck Survey will involve in the order of two to four dives on each site by suitably experienced archaeologists. Recording will be conducted to a level whereby a statement can be made as to the date, character, extent and archaeological importance of the site. Typically this will include a sketch plan of the site supported by key measurements and accurate positional information. Significant diagnostic features will be recorded by photography backed up with written records and measurements. Limited documentary research may also be required to support the assessment of importance.

The archaeological results of any diver/ROV survey will be compiled in a report, which will also include a statement of the likely requirements (if any) for further archaeological work.

APPENDIX V: ARCHAEOLOGICAL WRECK RECORDING LEVELS

Level	Type	Objective	Sub-level	Character	Scope	Description
1	Assessment	A record sufficient to establish the presence, position and type of site.	1a	Indirect (desk-based)	A basic record based on documentary, cartographic or graphic sources, including photographic (incl. AP), geotechnical and geophysical surveys commissioned for purposes other than archaeology.	Documentary assessment / inventory of a site, compiled at the start of work on a site, and updated as work progresses.
			1b	Direct (field)	A basic record based on field observation, walkover survey, diving inspection etc., including surveys commissioned specifically for archaeological purposes.	Typically a 1-2 dive visit to the site (to assess a geophysical anomaly, etc.).
2	Evaluation	A record that provides sufficient data to establish the extent, character, date and importance of the site.	2a	Non-intrusive	A limited record based on investigations that might include light cleaning, probing and spot sampling, but without bulk removal of plant growth, soil, debris etc.	Typically a 2-4 dive visit to assess the site's archaeological potential, backed up by a sketch plan of the site with some key measurements included.
			2b	Intrusive	A limited record based on investigations including vigorous cleaning, test pits and/or trenches. May also include recovery (following recording) of elements at immediate risk, or disturbed by investigation.	Either an assessment of the buried remains present on a site; the recovery of surface artefacts; or cleaning to inform for example a 2a investigation.
3	In situ	A record that enables an archaeologist who has not seen the site to comprehend its components, layout and sequences.	3a	Diagnostic	A detailed record of selected elements of the site.	The first stage of a full record of the site. This would include a full measured sketch of the site and a database (or equivalent) entry for all surface artefacts.
			3b	Unexcavated	A detailed record of all elements of the site visible without excavation.	Full site plan (i.e. planning frame or equivalent accuracy) with individual object drawings, and full photo record (possibly including a mosaic).
			3c	Excavated	A detailed record of all elements of the site exposed by open excavation of part or whole of the site.	This may take the form of full or partial excavation of a site.

Level	Type	Objective	Sub-level	Character	Scope	Description
4	**Removal**	A record sufficient to enable analytical reconstruction and/or reinterpretation of the site, its components and its matrix.			A complete record of all elements of the site in the course of dismantling and/or excavation.	
5	**Intra-site**	A record that places the site in the context of its landscape and other comparable sites.			A complete record of all elements of the site, combined with selective recording of comparable sites and investigation of the surrounding area.	…

Note: these levels represent guidance formulated by Wessex Archaeology for use during the archaeological investigation of wreck sites. They are currently used by English Heritage, but have not been formally accepted as a standard means of grading archaeological work.

APPENDIX VI: PROTOCOL FOR REPORTING FINDS OF ARCHAEOLOGICAL INTEREST

PURPOSE OF THE PROTOCOL

This document sets out the procedure for reporting discoveries of potential archaeological interest made during the course of installation work on the Gunfleet Sands 1 and 2 Offshore Wind Farms, including the submarine export cables.

The aim of the Protocol is to reduce any adverse effects of the development upon the historic environment by enabling people working on the project to report their finds in a manner that is both convenient to their every-day work and effective with regard to curatorial requirements.

The archaeological finds made by installation workers are important because they shed light on past human use of the landscape, sea and seabed. The information that such discoveries bring to light can help archaeologists to better understand what happened in times past, and therefore to better protect those aspects of our history that should be conserved on behalf of future generations.

CIRCUMSTANCES OF DISCOVERY

This Protocol addresses finds of archaeological interest made on the seabed, based on an assessment of the working practices involved in cable installation. These anomalies, such as resistance encountered during cable laying or contact on forward-looking sonar (if used), may indicate that an object or structure of archaeological interest has been encountered on the seabed.

SCOPE OF THE PROTOCOL

Note: Contact details, including all nominated contacts, of companies contracted by Gunfleet Sands Ltd. to undertake the installation of the Gunfleet Sands 1 and 2 offshore wind farms, inter-array and submarine export cables will be circulated once contracts have been finalised.

It is understood that Gunfleet Sands Ltd. will contract an individual or company to provide archaeological consultancy and to report as appropriate to Gunfleet Sands Ltd., English Heritage and ECCHC.

This protocol only applies to operations undertaken offshore.

MONITORING THE PROTOCOL

At the end of the installation phase the archaeological consultant shall submit a brief report on the implementation of the Protocol to Gunfleet Sands Ltd, English Heritage and ECCHC. The report shall also include an account of areas from which no reports have been made during the course of the installation. If no anomalies are found the report may simply consist of short correspondence detailing that the protocol was implemented and nothing has come to light.

GUNFLEET SANDS 1 AND 2 OFFSHORE WIND FARMS

PROTOCOL FOR REPORTING DISCOVERIES OF ARCHAEOLOGICAL INTEREST

INTRODUCTION

The Protocol has been designed to deal with discoveries made on the seabed during cable installation. A series of actions is defined for such cases. All actions will result from remote sensing as no material is recovered to the surface in the course of cable installation operations.

The Protocol anticipates discoveries being made by Staff (Plough/ROV Superintendent), who report to a Site Representative (Onboard Engineer in Chief) on their vessel, who then reports to Gunfleet Sands Ltd. Gunfleet Sands Ltd. will liase with the archaeological consultant and the relevant cable installation contractor. The archaeological consultant will ultimately prepare a report on the protocol suitable for submission to the English Heritage and ECCHC.

TERMS AND ROLES

On the vessel the person responsible for reporting anomalies will be the Onboard Engineer in Chief (EIC) in liaison with the vessel Captain. Anomalies will be brought to the attention of the EIC by the ROV/Plough Superintendent.

The archaeological consultant will be engaged by Gunfleet Sands Ltd to provide specialist advice and technical support services relating to the mitigation of the impacts of the scheme on the historic environment.

Gunfleet Sands Ltd shall draw the attention of all relevant contractors to the potential for archaeological material to be found in the course of installation and inform them of the possible importance of such finds.

Copies of this Protocol will be available onboard the installation vessel.

OPERATIONAL ACTIVITIES

The action of laying the Gunfleet Sands 1 and 2 Offshore Wind Farms submarine cables will be carried out using one of three methods: ploughing, trenching of jetting.

LEGAL IMPLICATIONS

It should be noted that if the wreck of an aircraft is encountered it is automatically protected as a protected place under the terms of the Protection of Military Remains Act (1986) and it is an offence to tamper with, damage, move or remove items.

DISCOVERIES ON THE SEABED

Tell the EIC

If an anomaly is identified by the forward looking obstacle avoidance sonar (if used), or if the towing cable tensiometer indicates that an object or structure has been encountered on the seabed, the Plough/ROV Superintendent shall inform the EIC.

If an anomaly is identified on the forward looking sonar on the plough (if used), the route will be deviated around the obstruction, in line with normal practise and the location of the anomaly identified and reported to the EIC.

If an anomaly is identified by a change in the tension it is understood that any impact will already have occurred and no deviation is possible. However, the change in tension should be brought to the attention of the EIC so that advice can be sought and any requirements for further investigation determined.

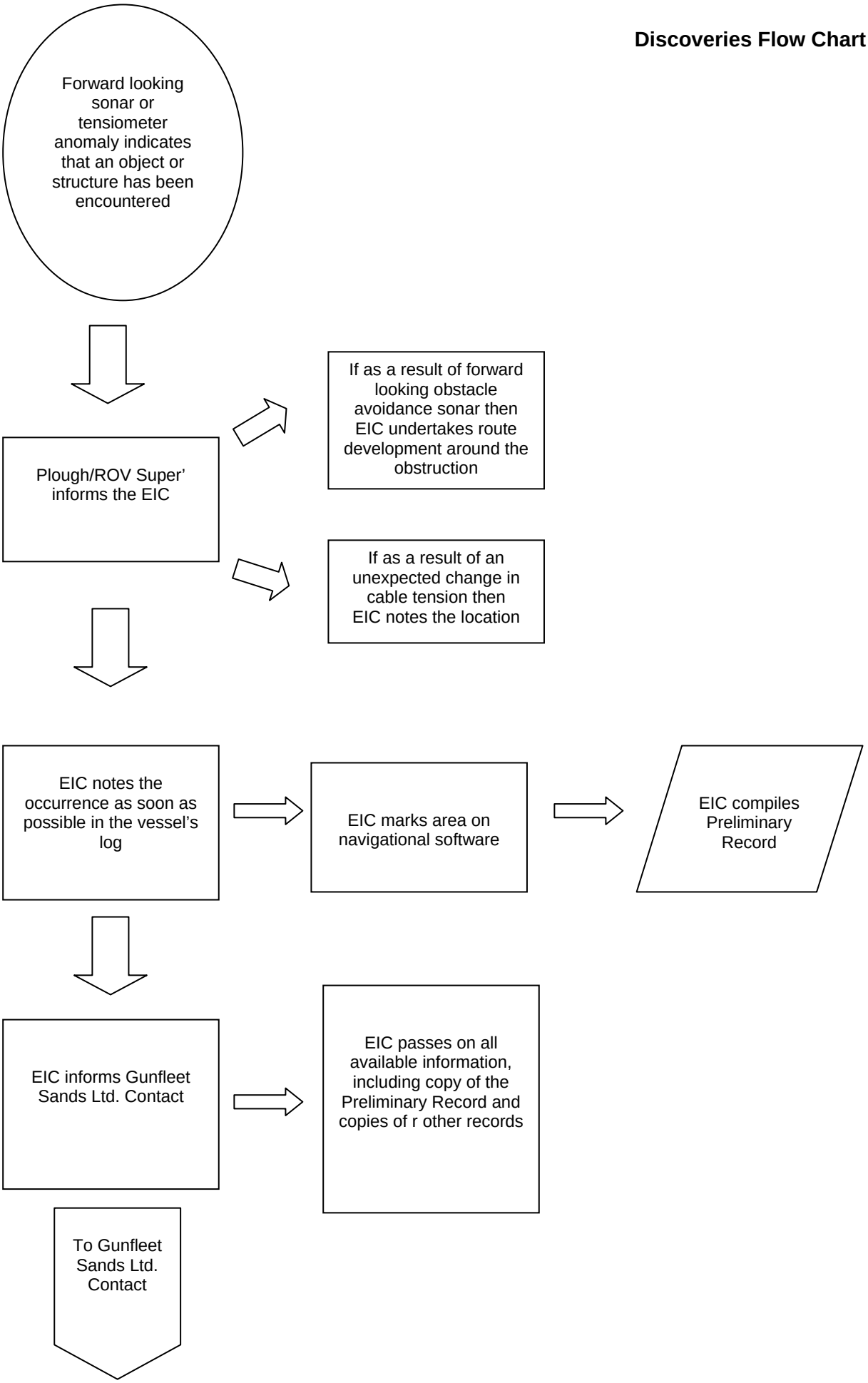
ACTIONS BY THE EIC

The EIC shall note the occurrence as soon as possible in the vessel's log together with the time and seabed position. The log entry should include a close approximation of the original position of the anomaly on the seabed. Additionally, the area shall be tagged or noted within navigational software.

A preliminary record of the occurrence will be compiled on the construction vessel. A sample form for this is presented in **Appendix VII**.

The EIC shall inform Gunfleet Sands Ltd of the occurrence as soon as possible and pass on all available information, including a copy of the Preliminary Record and copies of any other records that have been made.

Discoveries Flow Chart



ACTIONS BY GUNFLEET SANDS LTD CONTACT

Inform the Archaeological Contractor

Once informed of a find by the EIC, Gunfleet Sands Ltd shall inform the archaeological consultant as soon as possible so that advice can be sought.

Gunfleet Sands Ltd will confirm with the EIC that all the details set out in the Preliminary Record are comprehensive and correct. Gunfleet Sands Ltd shall pass on to the archaeological consultant all available information relating to the circumstances of the occurrence, including a copy of the Preliminary Record and copies of any other records that have been made.

ROUTE DEVIATION

Where the position of an anomaly or find is reasonably certain, Gunfleet Sands Ltd shall confirm the extent of any route deviation around the area of the anomaly and archaeological advice will be obtained.

Instigate Review of Route Survey Geophysical Data

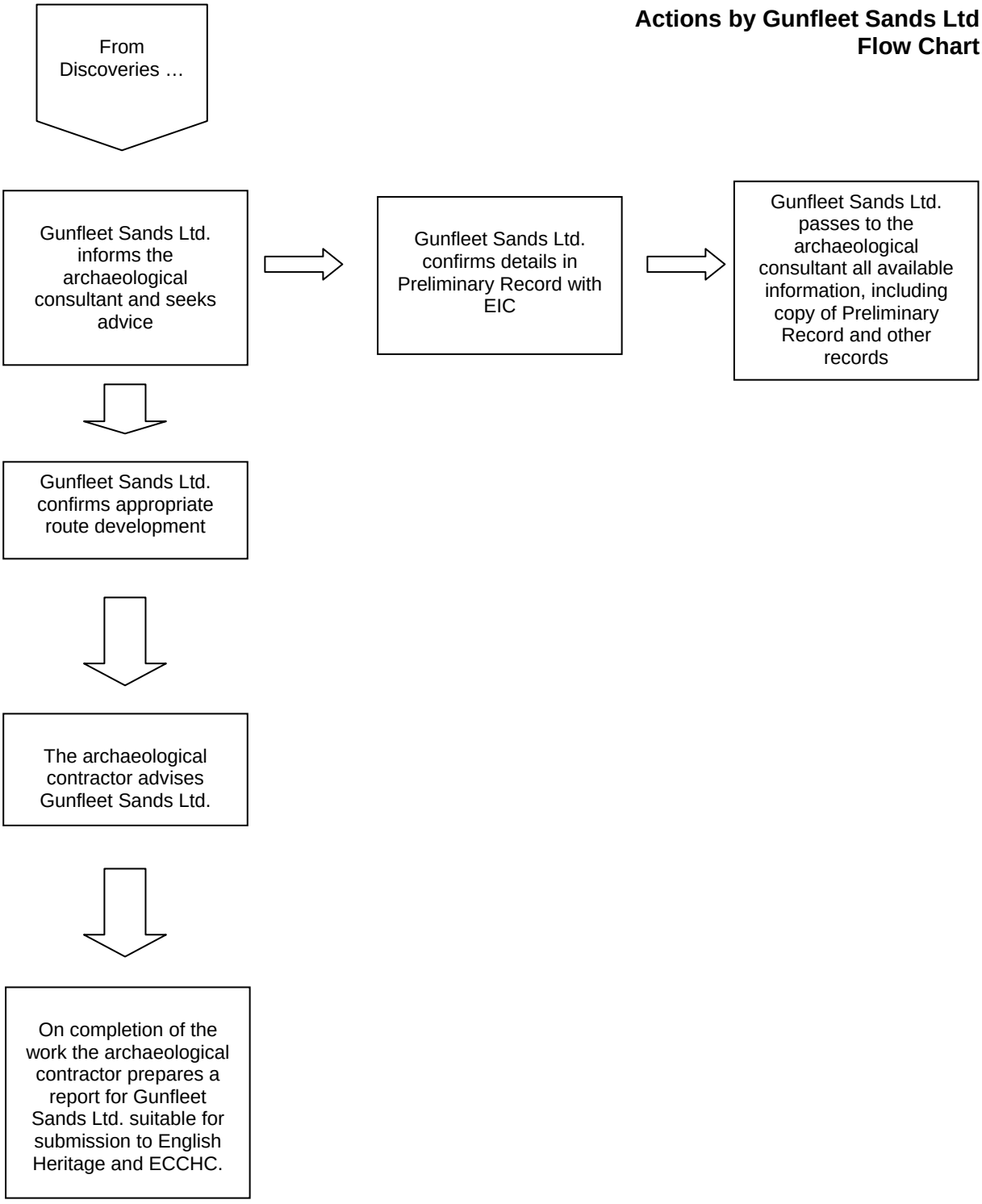
Gunfleet Sands Ltd shall arrange for the archaeological consultant to review the geophysical data to see if there is any evidence of an anomaly and to advise on its possible character.

Action by the Archaeological Consultant

Once contacted, information has been passed on and the archaeological consultant has been instructed, the archaeological consultant shall review all information relating to the occurrence in conjunction with geophysical and/or desk based information. The archaeological consultant will advise Gunfleet Sands Ltd. of any implications of the occurrence for the historic environment and on any further actions that might be required.

On completion of the work to which the protocol applies the archaeological consultant will prepare a report to Gunfleet Sands Ltd that can be submitted to English Heritage and ECCHC.

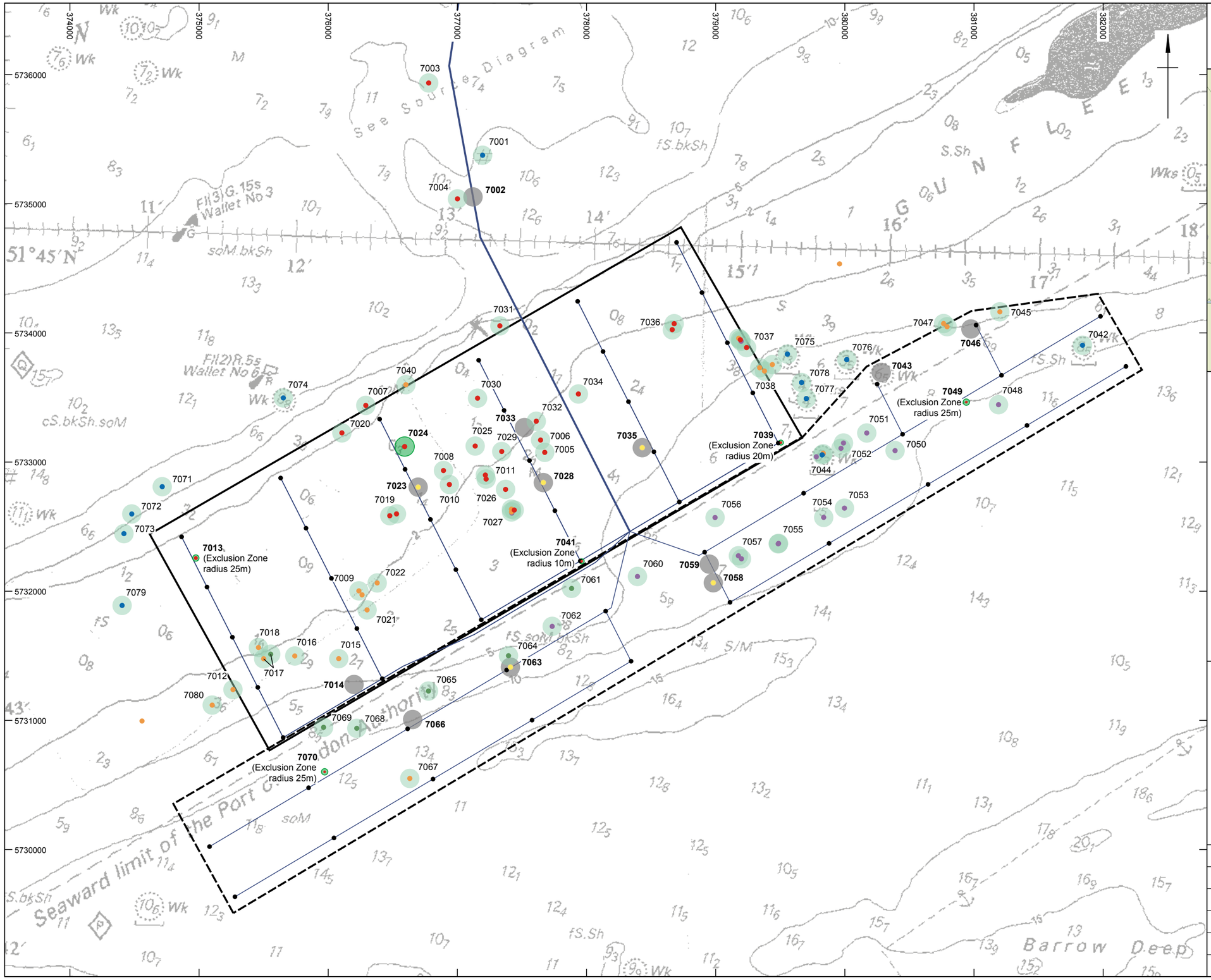
Actions by Gunfleet Sands Ltd
Flow Chart



APPENDIX VII: DISCOVERIES ON THE SEABED: PRELIMINARY RECORDING FORM

Discoveries on the Seabed: Preliminary Record

Date:	Name of Report Compiler:	Contact details:
Vessel Name:	Cable Name and Sea Area:	Name of Site Representative:
Name of Master/Officer of the Watch:	Name of Finder (if different from Officer of the Watch):	Time that anomaly was encountered:
Vessel position at time when the anomaly was encountered (KP):		
Latitude:	Longitude:	Datum (if different from WGS84):
Notes on position given: How accurate is the position given above? Is the position the original position of the anomaly on the seabed or have operations moved the material some distance from its original location?		
Description of the anomaly: Derived from Obstacle Avoidance Sonar or Cable Tensiometer?		
Apparent extent of anomaly: m long x m wide x m above general level of seabed:		
Extent of deviation and of route development:		
Date and time at which Contact was informed:	General notes:	



Wessex Archaeology



- Phase GS1
- Phase GS2
- Turbine location
- Turbine cables
- Cable route
- Archaeological Exclusion Zone
- Exclusion Zones reviewed and retained
- Exclusion Zones removed
- Removal of Exclusion Zones recommended
- Known wreck
- Geophysical anomaly GS1
- Magnetic Anomaly GSII
- Sub Bottom Anomaly GSII
- Side-scan anomaly GSII

0 1km

Admiralty Chart 1975 (dated 2001).
Drawing projection: UTM WGS84 zone 31N.

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Revised Exclusion Zone Plan

Figure 1