



Aggregate Dredging Licence Area 480

Archaeological Assessment of
Marine Geophysical Data

Pre-dredging Monitoring Report



AGGREGATE DREDGING LICENCE
AREA 480

ARCHAEOLOGICAL ASSESSMENT OF MARINE GEOPHYSICAL DATA
PRE-DREDGING MONITORING REPORT

Prepared for:

Hanson Aggregates Marine Ltd.
Burnley Wharf
Marine Parade
Southampton
Hampshire
SO14 5JF

By:

Wessex Archaeology Ltd.
Portway House
Old Sarum Park
Salisbury
SP4 6EB

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AGGREGATE DREDGING LICENCE

AREA 480

ARCHAEOLOGICAL ASSESSMENT OF MARINE GEOPHYSICAL DATA PRE-DREDGING MONITORING REPORT

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| Author(s): | Cristina Serra (Coastal & Marine Archaeologist/Geophysicist) |
| Managed by: | Paul Baggaley (Project and Technical Manager) |
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Summary

Wessex Archaeology Ltd has been commissioned by Hanson Marine Aggregate Ltd to undertake an archaeological assessment of marine geophysical data in view of a pre-dredging monitoring heritage review for aggregate dredging Licence Area 480. The marine geophysical survey area consisted of 21.89km² irregular polygon, orientated SW-NE and located 21km off the east coast of Lincolnshire.

The marine geophysical data consisted of sidescan sonar and bathymetry data acquired in 2008 in addition to sub-bottom profiler data acquired in 2000 and 2002. This report reviews the sites highlighted during Wessex Archaeology's 2003 desk-based assessment, suggests modifications, highlights new archaeological sites identified within the limits of the aggregate dredging Licence Area 480 and suggests mitigating measures.

Only one anomaly reported during the 2003 desk-based assessment lies within the limits of the aggregate dredging Licence Area 480. This anomaly was not re-identified during the assessment of 2008 marine geophysical data reviewed during this assessment. This is likely to be a combination of improved data quality aiding interpretations and sediment possibly covering the anomaly when the 2008 data were acquired. The assessment of 2008 sidescan sonar data resulted in the identification of six new sites of possible archaeological interest.

The archaeological assessment of 2000 and 2002 sub-bottom profiler data indicates a sequence of early, mid and late Devensian formations (glacial till and outwash) deposited over Cretaceous Chalk. Artefacts dating to Palaeolithic and Early Mesolithic Periods are unlikely but the existence of derived artefacts in secondary context cannot be precluded.

On the basis of the likely archaeological resource of the region and the sites identified in the sidescan sonar data, the suggested mitigation is as follows:

- Due to the nature and character of the six sites identified during this assessment no exclusion zones are proposed. Further investigation might clarify their origin, archaeological significance or even discriminate them as objects of natural or modern origin.
- Hanson Aggregate Marine Ltd applies the British Marine Aggregate Producers Association Marine Aggregate Dredging Protocol for reporting finds of archaeological interest.
- Appropriate training in the operation of the protocol should be given to vessel and wharf staff through material supplied as part of the Awareness Programme.
- Provision for archaeological involvement in any further benthic and geotechnical investigations in order to assert the potential survival of archaeological material and define the limits of their extent.

- Provision for post-dredging surveys to continue the monitoring of the effect of dredging on known sites and the potential exposure of sites of archaeological interest.

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Acknowledgements

This report was commissioned by Hanson Aggregate Marine Ltd. The marine geophysical data were acquired and supplied by EMU Ltd; Wessex Archaeology is grateful to the staff of these institutions for their co-operation.

Cristina Serra assessed the marine geophysical data and compiled the report. Kitty Brandon prepared the illustrations and the project was managed for Wessex Archaeology Ltd by Paul Baggaley. Quality assurance was undertaken for WA by Euan McNeill.

Data Usage and Copyright

Details of maritime sites were re-used from previous WA assessments and obtained from the National Monuments Record. The information supplied is © Crown copyright or © English Heritage copyright.

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1 INTRODUCTION

1.1 PROJECT BACKGROUND

- 1.1.1 Wessex Archaeology (WA) was commissioned by Hanson Aggregate Marine Limited (HAML) to carry out a pre-dredging archaeological assessment of marine geophysical data covering aggregate dredging Licence Area 480. This area is an irregular polygon orientated SW-NE and located approximately 21km off the east coast of Lincolnshire (**Figure 1**). The aggregate dredging Licence Area 480 covers approximately 9.89 km² of seafloor and is defined by the following coordinates:

| Node | Easting | Northing |
|------|---------|----------|
| A | 342564 | 5924216 |
| B | 342881 | 5923312 |
| C | 342557 | 5920711 |
| D | 340979 | 5917996 |
| E | 341972 | 5918042 |
| F | 342849 | 5918645 |
| G | 343276 | 5919171 |
| H | 343808 | 5919286 |
| I | 343916 | 5918250 |
| J | 343209 | 5917537 |
| K | 340415 | 5917093 |
| L | 339870 | 5915729 |
| M | 339373 | 5915563 |
| N | 342564 | 5924216 |

*Source: Crown Estate,
Datum: WGS 84 Projection: UTM Zone 31N*

- 1.1.2 The marine geophysical survey was collected in July 2008 by Emu Ltd and consisted of sidescan sonar and bathymetry data covering an irregular polygon nearly 22km² in size and buffering the dredging area.
- 1.1.3 In addition to the assessment of sidescan sonar and bathymetry data, HAML also commissioned the assessment of previous sub-bottom profiler (boomer) data

acquired in 2000 and 2002. The data covered the limits of the 2008 survey area in full.

- 1.1.4 In 2003 WA undertook a desk-based assessment (DBA) for the licence application concerning aggregate dredging Licence Area 480. The DBA defined a marine study area covering aggregate dredging Licence Area 480 and 1km buffer, approximately 69.7km² of seafloor was archaeologically assessed (WA 2003).
- 1.1.5 The DBA incorporated primary and secondary data sources including known and suspected archaeological sites obtained from numerous national archives in addition to sites identified during the interpretation of marine geophysical data. The reviewed material consisted of:
 - Records of terrestrial sites as well as wrecks, obstructions and casualties (documented losses) from English Heritage National Monuments Record (NMR) and Lincolnshire County Council.
 - Records held by the HM Receiver of Wreck (droits for wreck material recovered under the provisions of the Merchant Shipping Act 1995);
 - Records of wrecks and obstructions held by the UK Hydrographic Office (UKHO). These included known and named wreck losses, casualties and reported obstructions; Also, Review of cartography, historic charts and sailing directions held by UK Hydrographic Office.
 - A selective review of relevant published works relating to the palaeo-environment of the Southern North Sea (listed in the bibliography).
 - The geophysical dataset consisting of: sidescan sonar, sub-bottom profiler (boomer) and echo sounder data acquired by Gardline Surveys Ltd. in 2000. Sob-bottom profiler (boomer) data were [also collected by Andrews in 2002](#).

1.2 AIMS

- 1.2.1 The overall aim of this report is to provide HAML with an archaeological assessment of the seafloor from the marine geophysical data prior to dredging. The project aims to confirm or modify previous interpretations and to add any new sites that might be of archaeological interest. In order to maximise the available dredging area and minimise the impact upon submerged heritage this report highlights sensitive areas identified from the geophysics.”

2 DATUMS

2.1 CHART DATUM

- 2.1.1 Water depths are given in metres and refer to Chart Datum. Chart Datum approximates to Lowest Astronomical Tide. Water depths given have been taken from Admiralty Chart 2182A (UKHO 2000).

2.2 POSITION

- 2.2.1 This assessment has been carried out in World Geodetic System WGS84 Datum and projected to Universal Transverse Mercator Zone 31 North, and the results have been presented accordingly.
- 2.2.2 The results from WA's 2003 assessment were presented in Ordnance Survey of Great Britain 1936 Datum. In order to integrate these results into this assessment, these were converted into WGS84 UTM Zone 31 North.

- 2.2.3 The 2008 marine geophysical data were recorded by Emu Ltd in WGS84 Datum, and during processing were projected to UTM Zone 31 North.
- 2.2.4 The 2002 sub-bottom profiler data were acquired by Andrews Survey Ltd in WGS 84 but transformed in real-time to Ordnance Survey grid positions.
- 2.2.5 The 2000 sub-bottom profiler data were acquired by Gardline Surveys Ltd. In OSGB36, Airy (1830).

2.3 SEABED GEOLOGY & LANDSCAPE EVOLUTION

- 2.3.1 Generally, the geology of the area comprises pre-Tertiary rocks (Upper Cretaceous Chalk) underlying Pleistocene glacial till, which in turn underlies small lenses of fluvio-glacial sediment and Holocene marine sediments (Cameron *et al.* 1992).
- 2.3.2 The survey area is situated at the palaeo-outwash of the palaeo-river *Yorkshire*, which was later replaced by the river *Humber*. This area was part of a delta system during the Cromerian complex when glacioeustatic sea levels were low.
- 2.3.3 The geological strata of aggregate dredging Licence Area 480 illustrates the effects of landscape modelling destroying earlier contours through ice sheet advances during glacial periods, the creation of tunnel valleys, and the effects of fluvio-glacial activity characteristic of interglacials.
- 2.3.4 The geological strata reached its current form during the Devensian (70,000 – 12,000 BP) with Bolders Bank deposits (OIS 2) overlying the Cretaceous Chalk. This formation is a sub-glacial till in the form of a large lobe that extends 50km offshore from northeast England. This formation is generally between 6 and 25m thick (Cameron *et al.* 1992).
- 2.3.5 The surface of the Bolders Bank Formation was in turn re-modelled by small channels and depressions created by meltwater and fluvio-glacial processes as the ice sheet began to retreat. Within the channels carved out by the meltwater, sands and gravels would have been deposited. The Silver Pit and the associated gravel bank are believed to be a direct result of the tunnel valley formation.
- 2.3.6 The landscape would have remained periglacial until the end of the Dimlington Stadial (13,000 BP - c.6700 BP) (Coles 1998) with braided channels and poorly drained hollows rapidly becoming water filled (Ellis 1993:20).

3 METHODOLOGY

3.1 APPROACH

- 3.1.1 The methodology adopted reflects best practice in carrying out archaeological desk-based assessments, as set out by the Institute of Field Archaeologists (IFA), Standard and Guidance for Archaeological Desk-based Assessment (IFA 2001), and Marine Aggregate Dredging and the Historic Environment produced by the British Marine Aggregate Producers Association (BMAPA) and English Heritage (BMAPA/English Heritage 2003). The later document aims to ensure the effective and practical consideration of the historic environment in the licensing of marine aggregate extraction and elaborates on the guidance provided in the Code of Practice for Seabed Developers published by the Joint Nautical Archaeology Policy Committee in 1995 and revised and updated in 2006).

- 3.1.2 The approach adopted also reflects the requirements of Environmental Assessment arising from European Council Directive 85/337/EEC as amended by Directive 97/11/EC.

3.2 TECHNICAL SPECIFICATIONS

- 3.2.1 The archaeological assessment of marine geophysical data for this report consisted of the interpretation of sidescan sonar, bathymetry and sub-bottom profiler data.
- 3.2.2 The sidescan sonar survey was conducted by Emu Ltd in July 2008 using an Edgetech 4200 towfish system with the data available from the high frequency (455kHz) channel only. The sidescan sonar instrument was operated with a nominal range of 100m.
- 3.2.3 The survey was split into two sections, NS survey lines covering the largest portion of aggregate dredging Licence Area 480 and EW lines covering the smaller easternmost section. A total of 43 survey lines of sidescan sonar data were acquired at 75m and 150m line spacing.
- 3.2.4 The first ten NS lines were acquired at 75m line spacing, which produced a seabed coverage of 260%. The remainder of data were acquired at 150m line spacing, which produced a 130% coverage. This level of ensonification enhances the probability for the detection of objects and sites lying on the seabed, and allows for more accurate positioning of objects identified from more than one survey line.
- 3.2.5 The data were digitally recorded in XTF format and the instrument layback was corrected during acquisition. WA did not alter this during the processing and interpretation of the dataset.
- 3.2.6 The bathymetry data were acquired by Emu Ltd. The data were processed for tidal corrections and coordinate projection by Emu. The data were made available to WA staff in digital format in one single XYZ file.
- 3.2.7 The sub-bottom profiler data were acquired in 2000 by Gardline Surveys Ltd. Gardline Surveys made use of a surface-tow boomer and TSS signal processing suite. Gardline Surveys acquired a total of 466 line km in a NS direction and covering a total of 23km² of seafloor.
- 3.2.8 Andrews Survey Ltd. re-surveyed the area with approximately 59 line km in a EW direction in 2002. Andrews Survey made use of a EG&G Uniboom Model 230 boomer covering approximately 10km² of seafloor.
- 3.2.9 The trackplots were made available by the client in digital format. The sub-bottom profiler data were only available as hard copy.

3.3 DATA QUALITY

- 3.3.1 Prior to any processing and archaeological interpretation the data were reviewed to ensure that the quality was sufficient for analysis and archaeological assessment.
- 3.3.2 The data available to WA were generally graded as good based on the following criteria:

| | |
|----------|--|
| Good | Data which are clear and unaffected by weather conditions or sea state. The dataset is suitable for the interpretation of standing and partially buried metal wrecks and their character and associated debris field. These data also provide the highest chance of identifying wooden wrecks and debris. |
| Average | Data which are affected by weather conditions and sea state to a slight or moderate degree. The dataset is suitable for the identification and partial interpretation of standing and partially buried metal wrecks, and the larger elements of their debris fields. Wooden wrecks may be visible in these data, but their identification as such is likely to be difficult. |
| Variable | This category contains datasets with the quality of individual lines ranging from good or average to below average. The dataset is suitable for the identification of standing and some partially buried metal wrecks. Detailed interpretation of the wrecks and debris field is likely to be problematic. Wooden wrecks are unlikely to be identified. |

4 INTERPRETATION METHODOLOGY

4.1 GEOPHYSICAL DATA PROCESSING AND ANOMALY CHARACTERISATION

4.1.1 The sidescan sonar data were processed by WA using Coda Geosurvey software. This allowed the data to be replayed with various gain settings in order to optimise the quality of the images. The data were initially scanned to give an understanding of the geological nature of the area and were then interpreted for any objects of possible anthropogenic origin: the position and dimensions of any such objects were recorded into a gazetteer and an image of each anomaly acquired (**Appendix I**).

4.1.2 During this stage of the interpretation the sidescan sonar anomalies were ascribed an archaeological flag in order to record the geophysicists' initial assessment of the sidescan sonar anomaly. These flags were ascribed as follows:

| | |
|----------|---|
| High | Ascribed only where the geophysical anomalies clearly represent a wreck site or were very near to a previously known site. |
| Medium | Geophysical anomalies with no directly corroborating data but being of a size, shape or amplitude such as to suggest that they possibly relate to archaeological sites or features. |
| Low | Small, isolated, geophysical anomalies of uncertain origin, which are likely to be 'artefacts' in the data or natural features. |
| Very Low | Anomalies that are known or are highly likely to be of modern origin, and which are not archaeologically interesting (e.g. moorings, etc) |

4.1.3 The form, size and/or extent of anomalies is a guide to its potential. 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 define the edges of a buried but intact feature, or it may be all that remains as a result of past impacts from, for example, dredging or fishing. The application of a ratings system is therefore a means of prioritising sites in order to inform further stages of the interpretation process and on its own is not definitive.

4.1.4 The bathymetric data were gridded and made into a surface using IVS Fledermaus software. This data then provided a datum for the other geophysical data sets but was not of sufficient resolution for the identification of isolated anomalies.

- 4.1.5 The sub-bottom profiler data were studied in order to detect any submerged landscapes likely to hold archaeological material amongst its deposits. Features such as palaeo-channels, ravinement surfaces and peat/fine-grained sediment horizons are of archaeological interest.
- 4.1.6 The sub-bottom profiler data were made available in hard copy, thermal printed rolls, and thus could not be processed to enhance the acoustic response. The data were assessed and examples of images scanned for illustration purposes. The interpretations were digitally superimposed on the data using AutoCAD.
- 4.1.7 The sub-bottom profiler data were interpreted with two-way travel time (TWTT) along the z-axis. In order to convert from TWTT to depth the velocity of the seismic waves was estimated to be 1,600 m/s. This is a standard estimate for shallow, unconsolidated sediments, typical of the Holocene but this is believed to be an underestimated velocity for sediments such as tills, where the velocity might be closer to 2,000 m/s.
- 4.1.8 Also any small reflectors which appear to be buried material such as a wreck site covered by sediment will be recorded and the position and dimensions of any such objects recorded into a gazetteer and an image of each anomaly acquired. It should be noted that anomalies of this type are rare as the sensors must pass directly over such an object in order to produce an anomaly.

4.2 ANOMALY GROUPING AND DISCRIMINATION

- 4.2.1 The previous section describes the initial interpretation of all available geophysical data sets which are conducted independently of each other. This inevitably leads to the possibility of any one object being the cause of numerous anomalies in different data sets and apparently overstating the number of archaeological features in the study area.
- 4.2.2 To address this fact the anomalies are grouped together along with the results of the desk-based study. This allows one ID number to be assigned to a single object or site for which there may be a UKHO record, a bathymetry anomaly and multiple sidescan sonar anomalies.
- 4.2.3 Once all the geophysical anomalies and desk-based information has been grouped a discrimination flag is added to the record in order discriminate against those which are not thought to be of an archaeological concern to the proposed details of the scheme. These flags were ascribed as follows:

| | | |
|--------------------|----|--|
| Outside of scheme | O1 | Outside horizontal footprint |
| | O2 | Outside vertical footprint |
| | O3 | Lifted/cleared previously |
| Non-Archaeological | U1 | Not of anthropogenic origin |
| | U2 | Known non-archaeological feature |
| | U3 | Non-archaeological hazard |
| Archaeological | A1 | Anthropogenic origin of archaeological interest |
| | A2 | Uncertain origin of possible archaeological interest |
| | A3 | Historic record of possible archaeological interest |

- 4.2.4 The grouping and discrimination of information at this stage is based on all available information and is not definitive. It allows for all features thought to be of 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.

- 4.2.5 The final gazetteer of sites is presented in **Appendix I** with site numbering starting at **7000**. These sites are also illustrated in **Figures 2 and 3**; and an example of sub-bottom profiler data is presented in **Figure 4**.

5 RESULTS

5.1 SIDESCAN SONAR

- 5.1.1 During the 2003 archaeological assessment 11 sidescan sonar anomalies and 33 reported archaeological sites were highlighted. Only one sidescan sonar anomaly lay inside the limits of the dredging area and this was not re-identified during this archaeological assessment of marine geophysical data.
- 5.1.2 The interpretation of 2008 sidescan sonar data resulted in the identification of six new sites within the limits of the dredging area. Details of these sites are presented in **Appendix I** and **Figures 2-3**. All sites were ascribed an A2 discrimination flag. The absence of these anomalies in earlier datasets (WA 2003) could have been a result of sediment overlying these newly detected features, a result of data quality or the absence of material on the seabed at the time the surveys were undertaken.
- 5.1.3 The types of sidescan sonar anomalies found within the area are as follows:

| Anomaly Type | Area 480 |
|----------------|----------|
| Dark Reflector | 4 |
| Debris | 2 |
| Total | 6 |

- 5.1.4 Site **7000** represents a clear and distinct linear feature consisting of two separate dark reflectors, which are likely to form one single object aligned in a SW-NE direction. The site measures nearly 13m x 4m and has no apparent height. The individual objects measure 5.4m x 3.8m and 7.5m x 1.7m. Given the distinct ensonification of this site, it has been flagged as an object of possible archaeological interest with a medium confidence.
- 5.1.5 Sites **7001** and **7002** have been identified as two distinct pieces of debris and therefore of likely anthropogenic origin. Site **7001** measures over 9m x 6.5m with a height of 0.7m and site **7002** is a distinct feature but no clear object has been identified other than a thin linear dark reflector and a large bright reflector resembling a scour. Note the data covering site **7002** were distorted. The site measures over 12m x 6.4m and has no apparent height.
- 5.1.6 Site **7003** is a distinct object of unknown origin. It is a linear feature measuring 10.4m x 1.4m and stands approximately 0.6m high. This is a possible object of anthropogenic origin but of unknown archaeological interest.
- 5.1.7 Sites **7004** and **7005** were identified as distinct objects partially buried in areas of sandwaves. These were identified as features of possible anthropogenic origin but of unknown archaeological interest. Objects lying in sandwaves may reveal greater dimensions of further associated material. Site **7004** measures 3.4m x 3.2m and site **7005** measures 17.2m x 5.1m.

5.2 BATHYMETRY

5.2.1 The survey area extends south from the south-western edge of Silver Pit - a localised elongated erosional deep, probably a tunnel valley. The seafloor within the dredging area is characterised by a bank formation running northeast-southwest at water depths between approximately 12m CD in the north and 21m CD in the south. This bathymetric high is relatively featureless and expands from 200m to maximum 1200m. The seafloor to the east is characterised by sandwaves mostly orientated SW-NE. The seafloor depth ranges between approximately 22m CD in the east and approximately 28m CD in the west.

5.3 SUB-BOTTOM PROFILER DATA

5.3.1 As the sub-bottom profiler data were made available in thermally printed paper rolls, no further processing could be done to enhance the data quality. Therefore based on the available data, the quality varied between survey years and between lines. The 2000 data were generally of poorer quality than that from the 2002 survey with no greater seafloor penetration than approximately 10m and poor definition of reflective boundaries.

5.3.2 The 2002 data revealed a total of five units. The deepest unit was identified by a strong dipping reflector. This unit has been interpreted as the bedrock layer and is likely to be Upper Cretaceous chalk.

5.3.3 Overlying the chalk the data revealed the thickest unit of all defined by a low-amplitude parallel and sub-parallel undulating reflector interpreted as a layer of glacial till and it is likely to be the Bolders Bank Formation. This unit is between approximately 10m and at least 23m thick. Note strong reflectors are sporadically visible within this unit. These reflectors cannot be followed across lines and no further interpretation can be made.

5.3.4 The top of the Bolders Bank Formation seems to have been reworked by glacio-fluvial processes as it has an undulating top reflector, which isolated depressions have been filled with fine grain sediment believed to be of fluvio-glacial origin. A clear example has been presented in **Figure 4**.

5.3.5 The great majority of the survey area is defined by a gravel bank overlying the glacial outwash and till. The bank's maximum thickness is approximately 13m and extends for approximately 600m in a EW direction along the SW edge of Silver Pit. The formation of this gravel bank is believed to be associated with the formation of Silver Pit during the last Devensian glacial episode (Cameron *et al* 1992)

5.3.6 The uppermost unit, the modern seafloor, is a thin veneer of Holocene marine sands and gravels associated with the last marine transgression.

5.3.7 Based on recent studies undertaken by WA (2008) between dredging areas 197 and 106, approximately 8km east of aggregate dredging Licence Area 480, the landscape was subject to rapid re-modelling, which had an effect on the local periglacial ecology until the marine inundation of the area.

5.3.8 Although the presence of Palaeolithic communities is sporadic and intermittent in the region, the likely presence of *in-situ* artefacts is low due to the erosion of strata and re-working of sediments. Similarly the presence of Mesolithic material *in-situ* is also low due to the marine transgression. Based on the radiocarbon dating undertaken and sea-level curves (WA 2008) the area was already characterised as a shallow

marine/sub-littoral environment during the Mesolithic. Sporadic re-worked finds are still possible.

6 MITIGATION

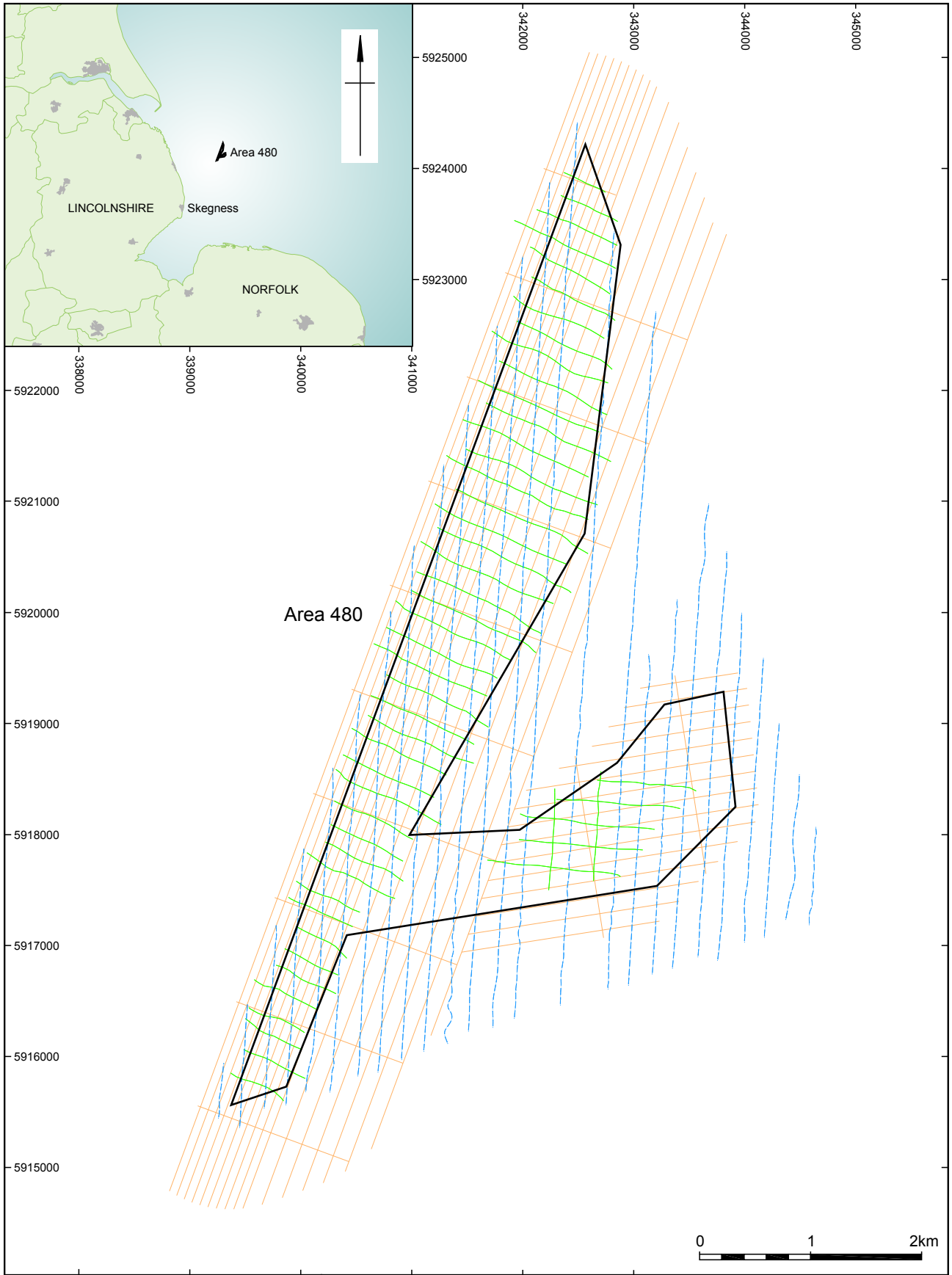
- 6.1.1 According to heritage agencies and the principles outlined in Marine Aggregate Dredging and the Historic Environment, the preferred approach to the presence of potential archaeological sites is to preserve *'in situ'* or preservation *'by record'* (BMAPA and English Heritage 2003). The mitigation suggested for marine aggregate extraction is avoidance, reduction, or remedying and offsetting, and monitoring.
- 6.1.2 The archaeological assessment has identified six sites in the 2008 marine geophysical data. These have been interpreted as objects of likely anthropogenic origin but of unknown archaeological origin. Based on their nature and character they are unlikely to be wrecks and as isolated debris are unlikely to be of archaeological interest. It is therefore not recommended that exclusion zones are implemented around these anomalies, however, extra vigilance in terms of the operation of the BMAPA/EH finds protocol is recommended when dredging in the vicinity of these anomalies so that should they prove to be of archaeological significance appropriate action can be quickly taken.
- 6.1.3 Site-specific investigations involving further high resolution surveys or ROV/diving inspections may clarify the nature and origin of these sites and their archaeological potential or even discriminate them as natural or modern objects.
- 6.1.4 On the basis of the likely archaeological resource of the region and the sites identified in the sidescan sonar data, the additional mitigation is as follows:
- Hanson Aggregate Marine Ltd applies the British Marine Aggregate Producers Association Marine Aggregate Dredging Protocol for reporting finds of archaeological interest.
 - Appropriate training in the operation of the protocol should be given to vessel and wharf staff through material supplied as part of the Awareness Programme.
 - Provision for archaeological involvement in any further benthic and geotechnical investigations in order to assert the potential survival of archaeological material and define the limits of their extent.
 - Provision for post-dredging surveys to continue the monitoring of the effect of dredging on known sites and the potential exposure of sites of archaeological interest.


7 REFERENCES

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APPENDIX I: SITES IDENTIFIED WITHIN THE LIMITS OF AGGREGATE DREDGING LICENCE AREA 480

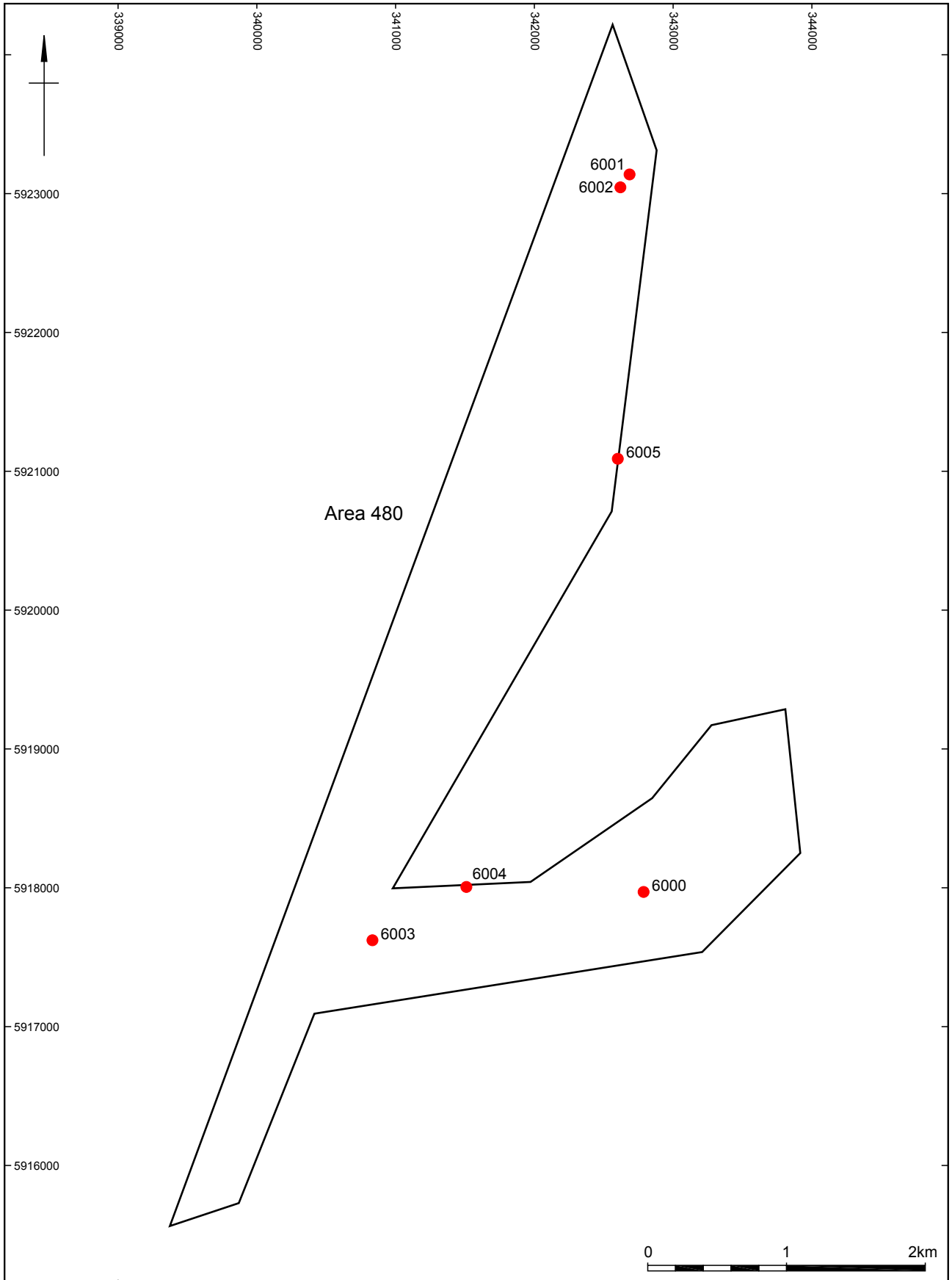
| WA ID | Classification | Easting | Northing | Description | Internal References | External References |
|--------------|-----------------------|----------------|-----------------|---|----------------------------|----------------------------|
| 7000 | Dark reflector | 342787 | 5917970 | Site formed by two objects, one measuring 5.4 x 3.8m and the second one 7.5m x 1.7m. The objects have no height. The site measures 12.9m x 3.8m | 3000, 3001 | None |
| 7001 | Debris | 342686 | 5923138 | Distinct and isolated object of unknown origin. The site measures 9.1m x 6.5m x 0.7m | 3025 | None |
| 7002 | Dark reflector | 342620 | 5923045 | Dark reflector and large seafloor disturbance in the form of a bright reflector. Possibly a site of modern origin. The site measures 12.1m x 6.4m | 3026 | None |
| 7003 | Debris | 340833 | 5917622 | Linear object with height. The site measures 10.4m x 1.4m x 0.6m | 3037 | None |
| 7004 | Dark reflector | 341510 | 5918006 | Object of unknown origin partially buried in sand waves. The site measures 3.4m x 3.2m | 3043 | None |
| 7005 | Dark reflector | 342601 | 5921090 | Distinct feature of unknown origin partially buried in an area of sand waves. The site measures 17.2m x 5.1m | 3045 | None |



| | | | | |
|--|---|---|------------------|-----|
| <ul style="list-style-type: none"> Dredging Area — 2000 sub-bottom profiler data — 2002 sub-bottom profiler data — 2008 Sidescan sonar data <p>Drawing projection: UTM WGS84 zone 31N</p>  | Digital Map Data © (2005) XYZ Digital Map Company. This material is for client report only © Wessex Archaeology. No unauthorised reproduction. | | | |
| | Date: | 12/08/08 | Revision Number: | 0 |
| | Scale: | 1:50,000 | Illustrator: | KJB |
| | Path: | W:\Projects\69890\Drawing Office\Report Figs\...\08-08-12 | | |

Site location

Figure 1



- Dredging Area
- Sites of archaeological interest

Drawing projection: UTM WGS84 zone 31N

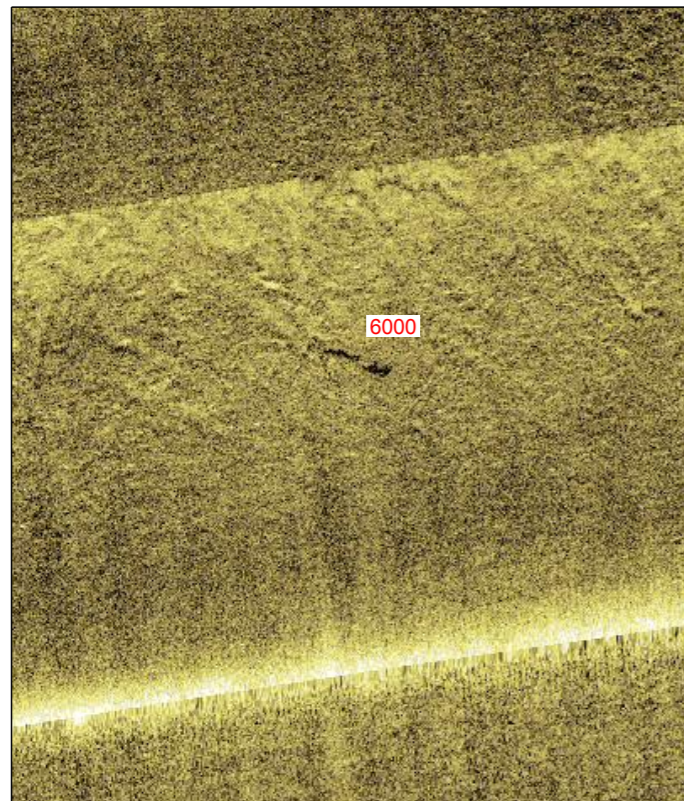


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|--------|---|------------------|-----|
| Date: | 12/08/08 | Revision Number: | 0 |
| Scale: | 1:40,000 | Illustrator: | KJB |
| Path: | W:\Projects\69890\Drawing Office\Report Figs\...\08-08-12 | | |

Sites of archaeological interest

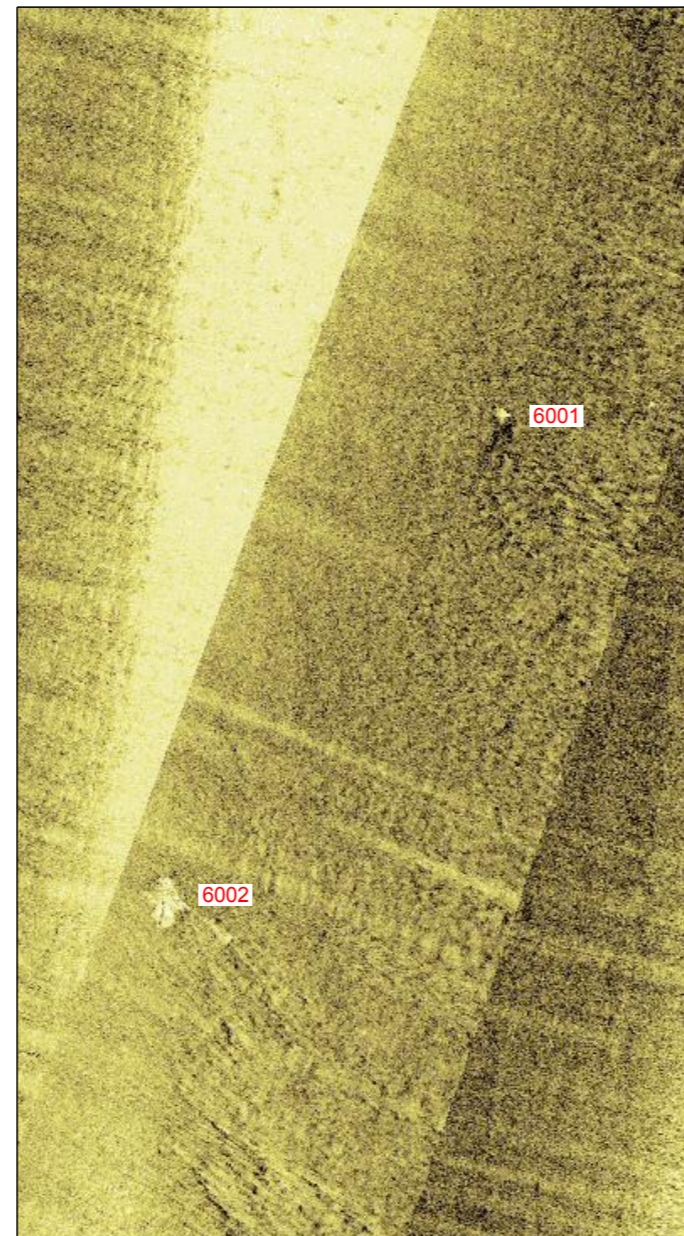
Figure 2



Site **6000**: Site formed by two objects, one measuring 5.4 x 3.8m and the second one 7.5m x 1.7m. The objects have no height.



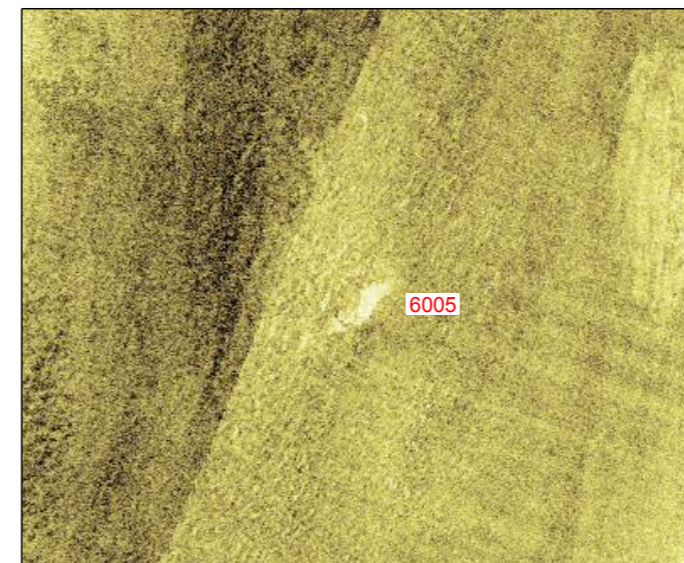
Site **6004**: Object of unknown origin partially buried in sand waves measuring 3.4m x 3.2m.



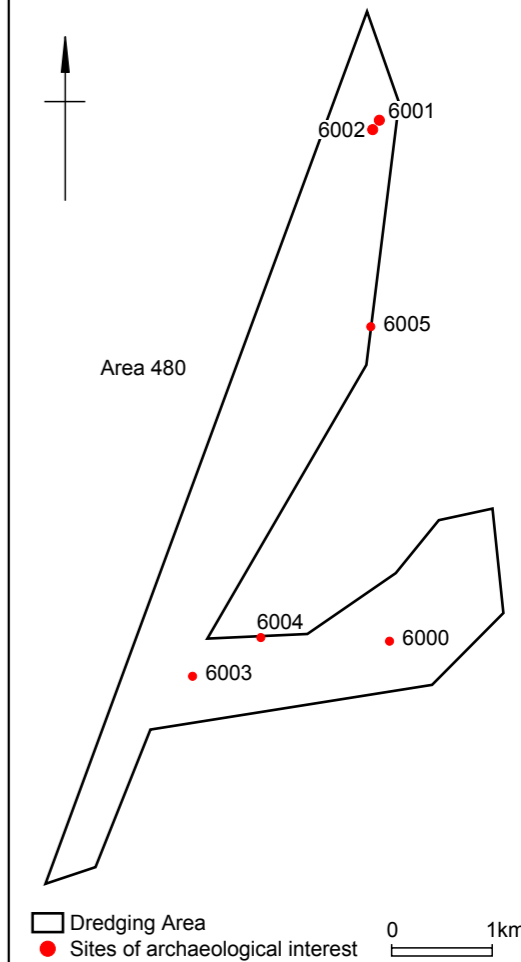
Sites **6001** and **6002**: two separate pieces of debris of unknown origin. Sites measure 9.1m x 6.5m x 0.7m and 12.1m x 6.4m.



Site **6003**: Linear object with height. Site measures 10.4m x 1.4m x 0.6m.



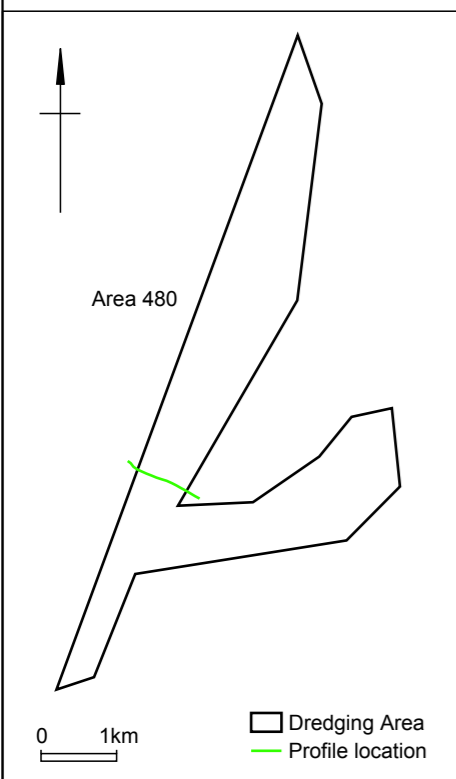
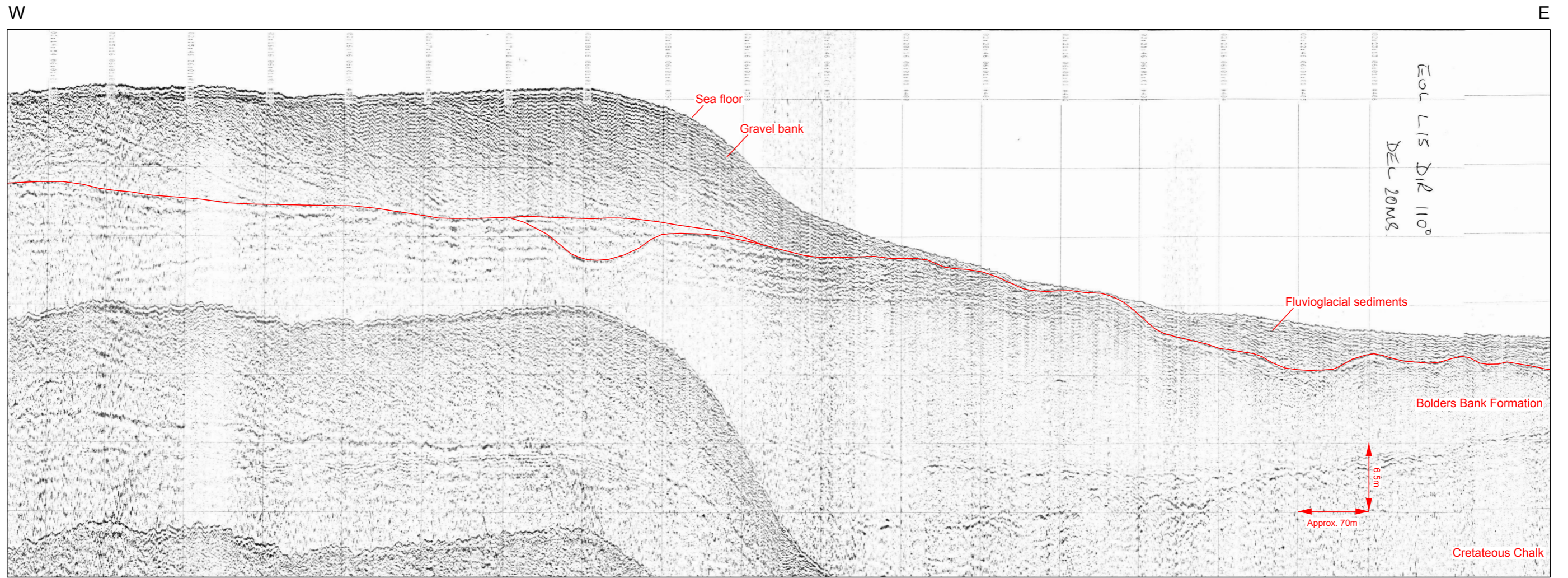
Site **6005**: Distinct feature of unknown origin partially buried in an area of sand waves. Site measures 17.2m x 5.1m.



Drawing projection: UTM WGS84 zone 31N

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|--------------------------|-----------------------------------|
| Revision Number: | 0 |
| Illustrator: | KJB |
| Date: | 12/08/08 |
| Scale: | 1:1500 (Inset 1:75000) |
| Path: | W:\Projects\69890\Drawing Office\ |
| Report Figs\...\08-08-12 | |



Drawing projection: UTM WGS84 zone 31N
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|--------|--|------------------|-----|
| Date: | 12/08/08 | Revision Number: | 0 |
| Scale: | 1:400 vertical (inset 1:100,000) | Illustrator: | KJB |
| Path: | W:\Projects\69890\Drawing Office\Report Figs\...08-08-12 | | |

Example of sub-bottom profiler 2002 data

Figure 4



WESSEX ARCHAEOLOGY LIMITED.

Registered Head Office: Portway House, Old Sarum Park, Salisbury, Wiltshire SP4 6EB.

Tel: 01722 326867 Fax: 01722 337562 info@wessexarch.co.uk www.wessexarch.co.uk

London Office: Unit 113, The Chandlery, 50 Westminster Bridge Road, London SE1 7QY.

Tel: 020 7953 7494 Fax: 020 7953 7499 london-info@wessexarch.co.uk www.wessexarch.co.uk

