



# Race Bank Offshore Wind Farm

Preliminary Assessment of ship-timbers recovered from  
G01-H01-001 and G01-H01-014



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October 2017



## **Race Bank Offshore Wind Farm**

### **Preliminary Assessment of ship-timbers recovered from G01-H01-001 and G01-H01-014**

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# Race Bank Offshore Wind Farm

## Preliminary Assessment of ship-timbers G01-H01-001 and G01-H01-014

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## Race Bank Offshore Wind Farm

### Preliminary Assessment of ship-timbers G01-H01-001 and G01-H01-014

#### Summary

Wessex Archaeology was commissioned by Ørsted to undertake a preliminary assessment of the ship's timbers recovered by grab during the clearance of obstructions G01-H01-001 and G01-H01-014, within the impact zone for the proposed inter-array cable routes of the Race Bank Offshore Wind Farm.

This report contains a preliminary assessment of the archaeological significance of the three ship's timbers recovered. It also assesses the potential for further material to be present that might be associated with the timbers and that may ultimately lead to a requirement for further investigation.

The assessment led to the confirmation of the timbers as ship's timbers. The recovered timbers appear to be isolated and not part of a larger coherent site. Interestingly, although the timbers were found in close proximity of each other, they are not related to the same wreck event and are part of two different shipwrecks. Therefore, it is very probable that they were relocated to their known position by post-depositional impacts from two unknown nearby wreck sites.

The possible date of the timber, based on typology, ranges from at least the early 17th century to the early 20th century at the latest. From the scantlings and the characteristics of the timbers, it is evident they were part of the lower hull of a ship, probably of between 100 and 200 tons.

The dendrochronological analyses carried out by Robert Howard of the Nottingham Tree-ring Dating Laboratory produced inconclusive results. Considering that the ship's timbers recovered do not have recognisable features that identify them as of recent manufacture, C14 dating analyses were conducted to further assess the archaeological significance of the material. The C14 analyses indicate that one of the timber (WA01) is likely (95% probability range) to be of 17th century date, although the earliest possible date for felling has been dated c. 1485. Due to the rarity of ship of this period, this timber is of high archaeological significance.

The C14 analyses on the timber WA02 showed that in all probability (95% probability range) the timber was felled in the earlier to mid-19th century at the earliest. This timber is assessed as of low archaeological interest.

The presence of a large scatter of linear anomalies, similar but apparently longer than those associated with the recently recovered timbers, within an area nearby of approximately 1km in length, might suggest the presence of further timbers in the vicinity (as per 01/04/2016). The area extends from approximately 100m SE of the southern recovered timber (as per 01/04/2016) and extends for approximately 1km to the SE. Turbine H01 and sections of the inter-array cables to either side are situated within this area. Although the nature of these anomalies is at the present time unclear, it is possible that these correspond to timbers that are part of a wreck that has been dispersed over a wide area by post-depositional impacts perhaps in part natural or by other human intervention. Alternatively, considering the absence of a clear coherent wreck structure in the data, it cannot be excluded that the anomalies correspond to a lost cargo of reused timbers, that could include timbers salvaged from old ships.



In order to establish the character of the material in the area it would be advisable to carry out dendrochronological analysis on further ship's timbers that may be recovered from the area in the future. It is also recommended that any buried items encountered during the cable route clearance work should be identified and recorded in line with the consent's requirements.

In the event that coherent sections of wreck material were to be recovered a re-evaluation of the archaeological significance of the timbers would be required. Finally, the presence of further buried wreck material within the immediate proximity to the location from which the timbers were recovered cannot be conclusively excluded as it could be covered by the shallow sandbanks present in the area. As shown by the recovery of timber WA01, there is potential of 17th century wreck material in the area and the discovery of coherent elements of such wreck would be of international relevance.



## Race Bank Offshore Wind Farm

### Preliminary Assessment of ship-timbers G01-H01-001 and G01-H01-014

#### Acknowledgements

This assessment was commissioned by Ørsted, Environment & Consents. The 2015 geophysical data were provided by Thomas Bojer Kristensen and David King. The 2017 multibeam bathymetry data and target lists were provided by Ian Renshaw. Wessex Archaeology is also grateful to Ian and Lee McIntyre for their assistance with the project.

The preliminary assessment of the timbers was undertaken by Paolo Croce. The assessment of geophysical data was undertaken by Dr Stephanie Arnott. The report was written by Paolo Croce and Stephanie Arnott. The timbers were recorded by Thomas Harrison and Paolo Croce. The dendrochronological analyses were carried out by Robert Howard of Nottingham Tree-ring Dating Laboratory. C14 dating was carried out by the Scottish Universities Environmental Centre, Glasgow, with laboratory codes SUERC-73404 and SUERC-74713. The figures were produced by Kitty Foster. The project was managed for Wessex Archaeology by Jack Russell and Toby Gane.



## Race Bank Offshore Wind Farm

### Preliminary Assessment of ship-timbers G01-H01-001 and G01-H01-014

#### 1 INTRODUCTION

- 1.1.1 Wessex Archaeology (WA) was commissioned by Ørsted to carry out the preliminary assessment of three timbers (**WA01**, **WA02** and **WA03**) recovered during the clearance of obstructions for the preparation for the inter-array cable installation for the Race Bank Offshore Wind Farm (**Figure 1**).
- 1.1.2 The three timbers were recovered from an area of shallow sandbanks during the clearance of targets G01-H01-001 and G01-H01-014 within the impact zone of the inter-array cable route between wind turbine generators (WTGs) G01, H01 and H02.
- 1.1.3 The target G01-H01-014 was already known to Wessex Archaeology as it had been previously interpreted as a dark reflector (**70268**) and discriminated as A2 or of "*Uncertain origin of possible archaeological interest*" (WA 2016). The anomaly had not been inspected by divers or ROV before the recovery. Target G01-H01-001 lay outside the study area used for the geophysical assessment of the array site in 2016 and hence had not previously been assessed by WA.
- 1.1.4 The discovery of the timbers was reported to Wessex Archaeology through the offshore renewables protocol for archaeological discoveries (ORPAD) (Crown Estate 2014) on 30 January 2016. As it became apparent that two large and potentially archaeologically significant ship's timbers had been recovered the operations on site were provisionally stopped until consent to proceed was given by the curator. Transport of the artefacts was organised when the clearance vessel came into port on 1 February and the timbers were delivered to Wessex Archaeology facilities where they could be recorded and temporarily stored.
- 1.1.5 The timbers were recovered outside an area of known linear anomalies between WTGs G01 and H01 (**Figure 2**). This group of anomalies was initially identified as possibly part of a timber cargo lost or discarded at sea due to the fact that it is scattered over a wide area and does not present any clearly articulated structure as would be expected from a coherent wreck site. Nonetheless, the possibility that it could be the remains of a wreck dispersed over a wide area was not dismissed at the time. A grab-camera inspection of one of these anomalies (G01-H01-11) did confirm the presence of timbers but did not provide any direct evidence that it consisted of ship-related material.
- 1.1.6 After the three finds from G01-H01-001 and G01-H01-014 were fully documented it was agreed with the curator and the client to undertake a program of selective dendrochronological sampling on the timbers in order to inform this assessment.
- 1.1.7 In order to establish the absence or presence of newly exposed material potentially associated with the recovered timbers, a review of the most recent geophysical data of a 50m area around the recovery location was also agreed. The data from 2015 were also





reassessed in this area as part of it lies outside the area within which the geophysical assessment was undertaken over the array site in 2016 (WA 2016). The results are presented in **section 5**.

## 2 AIMS AND OBJECTIVES

2.1.1 The aim of this assessment is to establish the archaeological significance of the ship's timbers **WA01**, **WA02** and **WA03** recovered from G01-H01-001 and G01-H01-014 and assess the potential for further archaeological discoveries within 50m of the recovery locations. The objectives are as follows:

- *Produce a detailed archaeological record of the timbers **WA01**, **WA02** and **WA03**;*
- *Characterise the finds and develop conclusions on the period and state of preservation in order to assess the archaeological significance;*
- *Assess the potential for further material within an area of 50m from the recovery positions and review the geophysical data to identify potential material that may require further investigation.*

## 3 METHODOLOGY

### 3.1 Timbers assessment

3.1.1 All fieldwork procedures and standards complied with the relevant guidance by the Chartered Institute for Archaeologists (CIfA).

3.1.2 The detailed survey of the timbers was carried out on 7 February 2017. This consisted of:

- *A measured survey of the timbers (Plate 1);*
- *A drawn record of the main views and features (Plate 1);*
- *A photographic record of general views and details (Plate 2); and*
- *A photographic record conducive to photogrammetric reconstruction (Plate 3).*

3.1.3 Due to the sheer size and weight of timbers **WA01** and **WA02** only the three exposed sides were photographed whilst the underside was recorded by 'touch'. The much smaller **WA03** could easily be manoeuvred and all sides were photographed and recorded visually.

3.1.4 As dating timbers recovered without context on the basis of particular features is often not conclusive, it was agreed by the client and the curator to carry out a program of sampling for dendrochronology.

3.1.5 The sampling was carried by Robert Howard on 7 February with Stuart Churchley, a representative from Historic England, present. A total of two samples, one from **WA01** and one from **WA02**, were taken using a chainsaw. The samples were selected on the basis of the potential number of rings and presence of sapwood. The sampling process was documented by video and photographs.

3.1.6 Geophysical datasets from 2015 were compared with more recent 2017 data to ascertain if there was any movement of the finds or whether the finds were linked to any known or potential wrecks in the vicinity of the discovery.



### 3.2 Geophysical data

- 3.2.1 The most recent geophysical data acquired over the site are multibeam bathymetry data acquired in January 2017. The data cover the inter-array cable route from WTG G01 to H01 and on to H02. The data cover a corridor of approximately 150m wide. These data were provided to WA as processed and gridded data with a cell size of 0.2m.
- 3.2.2 Ørsted provided a spreadsheet containing targets that may be impacted by the installation of the inter-array cable between WTGs G01 and H01 and WTGs H01 and H02. The targets were picked on their appearance in the 2017 bathymetry data as features that might contain objects that would need to be removed, erring on the side of caution.
- 3.2.3 A rectangular study area covering the locations of the recovered timbers and 50m to the west, east, north and south was established. Coordinates are given in **Table 1** below:

**Table 1:** Study area coordinates (ETRS89 UTM31N)

Vertex	Easting	Northing
NW	356419	5906636
NE	356558	5906636
SE	356558	5906515
SW	356419	5906515

- 3.2.4 The 2017 multibeam bathymetry data were assessed over the study area, with particular focus on the seven targets Ørsted had identified within this area (**Figure 3**).
- 3.2.5 Multibeam bathymetry data acquired in March to May 2015 over the study area were also assessed to gain an understanding of how the appearance of features of interest had altered by January 2017. The 2015 data were acquired by Spectrum Geosurvey using a Reson 7125 system. The data were provided processed and gridded to 0.25m in .asc files.
- 3.2.6 The most recent sidescan sonar data were acquired in 2015 by Spectrum Geosurvey along with the multibeam data. These data were acquired using an Edgetech 4200 towfish operating at 600kHz and with a range of 60m. The line spacing was 20m. Towfish positioning was provided by use of a USBL system. The data were provided to WA as .xtf files.
- 3.2.7 The geophysical data were processed and interpreted following WA's standard methodology, as described in the 2016 assessment of geophysical data over the array site (WA 2016).
- 3.2.8 All geophysical data were provided in coordinate system ETRS89 UTM31N and all positions given in this report use the same system, as required by Ørsted (2016).

## 4 ASSESSMENT OF TIMBERS

### 4.1 Position

- 4.1.1 The timbers were recovered from an area of shallow sand waves or sandbanks that display a general SE-NW alignment. The plane of pigmentation and alteration of the surfaces of the timbers suggest that they were half-buried in the seabed sediment.
- 4.1.2 The coordinates of the positions of the timbers is given in the table below:

**Table 2:** Coordinates of the targets (ETRS89 UTM31N), provided by Ørsted

ID	Easting	Northing
<b>WA01</b> - G01-H01-001	356469	5906565
<b>WA02</b> - G01-H01-0014	356507	5906585
<b>WA03</b>	356507	5906585

- 4.1.3 The two positions for **WA01** and **WA02** are approximately 43m apart. A third timber, **WA03**, not recorded in the ORPAD form, was delivered to Wessex Archaeology together with the other two. From an examination of the photographs taken at the time of the discovery it appears that **WA03** was recovered concurrently with **WA02** so the position given above is the same as **WA02**.
- 4.1.4 A large area containing hundreds of linear anomalies (**Figure 2**) is located 100m SE of the southernmost timber (**WA01**). These anomalies are similar in shape but longer, at up to approximately 20m, than **WA01** and **WA02**. They are located at the edge of the area of shallow sandbanks which partly covered **WA01** and **WA02**.

## 4.2 Archaeological assessment

- 4.2.1 According to information provided by the client, the grab was lined with planks and rubber in order to cause less impact on the recovered material. As a result, the timbers, which weigh several hundred kilos, showed only very light abrasions associated with the recovery.
- 4.2.2 The two timbers are part of two different wreck sites. However, the timbers display similar characteristics such as choice of material (oak), fasteners (iron only) and condition.
- 4.2.3 The finds may have been originally located within the nearby large area of linear anomalies (**Figure 2**) which it is believed might indicate one or more dispersed wreck sites. It is possible that they were trawled, wire swept, salvaged or otherwise impacted into their current positions, or possibly recovered and re-deposited at sea.
- 4.2.4 The timbers recovered are identified as part of the lower elements of the hull of two different vessels. No evidence of recent damage suggests that the timbers were isolated when recovered and not removed from an existing coherent section of a wreck site. This would suggest that the event that redeposited the timbers to their location is not recent.

### *G01-H01-001 – WA01*

- 4.2.5 **WA01** is made from a compass oak timber and the grain follows the slightly concave curve of the profile. The other sides of the timber are flat and do not show any significant curve. **WA01** is 6m long and scantlings are 320mm sided, and average 300mm moulded. At the foot end the timber is scarfed but at the other end it terminates with a rounded section which is only semi-worked. The timber tapers considerably in both dimensions between the two ends measuring the largest at the scarf end 300mm sided and 340mm moulded and reducing to 150mm sided and 180mm moulded at the other end.
- 4.2.6 This scarf is very eroded and little of the original surface is preserved. The presence of a rounded indentation at three quarters of the scarf length might suggest that the scarf was hooked, however it cannot be discounted that it was originally plain. The scarf is 680mm long and displays two fasteners through-holes of 20mm and 70mm. The largest is at the end of the scarf and it is very worn.
- 4.2.7 On the external convex face are five deep notches. These are disposed in a quasi-symmetrical fashion with one in the centre and two on each side. The average length of the



recesses is 260mm but there are slight variations, the smallest measuring 200mm. They are cut into the wood to a maximum of 50mm with different angles and are 350 to 450mm apart.

- 4.2.8 Four of the recesses are fastened through the middle with what seem to be iron bolts, and one seems to be fastened by two bolts. All the bolts run across the grain with little or no angle on the perpendicular of the surface. Five out of six iron fasteners are aligned approximately to the middle line of the timber. The sixth one is the closest iron fastener to the scarf and was possibly drilled towards the edge in order to avoid a clear point of weakness.
- 4.2.9 All the iron bolts show products of corrosion and four exhibit an evident accumulation of concretion on their end. The concretion could suggest the presence of two small bands or plates on the recesses although this is not clear. The iron fastener's diameters, measured on the wood to take into account the concretion accumulation, measures 32mm. They are arranged in an almost symmetrical fashion with the space between the bolts measuring 400mm, 1300mm, 650mm, 600mm, 1250mm, 1250mm starting from the bolts at the scarf end.
- 4.2.10 **WA01** is provisionally identified as possible half floor timber or futtock rider. Riders were timbers used as internal reinforcement. They were standard on warships and were added to merchant ships that were old or needed strengthening or repair.

*G01-H01-0014 – WA02*

- 4.2.11 The geophysical anomaly associated with this timber had been previously assessed as of "Uncertain origin of possible archaeological interest" in the Wessex Archaeology assessment of 2015 geophysical data (WA 2016). The multibeam image suggests that the timber lay on the seabed with an approximate N-S orientation.
- 4.2.12 The timber **WA02** recovered from G01-H01-0014 is a long and straight grained timber made of oak. The timber has an approximately squared section with rounded edges. The edges and traces of sapwood suggest that this was a boxed heart timber and had been only roughly fayed by the shipbuilders.
- 4.2.13 The condition of the timber is excellent. Only minor degradation was noticed and there is no infestation from shipworm or similar. The few traces of marine growth infestation and a difference in the colouration on the surface of the timber suggest that it was lying on its side and was partly exposed by only 100-120mm.
- 4.2.14 The timber measures 7.38m in length, an average of 304mm moulded and 280mm sided. The scantlings are quite regular with a variation between 270 and 320mm in the moulded dimension and between 220 and 280mm in the sided dimension. The timber ends at one side with a nib scarf, (a plain scarf with indented ends). **WA02** seems to have been fastened by iron bolts only. These were all driven perpendicularly to the grain of the timber along the vertical axis. No copper or copper/alloy fastening were noted. A potential clinch ring (iron washer) is noted within the concretion products of one of the iron fasteners and two of the iron fasteners seems to have been clenched or turned. Excluding the scarf fasteners, there are eight iron fasteners with diameter that averages 32mm, taking into account erosion and concretion. Seven of these bolts are aligned along the centre line of **WA02** and are regularly spaced (spacing being 1050mm, 870mm, 900mm, 930mm, 860mm, 940mm).
- 4.2.15 The horizontal scarf is 1.18m long and was locked by at least four fasteners two of which are missing. The remaining two are in place and are iron bolts. At the other end the timber



terminates with a small bevel and faint trapezoidal section. The underside of the timber is not notched.

- 4.2.16 A small rectangular timber is inserted into a rebate carved into the lower side of **WA02**. This small timber measures 490 by 140mm, it is also made of oak and the tool marks of a hand saw are visible on its surface. It is fastened to **WA02** by two iron bolts.
- 4.2.17 A row of nine round nail-holes of 4-5mm diameter runs along the lower edge of one of the sides of the timber. The nail-holes are quite regularly spaced from the scarf to at least the mid-section of the timber. The distance between the nail-holes varies from 180mm to 300mm. In the photos of the recovery it appears that an extremely eroded plank of a light-coloured wood, possibly pine, was attached by the nails in this position to **WA02**.
- 4.2.18 **WA02** is provisionally identified as a keelson. Nib scarf joints were generally used for keel, keelson, stempost and other long timbers. The presence of regularly spaced iron fasteners suggests the presence of floor timbers and the nail-holes could indicate the presence of ceiling planks. The small insert could be a repair or part of the locking mechanism of the mast step assembly.

#### *G01-H01-0014 – WA03*

- 4.2.19 **WA03** is believed to have been recovered with **WA02** and as **WA01** and **WA02** is made of one piece of solid oak.
- 4.2.20 **WA03** is a box hearted single rectangular block of oak with a rectangular cutting to provide a seat for another ship's element, possibly the foot of a mast. The timber is very eroded and most of the original surface is lost. It measures 1140mm in length, 320mm in width and 100mm in thickness with the aperture measuring 420mm by 150mm. The timber was fastened with seven large iron bolts to another timber, probably to the keelson. The bolts are fastened in two rows of two and one group of three along the length of the upper/lower surface of the block.
- 4.2.21 This probable mast step displays two further lateral bolts that were driven across onto the port and starboard sides. There is no evidence of iron plates on the side of the mast step suggesting that these were not fitted. Two small nail-holes of 2-3mm in diameter and 50mm apart are visible along the lower edge of one side.
- 4.2.22 **WA03** is provisionally identified as a mast step which was likely to be attached on the upper side of the possible keelson **WA02** at the end opposite to the scarf. The heels of masts were stepped into similar blocks since at least the 1600s as shown by early drawings (Crothers 2013). Statistically it is unlikely that such an arrangement would have been used later than the beginning of the 20th century as by then cast steel shoes were generally preferred by then (Desmond 1919). Interestingly, this mast step represents a unique solution as the mortise goes through the entire thickness of the block forming a rectangular hole.

### **4.3 Dendrochronology**

- 4.3.1 The dendrochronology analysis did not find any correlation for the tree ring sequence of timbers **WA01** and **WA02**. The sequence data have been compared to the Nottingham Tree-Ring Dating Laboratory (NTRDL) oak and external laboratories and no cross-matching or dating at any position was found (NTRDL 2017).
- 4.3.2 Both samples **WA01** and **WA02** had the heartwood/sapwood boundary and had 69 rings and 53 rings respectively. Single, full cross-sectional, slices were taken from each timber.

The full slices were initially prepared by short-term freezing before narrower radial sections were then removed from them. The surfaces of the radial samples were then planed and scalped to clearly reveal the annual growth rings. Starting with the inner-most ring on each sample and working outwards, the width of each successive growth ring was measured to a tolerance of 1/100mm (NTRDL 2017).

- 4.3.3 The data of the two samples have been compared with each other, but there is no matching between them. This does not necessarily mean that they are of different date to each other as they could be of the same date, but sourced from two widely separated woodlands (NTRDL 2017).
- 4.3.4 This lack of cross-matching and dating is probably caused by a combination of two factors. Firstly, while in theory both samples have a sufficient number of rings for dating (the usual minimum being 50), neither of them has a particularly high ring count, this making potential cross-matching less likely. Secondly, it's possible that both timbers have been sourced from trees growing in woodlands at a time and/or a place for which no reference patterns exists against which they can be matched (NTRDL 2017).

#### 4.4 Radiocarbon dating

- 4.4.1 The radiocarbon analyses were carried out by the laboratory at the Scottish Universities Environmental Research Centre (SUERC) AMS Facility (laboratory code SUERC-73404 GU43788 and SUERC-74712 GU44701). Different rings for the samples of timber WA01 and WA02 were analysed in order to determinate a firmer 'fix' on the calibration curve.
- 4.4.2 The C14 analyses on the rings 8-12 of **WA01** produced two possible dates at the 95% probability range: the stronger has a date range of 1449-1530, with a slightly weaker possibility of it being 1542-1635. Adding approximately an assumed 60 years in total for the outer rings/sapwood on the tree the earliest possible date for the felling is around 1510, the latest being 1695.
- 4.4.3 The same analyses on the rings 57-61 produced again two possible dates. In this case, the weaker date has a range of 1455-1539, with the slightly stronger possibility being 1539-1635. Given that this date is from the outer rings of the samples and allowing a further 30 years for the outer sapwood the earliest possible date for the felling of the tree is around 1485 and the latest being around 1665.
- 4.4.4 **WA02** sample from rings 48-52 was dated at the 95% probability range to 1802-1938. Allowing for a similar number of outer rings on the tree, the expected earliest felling date to the first half of 19th century.
- 4.4.5 Again, at the 95% probability range, the rings 3-7 of **WA02** produced a strong date of 1805-1933. Allowing for a similar number of outer rings on the tree, a felling date around 1865 at the earliest might be expected. There is however a much weaker possibility of the timber dating to 1672-1736 which, allowing for outer rings on the tree, would date the felling of the tree between 1732 and 1800.

#### 4.5 Discussion

- 4.5.1 C14 analysis suggests that these timbers are part of two different wreck sites.
- 4.5.2 **WA01** is a possible rider or futtock from a military or commercial vessel that was probably built in the 17th century. The constructional details of the piece are consistent with ship construction techniques that were used since at least the first half of the 16th century.



- 4.5.3 A search in the NRHE data for the recorded losses between 1485 and 1665 within a 5 nautical miles area around the position of **WA01** resulted in no known recorded losses between 1485 and 1665.
- 4.5.4 The timber **WA02** and **WA03** are part of the structural components of lower hull of a vessel that is likely to date to the 19th century. Assuming that the keelson was bolted at every floor timber or every other floor timber it could be inferred that the vessel was built with a timber and space of approximately 450mm or 900mm. The comparison of the dimensions and the keelson scantlings with the table of minimum dimensions given by the Lloyds regulations of 1861-1862 suggests vessel of a potential maximum tonnage of 200 tons. It is probable that the vessel was foreign built or built by a minor shipyard as the tree ring patterns of the oak used found no local reference patterns.
- 4.5.5 A search of the NRHE data for the recorded losses between 1805 and 1993 within a 5 nautical miles area around the position of **WA02** resulted in 107 known vessels that may have been sunk in the area.
- 4.5.6 The absence of copper and total predominance of iron in the fastenings could suggest that the wreck was built in the first half of the 19th century rather than the later part of it. However, the lack of diagnostic elements on the method of construction and information relating to the context of the construction means that a more precise date of construction of the ship is not available at the current stage of the investigation.

## 5 ASSESSMENT OF GEOPHYSICAL DATA

- 5.1.1 All three datasets, the 2015 sidescan sonar, 2017 multibeam bathymetry and 2015 multibeam bathymetry, were assessed over the study area. The geophysical anomalies were grouped where believed to be the same object. It should be noted that the positioning accuracy of the sidescan sonar anomalies is approximately  $\pm 5\text{m}$  and while all efforts have been made to group anomalies correctly, both those in different lines of sidescan sonar data and anomalies in multibeam bathymetry, it cannot be guaranteed that all anomalies in a group do represent the same feature and the position is completely accurate. Anomalies for what are believed to be different objects do overlap in some cases.
- 5.1.2 The grouping of anomalies produced nine features of potential archaeological interest within the study area (**Figure 3**). A gazetteer with full details of each feature is included in **Appendix I**. These features are discriminated as shown in **Table 3**.

**Table 3:** Features of archaeological potential with the study area

Archaeological Discrimination	Quantity	Interpretation
A1	2	Anthropogenic origin of archaeological interest
A2	7	Uncertain origin of possible archaeological interest
A3	0	Historic record of possible archaeological interest with no corresponding geophysical anomaly
<b>Total</b>	<b>9</b>	

- 5.1.3 Two of the features were classified as A1 as they are at the locations of the targets where the timbers were recovered from. Geophysical anomaly **7004**, corresponding with **WA01**, was observed in the sidescan sonar data as an elongate feature measuring 4.4 x 1.0 x 0.3m near the edge of the sandwave area. It was also observed in the 2017 bathymetry data as a linear feature measuring 3.2 x 1.2 x 0.2m. Both these sets of dimensions are rather smaller than the actual size of the timber, which was measured to be 6.0 x 0.3 x 0.3m. This is likely



to indicate that the timber was partially buried and the full length was not exposed. The feature appears more natural looking in the 2015 bathymetry data than the other datasets.

- 5.1.4 The second timber, **WA02**, came from the location of feature **70268**. This feature was also observed as an elongate object with height in the sidescan sonar data. It has dimensions of 4.1 x 0.7 x 0.4m and lies in the area of sandwaves. This feature appears in the 2017 bathymetry data to measure 4.0 x 1.2 x 0.1m. In the 2015 bathymetry data the feature was less exposed with only approximately 2m of the length visible. The measured dimensions of the recovered timber are again larger, at 7.4 x 0.3 x 0.3m, than those observed from the geophysical anomalies. Again, this suggests that the full length of the timber was not exposed at the surface at the time the data were obtained.
- 5.1.5 It is not possible to determine whether **WA03** is observed in the data as it is not known precisely where it was recovered from and it is in any case significantly smaller than the other timbers and unlikely to have been discerned unless it was an isolated object on a flat seabed.
- 5.1.6 A single feature, **7002**, was observed in the bathymetry data only, classified as a mound and discriminated as A2. In the 2017 data it appears as a linear feature measuring 4.5 x 1.2 x 0.1m. It is not visible in the 2015 bathymetry data and the position in this dataset is located at the base of a sandwave, illustrating the mobile nature of bedforms in this area. Nothing was observed at this location on the seabed by Ørsted, using Blueview sonar, and hence no grabbing was undertaken here.
- 5.1.7 The remaining six features were all discriminated as A2 and identified as dark reflectors. None were picked as targets for clearance by Ørsted. They were only observed by WA in the sidescan sonar data, probably owing to their small sizes. The majority of these features, **7000**, **7003**, **7005** and **7007**, are small features of between 1.3m and 1.5m in length. The other two features, **7001** and **7006**, are slightly larger at over 2m in length.
- 5.1.8 Feature **7001** is a linear object with height measuring 2.4 x 0.7 x 0.2m. It is seen in the sidescan data to lie between sandwaves. It generally appears as a dark reflector but does appear as a bright reflector in some lines of data, possibly owing to the direction of ensonification.
- 5.1.9 Dark reflector **7006** is an approximately triangular feature with height observed between sandwaves. It has dimensions of 2.1 x 0.9 x 0.4 m and it is possible that it may be debris.
- 5.1.10 Of the four smaller features, **7003** is the smallest and has no height. It has dimensions of 1.3 x 0.5 x 0m and appears situated on the edge of a sandwave. Features **7000** (1.5 x 1.1 x 0.2m), **7005** (1.5 x 0.7 x 0.1m) and **7007** (1.4 x 0.2 x 0.1m) are all small objects with height that may be debris or possible rocks. There are few features like this in this area.
- 5.1.11 There is no evidence of a coherent wreck site. Other than the two recovered timbers (**7004/WA01** and **70268/WA02**) and a linear mound (**7002**), at the position of which nothing was observed on the seabed by Ørsted, the other anomalies are all below 2.5m in size. It is possible that any or all of these are debris but they may not necessarily be related to the timbers so far recovered.
- 5.1.12 The area of sandwaves that covers the majority of the study area (charted as North Ridge) and extends beyond can be seen to have encroached to the southwest by approximately 5m between the surveys of March to May 2015 and January 2017. It is likely therefore that the depth of mobile sands in the study area has also altered. It is possible that further items of debris are contained within the study area, and indeed the wider area, but are buried



below the sandwaves and hence not visible in either the sidescan sonar or bathymetry data. Magnetometer data were assessed over the inter-array cable corridor during the 2016 assessment and no anomalies were identified in this area, between G01 and H01 (WA 2016). Any debris is therefore unlikely to have a substantial ferrous content.

## 6 CONCLUSIONS AND RECOMMENDATIONS

- 6.1.1 The archaeological evidence suggests that the timbers recovered are isolated and were not associated with a larger, more coherent site at the time of the recovery.
- 6.1.2 As the finds are large structural timbers it is surprising that they were not recovered attached to other parts of the wreck. This might suggest that the timbers were part of two different wreck sites that were subsequently re-located by high impact human interference such as trawling. In this sense, the timbers may be considered representative of an outer scatter of debris from two unknown wreck sites. The radiocarbon analyses revealed that the **WA01** is a ship timber that is likely to date to the 17th century. Ship wrecks of this period are rare finds so the potential discovery of a 17th century wreck would be of significant archaeological interest.
- 6.1.3 At the present stage, there is no evidence that suggest the presence of a coherent wreck site within 50m of the recovery location. However, there are six features discriminated as A2 and it is possible that any or all of these are debris that may or may not be associated with the recovered timbers. Finally, the presence of further buried material cannot be excluded within the sandbank area. Therefore, it is recommended that any buried items encountered during the jetting work to clear the top layer of sediment should be identified and recorded in line with the consent requirements.
- 6.1.4 The presence of a concentration of linear anomalies similar but longer than the ones associated with **WA01** and **WA02** could indicate the presence of at least one dispersed previously unknown wreck site in the area. However, at the current stage of investigation there is no certainty as to whether these anomalies are of archaeological origin and if there is any association with the timbers recently recovered. This area starts approximately 100m SE of the given position of **WA01** and extends approximately 1km to the SE. Turbine H01 and parts of the inter-array cables to either side of it lie within this area of linear features (**Figure 2**).
- 6.1.5 A link between the recent timber finds and the wooden wrecks previously found during the ROV survey of November 2015 is unlikely, but cannot be discounted on the basis of the evidence available. The distance between the recovered timbers and the wrecks FE15\_MC\_7048 and FE\_15\_SC\_1056 is respectively 2.3 nautical miles and 1.3 nautical miles. Although this distance may seem significant, wrecks dispersed over a wide area are not unheard in the archaeological record (Muckelroy 1975). However, the comparison of the scantlings of the timbers of FE\_15\_SC\_1056 and WA01 and WA02 seems to indicate that the material found at FE\_15\_SC\_1056 is likely to be from a much smaller vessel. The timbers from the other and furthest wreck site (FE15\_MC\_7048) have scantlings that are of similar size to WA01 and WA02. Nonetheless, a clear association between the two sites remains at this point speculative and as a matter of fact, the absence of debris trail between the three locations may be an indication that the three sites are more likely to be related to different wrecking events.
- 6.1.6 In addition to Carbon-14, Chloroplast DNA analyses are considered to be a promising method that could be used to track the origin of the timbers. Although Chloroplast DNA analyses are not often used in archaeology, they have been successfully extracted from archaeological waterlogged timber in at least two cases and this technique has

demonstrated to be particularly effective on European oaks, especially British oaks (Spiers 2009, Creasman 2010).

- 6.1.7 On 7 February 2017 Wessex Archaeology was notified that the obstruction clearance has resulted in the recovery of three further timbers from the locations G01-H01-001 and G01-H01-014. These have been examined and are considered most likely to represent unworked material from a relict palaeolandscape, rather than ship's timbers (Wessex Archaeology 2017).
- 6.1.8 In order to improve the characterisation of the area Wessex Archaeology advises that a selection of the more recently recovered timbers should be subject to dendrochronological analyses as this may provide a site chronology.
- 6.1.9 Finally, in case of accidental discovery or recovery of a coherent section of wreck a re-evaluation of the archaeological significance of the timbers would be recommended.

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## APPENDIX I – SEABED FEATURES OF ARCHAEOLOGICAL POTENTIAL

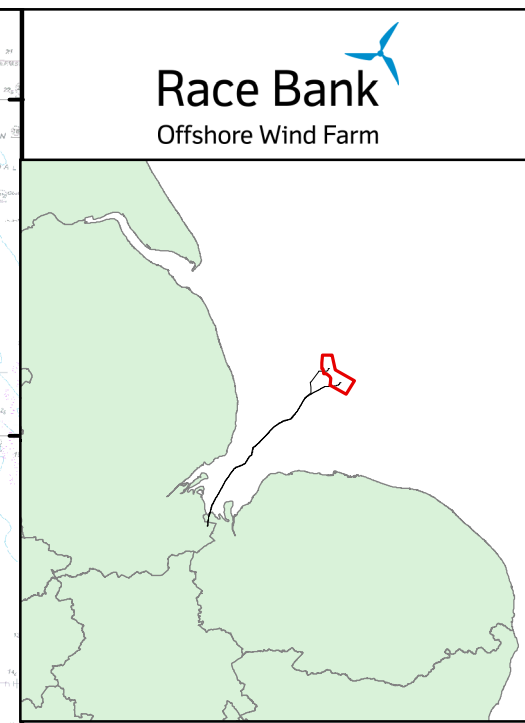
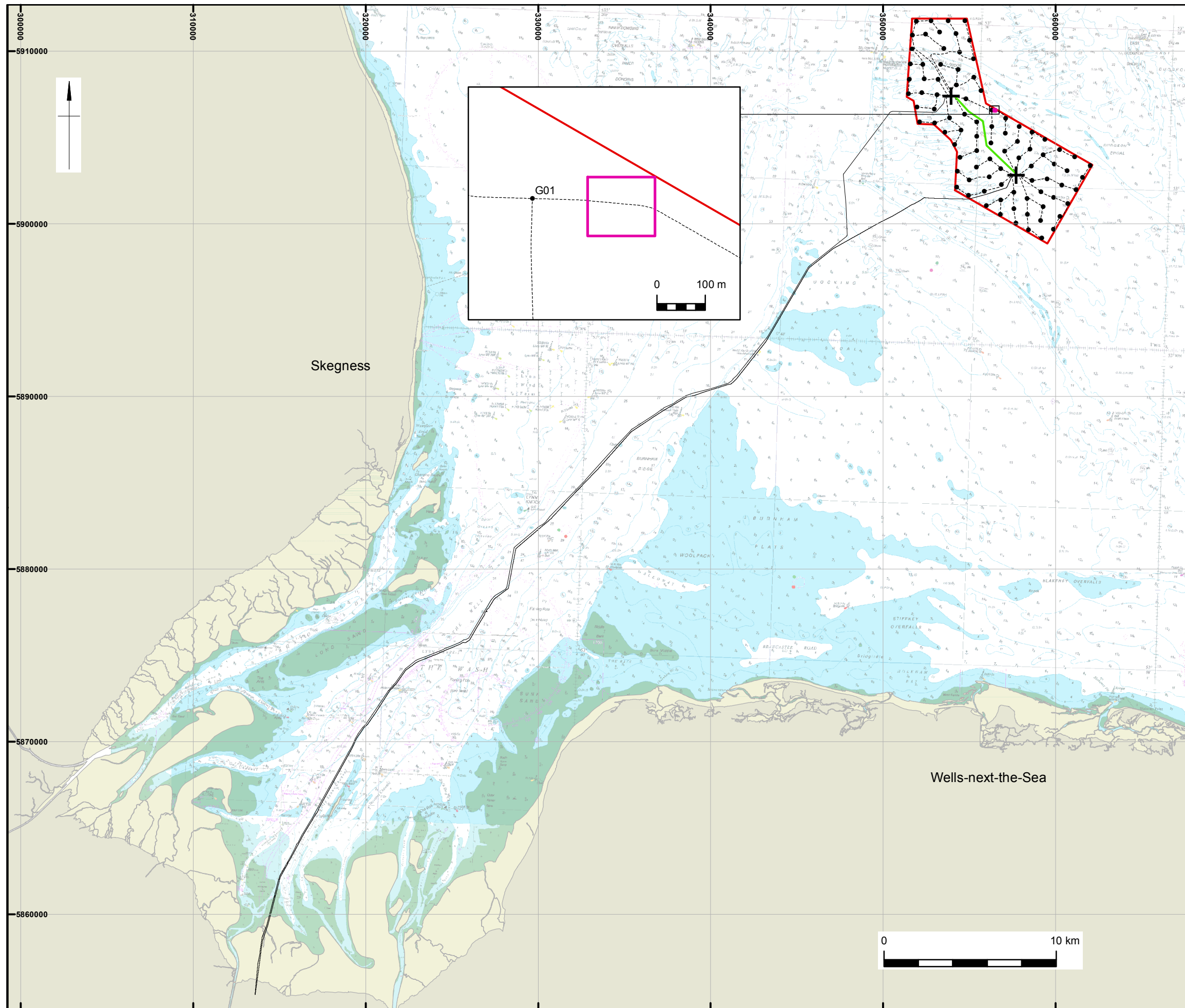
WA ID	Classification	Easting	Northing	Archaeological Discrimination	Length (m)	Width (m)	Height (m)	Description	External reference
7000	Dark reflector	356470	5906554	A2	1.5	1.1	0.2	Small object with height in SSS data near similar feature 65376.	-
7001	Dark reflector	356486	5906601	A2	2.4	0.7	0.2	Linear object with height between sandwaves in SSS data. Possible debris. Appears as a bright reflector in some lines.	-
7002	Mound	356487	5906558	A2	4.5	1.2	0.1	Visible in the 2017 bathy as a linear that looks possibly anthropogenic. This feature is not visible in the 2015 bathy - the position is at the base of a sandwave. Nothing was observed at this position in the SSS data. Nothing was observed at this location on the seabed by Ørsted with the Blueview sonar and hence no grabbing was undertaken.	G01-H01-013
7003	Dark reflector	356465	5906594	A2	1.3	0.5	0	Small dark reflector on edge of sandwave in SSS data. No apparent height.	-
7004	Ship timber	356469	5906565	A1	4.4	1	0.3	Elongate object with height near edge of sandwave area. Depending on direction of ensonification the object appears as either a dark or bright reflector in the SSS data. In the 2017 bathy it is seen to be a linear feature between sandwaves, measuring 3.2x1.2x0.2m, although it could just have been a fork in a sandwave. In the 2015 bathy data it appeared more natural. This object has been recovered and proven to be a ship timber ( <b>WA01</b> ) measuring 6.0x0.3x0.3m.	G01-H01-001
7005	Dark reflector	356460	5906559	A2	1.5	0.7	0.1	Small object with height near edge of sandwave area in SSS data. Might just be a rock but could be debris.	-
7006	Dark reflector	356456	5906618	A2	2.1	0.9	0.4	Possible debris. Approximately triangular feature with height between sandwaves in SSS data.	-



WA ID	Classification	Easting	Northing	Archaeological Discrimination	Length (m)	Width (m)	Height (m)	Description	External reference
7007	Dark reflector	356426	5906541	A2	1.4	0.2	0.1	Small object with height in SSS data. Possibly just a rock with a scour but may be debris.	-
70268	Ship timber	356509	5906587	A1	4.1	0.7	0.4	Appears in the SSS data as an elongate object with height in area of sandwaves. Depending on direction of ensonification the object appears as either a dark or bright reflector. In the 2017 bathy it is seen to be located in a trough between sandwaves and looks like it may be part of them. It measures 4.0x1.2x0.1m. In the 2015 bathy it appeared as a low linear feature c. 2m long cutting across a trough between sandwaves. This object has been recovered and proven to be a ship timber ( <b>WA02</b> ) measuring 7.4x0.3x0.3m. Previously observed in 106942.06 assessment, hence ID number.	G01-H01-014

#### Notes

1. Coordinates are in ETRS89 UTM31N
2. Positional accuracy estimated at  $\pm 5$ m



**Race Bank**  
Offshore Wind Farm

- Study Area
- + Substations
- Turbines
- HV Interlink Cable
- Inter-Array Cables
- Export Cable Route
- Race Bank Offshore Wind Farm



Drawing projection: ETRS89 UTM31N  
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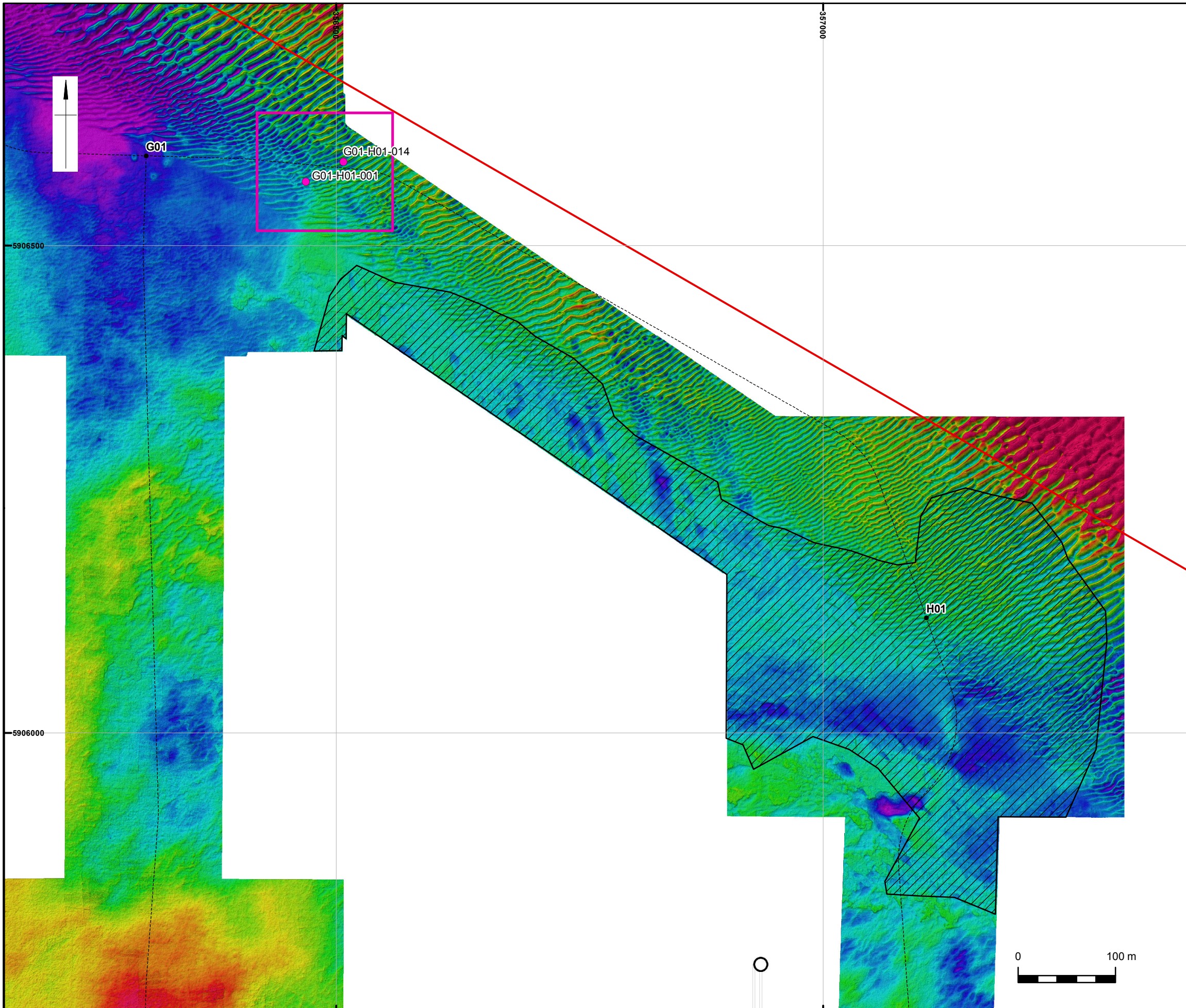
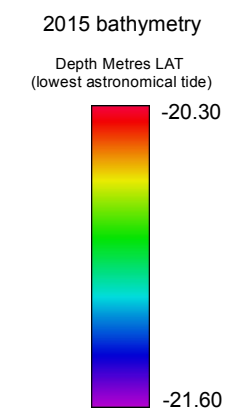
Location map

Figure 1

# Race Bank

Offshore Wind Farm

- Race Bank Offshore Wind Farm
- Study Area
- Turbines
- Inter-Array Cables
- Area of linear features
- Recovered ship timbers



Drawing projection: ETRS89 UTM31N

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Large area of linear features

Figure 2

□ Race Bank Offshore Wind Farm

□ Study Area

----- Inter-Array Cables

**DONG targets for clearance**

▲ Not Found

▲ Timber recovered to deck

▲ Lobster pot, relocated from here

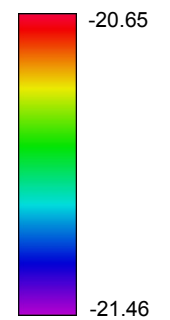
**WA geophysical anomalies**

● A1 – Anthropogenic origin of archaeological interest

● A2 – Uncertain origin of possible archaeological interest

2017 bathymetry

Depth Metres LAT  
(lowest astronomical tide)



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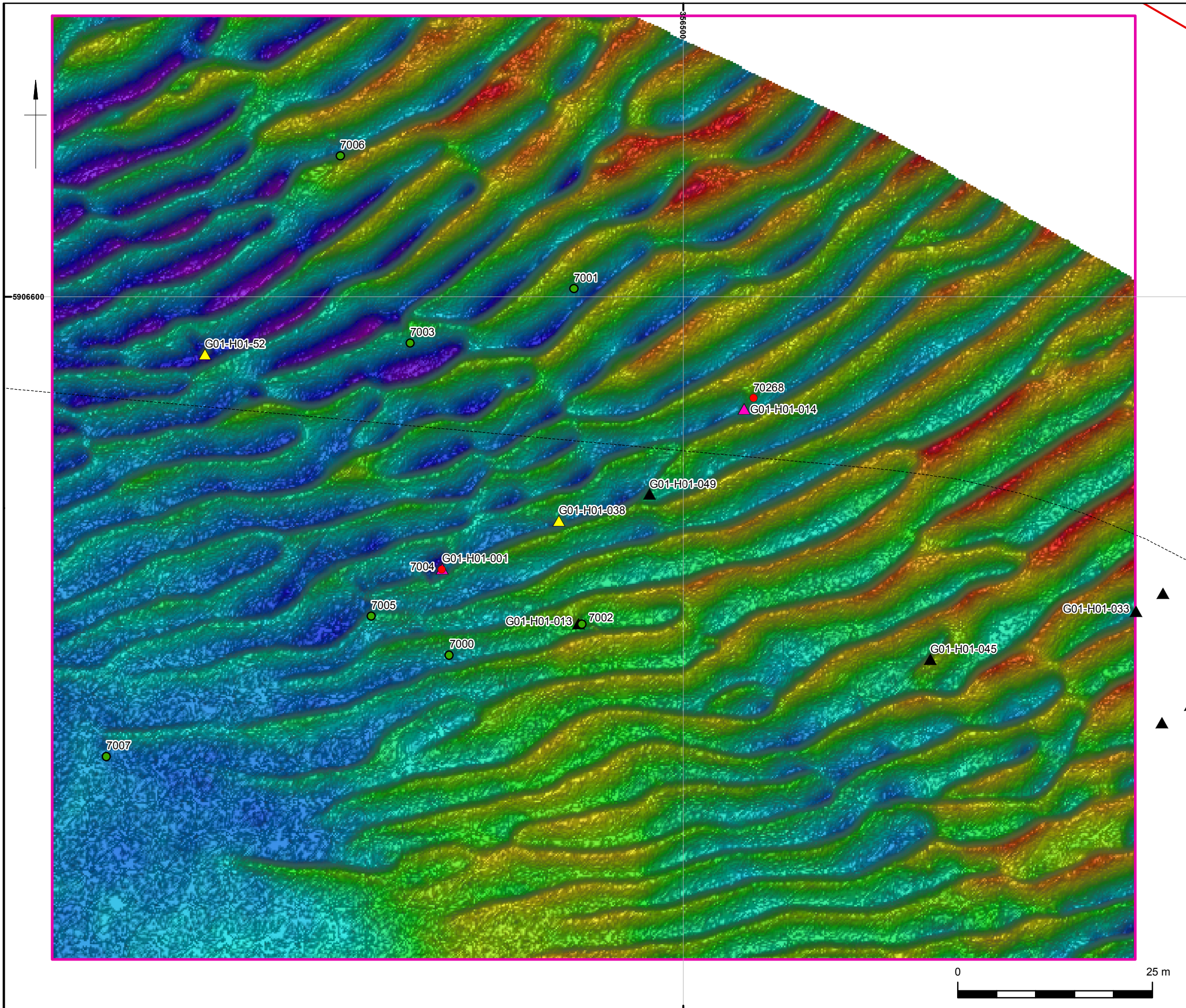
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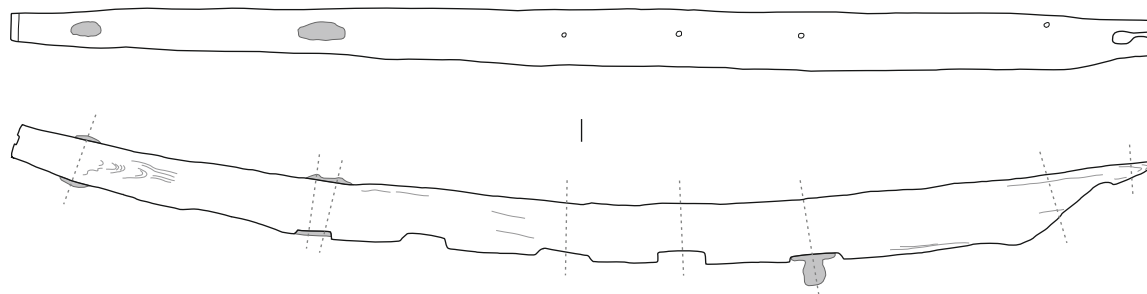
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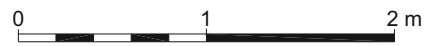
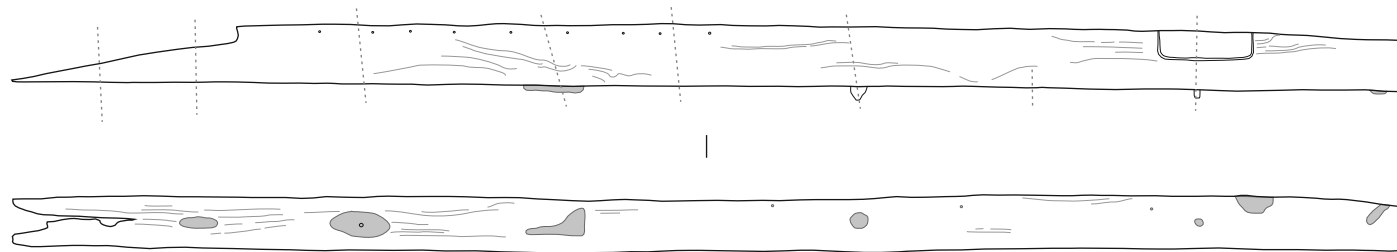
Seabed features of archaeological potential in study area

Figure 3





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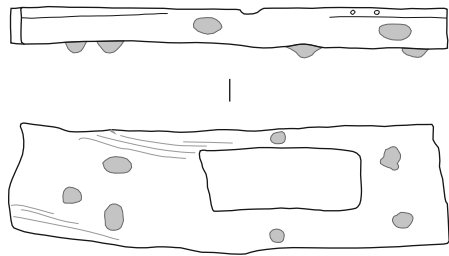
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