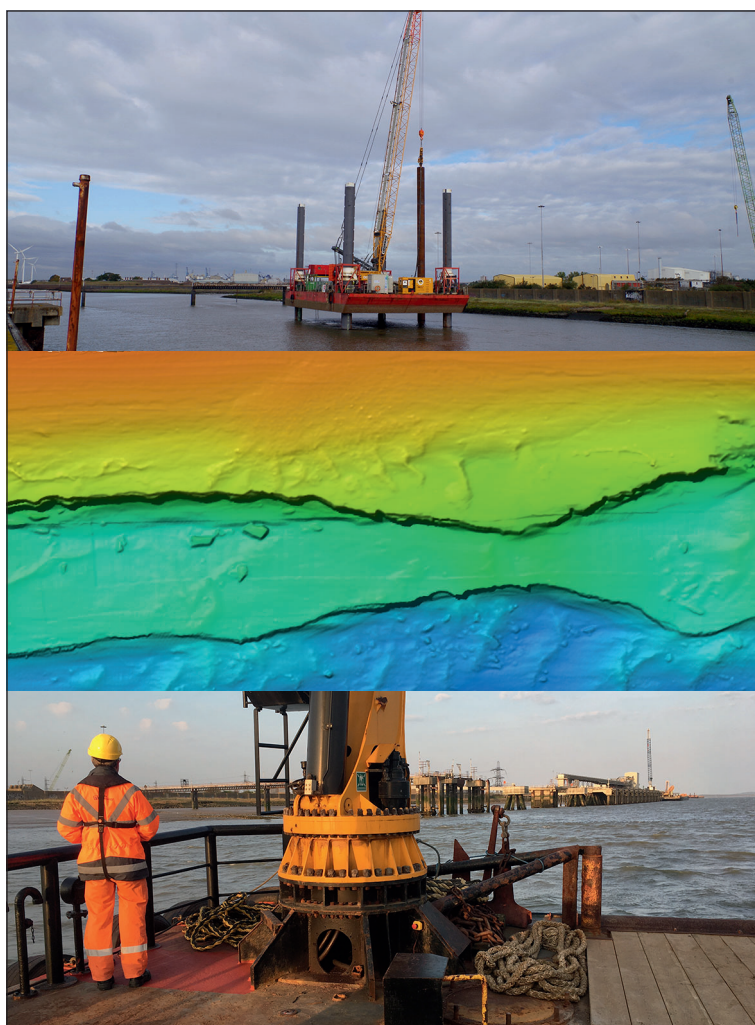




# Tilbury 2

Final Archaeological Report



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## Summary

Wessex Archaeology was commissioned by RPS on behalf of the Port of Tilbury London Ltd. (POTLL) to produce a final report for all archaeological mitigation undertaken as part of the Tilbury 2 Development.

The recommended archaeological mitigation measures were set out in the Written Scheme of Investigation (WSI), and included:

- a protocol for unexpected archaeological discoveries;
- archaeological investigation of geophysical anomalies through the UXO survey and archaeological diver survey;
- archaeological assessment of post-WID dredge marine geophysical survey data; and
- an archaeological watching brief for intertidal works

This report sets out the framework for the archaeological assessment, including the archaeological potential as assessed in the desk-based assessment, WSI, geotechnical and geophysical assessments; and summarises the results of the archaeological mitigation works.

Although the archaeological assessment of geophysical survey data suggested the presence of anomalies of possible archaeological interest (A2s), the UXO and diver surveys demonstrated that they were generally either modern debris related to 20th century activities at the jetty or were natural features. No features of archaeological interest were identified.

The archaeological assessment of post-WID dredge marine geophysical feature did not reveal any further anomalies of possible archaeological interest.

Apart from finds reported during the UXO survey, no further finds were reported through the Protocol.

There were no finds from the archaeological watching brief during the intertidal piling operations.

In conclusion, the recommended archaeological mitigation was appropriately implemented, and ensured that any anomalies of possible archaeological interest were sufficiently investigated to confirm their character as non-archaeological, and a safety net was in place for any unexpected archaeological discoveries.



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- John Harper at Seatech Diving.

The intertidal watching brief was undertaken by Emilia Seredynska, who contributed to this report. The rest of the report was compiled from previous archaeological assessments by Andrea Hamel. Graphics were produced by Kitty Foster. Dan Atkinson managed the project for Wessex Archaeology and undertook quality assurance.



# TILBURY 2

## Final Archaeological Report

### 1 INTRODUCTION

#### 1.1 Project background

1.1.1 Wessex Archaeology was commissioned by RPS and the Port of Tilbury London Ltd. (POTLL) to produce a final report for all mitigation undertaken as part of the Tilbury 2 Development (**Figure 1**). This report summarises the archaeological results of the project.

1.1.2 The Archaeological Written Scheme of Investigation (WSI) (POTLL/T2/EX/228 Wessex Archaeology August 2018) set out the archaeological mitigation that would be carried out for dredging and other marine and intertidal works during the construction of Tilbury 2.

1.1.3 The WSI was informed by earlier works and method statements, including:

- the draft WSI (Wessex Archaeology 2017a);
- the archaeological assessment of marine geophysical survey data (Wessex Archaeology 2017b);
- a desk-based assessment (Wessex Archaeology 2017c);
- a method statement for geoarchaeological assessment (Wessex Archaeology 2017d); and
- a geoarchaeological assessment (Wessex Archaeology 2017e).

1.1.4 This report summarises the results of the previous archaeological assessments (geophysical and geoarchaeological) for completeness, as well as the mitigation work recommended in the WSI.

#### 1.2 Development

1.2.1 The Tilbury 2 Development involved the re-development of the location as a new port terminal, upgrading the jetty with new berthing dolphins, a link bridge and additional hopper and conveyor belt, and a new berth for Roll-on/Roll-off (Ro-Ro) ships. Associated dredge pockets around the jetty area were dredged to create the berth. More details about the development can be found in the WSI (POTLL/T2/EX/228 Wessex Archaeology August 2018) and associated method statements (Wessex Archaeology 2019a, b and e)

#### 1.3 Previous impact

1.3.1 There was likely previous impact to parts of the development area, through the development and use of the existing jetty, as well as any associated dredging. However, there was likely archaeological potential in areas that had not previously been disturbed.

## 1.4 Potential impacts

### *Impacts*

1.4.1 The potential impacts during development, as outlined in the WSI (POTLL/T2/EX/228 Wessex Archaeology August 2018) comprised direct disturbance to archaeological material on and under the seabed through:

- dredging;
- piling foundations/supports for dolphins and jetty uprights; and
- sheet piling.

1.4.2 Operational activities such as maintenance dredging could also have impacts, removing archaeological material that was redeposited in the sediments from elsewhere.

1.4.3 Indirect impacts could include changes to erosion patterns, sediment transport, currents and water quality. Exposed features, such as ones that might erode on the edges of newly dredged areas, will deteriorate faster than ones buried within seabed sediments. Should features be covered by increased sediment, they will be afforded additional protection.

### *Significance of effects*

1.4.4 Marine archaeological receptors are fragile and non-renewable, and any impacts have the potential to lead to effects that are both permanent and negative. Therefore, mitigation measures were outlined to reduce the significance of the effect.

## 1.5 Mitigation measures

1.5.1 The mitigation measures were set out in the WSI (POTLL/T2/EX/228 Wessex Archaeology August 2018). Thirteen mitigation measures were proposed, and are discussed in **Table 1**, along with the implementation and the section of this report where the results are discussed.

**Table 1** Mitigation measures from the WSI

No.	Proposed mitigation measure	Implementation	Section of this report
1	A protocol for archaeological discoveries (the Protocol)	Implemented throughout the development and post-development works. The Protocol was detailed in the archaeological method statement (Wessex Archaeology 2019a).	4.2
2	Archaeological assessment of reprocessed 3D chirp data	The results were compiled and incorporated into the data used to inform mitigation measure number 3.	4.4
3	Investigation of a proportion of the medium and low potential geophysical anomalies identified by archaeological assessment of marine geophysical surveys (and agreed in discussion with Historic England and outlined in an action specific method statement submitted to the MMO for approval). This could be undertaken as part of UXO clearance, through a non-archaeological diver investigation, or through grab sampling or targeted backhoe excavation.	A method statement was produced for the archaeological diving assessment (Wessex Archaeology 2019a), and a second was produced for the recovery of material (Wessex Archaeology 2019b). Both were approved by Historic England and the MMO. The UXO survey and the archaeological diver investigations were undertaken in March-April 2019, and a report of results was produced (Wessex Archaeology 2019c).	4.3, 4.4



4	Preservation <i>in situ</i> , as the primary option for mitigation, could be achieved through the implementation of Archaeological Exclusion Zones (AEZs) and Temporary Exclusion Zones (TEZs), should material of high archaeological potential be encountered. These would be implemented through consultation with Historic England and the MMO.	No material of high archaeological potential was encountered during the development works.	N/A
5	Recovery of artefacts and/or other archaeological receptors should be a final resort, when all other mitigation has failed or is not feasible due to safety or practicability. Any recovery should be undertaken under the supervision of an appropriately trained/experienced archaeologist.	A method statement for the recovery of material was developed (Wessex Archaeology 2019b). Material cleared by UXO divers was generally not of archaeological interest. Material encountered during the archaeological survey was left <i>in situ</i> apart from small samples.	4.4
6	Following the completion of each dredge run, a survey of the riverbed will be completed. This data will be provided to Wessex Archaeology for archaeological assessment as set out in a task-specific method statement.	A method statement for further geophysical surveys was developed (Wessex Archaeology 2019a). However, following production of the method statement, it was agreed with Historic England that only the final, post dredge survey would be required. The results of the post-dredge survey were reported on in a separate report (Wessex Archaeology 2019d)	4.5
7	The MBES data collected during the surveys after each dredge run may be complemented by bathymetry data collected by the dredger (only for WID), should it be of high enough resolution for archaeological assessment. This will be provided to Wessex Archaeology for assessment.	The bathymetry data collected by the dredger was not reviewed, as the MBES data provided a sufficient dataset for archaeological assessment.	N/A
8	Due to the contaminated nature of the sediment within the identified area in the east of the approach dredging pocket, it would not be possible to conduct mitigation on the removal of the sediment. Depending on further tests and adequate risk assessment, it may be possible for Wessex Archaeology staff to conduct artefact recovery from this material, given adequate controls	The approach dredging pocket was not dredged, and therefore no archaeological assessment was required.	N/A
9	Following the results of the sampling programme, permitted anchorage areas for the anchoring of dredgers, barges, and Jack Up/Spud Leg barges will be identified which contain no known archaeological receptors, to ensure no surface/near surface archaeological receptors are damaged by this action.	No receptors of archaeological interest were identified, and therefore this mitigation measure was not required.	N/A
11	A formal programme of archaeological monitoring in the form of a watching brief will be conducted during all construction work in the intertidal zone to ensure any potential archaeological deposits are identified and recorded. This work is likely to include excavation pits at the pile locations.	A methodology for a watching brief was developed (Wessex Archaeology 2019e) and was approved by Historic England. The results of the watching brief are compiled in this report.	4.6
12	Archaeological assessment of the final post-dredge marine geophysical surveys will be completed to ensure that any archaeological remains exposed by the removal of sediment by the dredge are identified and protected, if required.	The archaeological assessment of the final post-dredge marine geophysical survey was undertaken and reported on in a separate report (Wessex Archaeology 2019d).	4.5
13	Should mitigation stage 12 identify any archaeological remains, a second Protocol will be established for the operation and maintenance phase of the project.	No archaeological remains were identified during stage 12.	N/A

## 1.6 Aims

- 1.6.1 The aim of this document is to summarise the archaeological work undertaken for the Tilbury 2 Development, as set out in the WSI (POTLL/T2/EX/228 Wessex Archaeology August 2018) and detailed in the table above. It includes a brief archaeological baseline and results of the archaeological assessment of geotechnical and geophysical work to provide the background for the archaeological mitigation.

## 1.7 Copyright

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## 1.8 Study area(s)

- 1.8.1 The marine study area in the archaeological desk-based assessment (Wessex Archaeology 2017c) comprised a 2 km buffer to allow for the capture of relevant archaeological records that may have poor positional data, such as historic wrecks and aircraft losses. However, for this report, the study area was generally limited to the Tilbury 2 DCO boundary site. Each archaeological works package had a specified study area, and these are discussed briefly below, within each methodology. The reports for each works package provide further details.

## 2 BASELINE RESOURCE

### 2.1 Introduction

- 2.1.1 The baseline resource was explored in detail in the desk-based assessment (Wessex Archaeology 2017c) and updated with the results of the archaeological assessments of geophysical and geotechnical data in the WSI (POTLL/T2/EX/228 Wessex Archaeology August 2018). This section provides a brief summary.

### 2.2 Geoarchaeology

- 2.2.1 The Thames estuary has been through repeated changes due to glacial periods during the Pleistocene, the most recent being the Devensian (c. 110,000-13,500 BP). Glacial conditions caused a global drop in sea levels to up to 120 m below present level, and the shifting of the course of the Thames. During the Holocene, there were late, smaller shifts within the wide Thames Estuary. These changes in sea level made the Thames estuary suitable for hominin exploitation during much of the Pleistocene, and the Thames river terraces are one of the most important sources for artefacts dating to the Lower Palaeolithic (c. 900,000 – 300,000 BP) and the Early Middle Palaeolithic (c. 300,000 – 60,000 BP). During the early Holocene, post-glacial conditions warmed, and global sea levels rose, causing a marine transgression which flooded much of the lower Thames valley, developing the wide estuary seen today.
- 2.2.2 Following this the area saw repeated smaller regressions and transgressions up to the 3rd/4th centuries AD. It is likely that these included inundations during the late Mesolithic, early Neolithic and much, if not all of the Bronze Age. The site has the potential to contain deep sediments relating to these events, as well as providing a stepping stone for integrating offshore and onshore geoarchaeological records, allowing unified

reconstructions, identified as an important research aim for palaeolandscapes research (Dix and Sturt 2013, Bicket and Tizzard 2015).

- 2.2.3 Salt marshes and estuaries were heavily exploited throughout prehistory and history, and there is potential for peat banks within the intertidal area in these reaches of the Thames. It is currently unknown which period these peat banks belong to, and although they are sometimes associated with Roman artefacts, it is also possible that some relate to earlier land surfaces, covered by the accumulation of alluvial silts formed by each successive inundation. There is potential for the survival of organic material through the favourable preservation conditions provided by water-logged, fine-grained sedimentary environments.

## 2.3 Early Prehistory

- 2.3.1 The archaeological potential of the marine study area for the Lower, Middle and Upper Palaeolithic comprised a review of local climatic and geological conditions, as well as archaeological evidence from further afield.
- 2.3.2 River terrace gravels are known to provide an important source of Palaeolithic artefacts. Most of these do not occur in primary context, but have been derived from river beaches, old land surfaces or even earlier worked terrace deposits (Wymer 1999: 21). Due to the presence of Flandrian sediments in the marine study area, there is little potential for pre-Flandrian archaeological artefacts to remain *in situ*, however there is potential for derived or secondary artefacts which were transported by Holocene marine transgression.
- 2.3.3 Prior to the Devensian glaciation, the marine study area was subject to extensive environmental changes. During periods when the sea level fell, vegetation and fauna would colonise the exposed land, providing a landscape suitable for hominid exploitation.
- 2.3.4 There have been previous discoveries of peat in the area, such as the Tilbury I and Tilbury II peat deposits that developed during Mesolithic period (c. 10,000-6,000 BP) (BGS 1996: 136), and it is possible that artefacts related to human activity could be found in these deposits. The Tilbury III deposit relates to the Neolithic period (c. 6,000-4,000 BP). It is also possible that Neolithic artefacts could be found in this lens. During the construction of Tilbury Docks, a human skull was discovered in the alluvial sediments and dated to this period (BGS 1996: 127).

## 2.4 Later Prehistory

- 2.4.1 There were no known features in the intertidal or marine zones, and limited potential. During later prehistory, the area may have been used for hunting and gathering, activities that leave little evidence, or the Iron Age production of salt.

## 2.5 Romano-British Archaeology

- 2.5.1 Evidence of Roman occupation has been found in the intertidal zone to the east of the Tilbury 2 Site, comprising hut circles and pottery remains. These indicate Roman settlement and suggested a high potential for the discovery of further material of this type. There could also be potential for evidence of Romano-British salt-making activities.

## 2.6 Early Medieval and Medieval Archaeology

- 2.6.1 There are no known features of this period in the intertidal or marine zones of the marine study area. However, in the wider area, there were medieval oyster beds and sea wall defences. Tilbury was known to have been occupied during this period, suggesting the potential for evidence of maritime trade or intertidal/riverbank usage.

## 2.7 Post-medieval Archaeology

- 2.7.1 There are no known post-medieval features in the intertidal or marine zones. Potential for discoveries of marine finds is related to recorded losses, the locations of which are poorly recorded. There was a large amount of river traffic entering and leaving the Port of London during this period, and the nearby location of Tilbury Fort suggests potential for archaeological material, particularly isolated artefacts related to shipping and possibly even unreported or unrecorded shipwreck remains.

## 2.8 Modern Archaeology

- 2.8.1 There were a small number of modern features in the marine study area, with three within the DCO boundary. The sites within the development area comprised: an unusually shaped pillbox that is half submerged at low tide; an area of concrete blocks; and a set of concrete piles that were described as lifted.
- 2.8.2 There were no known marine sites within the DCO boundary.
- 2.8.3 In the wider area, there were a number of recorded losses, including vessels and an aircraft crash site, and as their precise location is unknown, there was potential for material from these vessels to be within the DCO boundary. In addition, as this part of Essex formed part of 'Bomb Alley' during the Second World War, there was potential for unexploded ordnance (UXO). There was also potential for evidence of small unrecorded barge and coastal craft wrecks.

## 2.9 Undated Archaeology

- 2.9.1 Within the development area, there was one site of unknown date, comprising a line of small stakes within the intertidal mud, thought to be part of a fish trap or revetment.

## 3 RESULTS OF SURVEYS THAT INFORMED THE MITIGATION RECOMMENDED IN THE WSI

### 3.1 Introduction

- 3.1.1 The results of the geoarchaeological assessment (Wessex Archaeology 2017e) and the archaeological assessment of geophysical data (Wessex Archaeology 2017b) that were undertaken to inform the WSI (WSI (POTLL/T2/EX/228 Wessex Archaeology August 2018) are briefly summarised in this report, as they provide the framework for the mitigation measures that were recommended for the Tilbury 2 Development.

### 3.2 Geoarchaeological assessment

- 3.2.1 A method statement was produced for the geoarchaeological assessment (Wessex Archaeology 2017d), and the results detailed in the geoarchaeological report (Wessex Archaeology 2017e). This section provides a brief overview.
- 3.2.2 The study area comprised eight boreholes (**Figure 2**) and eight riverbed samples that were gathered within the site boundary. A Stage 1 geoarchaeological assessment was undertaken on geotechnical logs produced by the geotechnical contractor. Interpretation was undertaken by a suitably experienced and qualified geoarchaeologist with reference to previous investigations in the area.
- 3.2.3 Alluvium was apparent in all eight boreholes, and the gravels were present in five of the eight boreholes. The geotechnical boreholes revealed a relatively simple sequence of early Holocene alluvium overlying Pleistocene sands and gravels (River Terrace Deposits) of the



Shepperton Gravel Formation. The surface of the Shepperton Gravels ranges from -16.5 m to -12.5 m OD, overlain by between 1.5 m to 6.5 m of alluvium **Figure 3**). The alluvium was apparent in all eight boreholes, and the gravels were present in five of the eight boreholes. The alluvium contains pockets of peat <20 mm – 40 mm that are considered to represent eroded and redeposited organic material.

- 3.2.4 The key deposits are shown in **Figure 2**, and **Figure 3** illustrates the transect across the boreholes that was produced.
- 3.2.5 Deposit modelling was undertaken to map the lateral extents and depth of deposits within the development area. The eight deposit records were entered into an industry standard software package (Rockworks™ v17.0). Each interpreted unit (e.g. peat, alluvium, bedrock) was assigned a colour and pattern allowing correlation and grouping of these deposits is based on the lithological descriptions in the original logs, which define distinct depositional environments referred to as 'stratigraphic units'.
- 3.2.6 Where suitable contexts were present, Digital Elevation Models (DEMs) were produced.
- 3.2.7 No distinct peat horizons were recorded in any of the boreholes. The main limiting factor for further work was the absence of terrestrial plant macrofossils and other organic material in the alluvium suitable for radiocarbon dating, and any palaeoenvironmental data would therefore lack a secure chronological context. The lack of securely datable horizons severely limits the geoarchaeological potential of the recorded deposits, and no further geoarchaeological work was recommended on any of the samples.

### 3.3 Pre-construction marine geophysical survey

- 3.3.1 An archaeological assessment of marine geophysical survey data was undertaken prior to the development, in order to develop a baseline of the marine archaeological resource (Wessex Archaeology 2017b), and the results were incorporated into the WSI (POTLL/T2/EX/228 Wessex Archaeology August 2018).
- 3.3.2 The geophysical survey data were acquired in April 2017 by SAND Geophysics Limited and Port of London Authorities. The data comprised sidescan sonar, magnetometer, multibeam bathymetry and .pdf images of 3D chirp sub-bottom profiler data. Data from two of the survey areas, Study Area West and Study Area East, within the development area were assessed. **Figure 4** illustrates the geophysical survey coverage, with results in **Figures 5** and **6**.
- 3.3.3 The archaeological assessment of geophysical data report (Wessex Archaeology 2017b) contains a detailed methodology regarding the data sources, technical specifications of survey equipment, data quality, data processing and anomaly grouping and discrimination.
- 3.3.4 The data were assessed. The sidescan sonar data were rated as 'variable' with some lines of good quality, and others of below average quality with some evidence of poor weather conditions or sea state. The magnetometer data were also rated as 'variable' due to high magnetic background variation caused by underlying geology, and likely high potential for modern ferrous debris. The multibeam bathymetry data were rated 'good'. The sub-bottom profiler data were not processed by Wessex Archaeology, but .pdf images of targets in the 3D Chirp data were provided and assessed.
- 3.3.5 Throughout Study Area West and Study Area East, a total of 311 geophysical anomalies were identified, and of these 116 were identified as being of possible archaeological interest. The 116 anomalies were classed as A2 archaeological discrimination (indicating that they are of uncertain origin of possible archaeological interest). These anomalies

comprised debris (15), debris fields (2), dark reflectors (12), bright reflectors (2) and magnetic anomalies with no surface expression (116).

- 3.3.6 A total of 20 3D Chirp anomalies were grouped with the above listed anomalies, but in addition to these, there were 70 isolated anomalies that could not be associated. These could also represent buried material of possible archaeological interest, with no associated magnetic anomaly, indicating a non-ferrous composition.
- 3.3.7 No Archaeological Exclusion Zones (AEZs) were recommended for any of the anomalies, however further investigations were recommended to mitigate against any impact from the proposed development, and these recommendations were captured in the WSI (POTLL/T2/EX/228 Wessex Archaeology August 2018).

## 4 RESULTS OF MITIGATION

### 4.1 Archaeological method statements

#### *Archaeological method statements for works in the marine zone*

- 4.1.1 An archaeological method statement was produced to cover the pre-construction marine works (Wessex Archaeology 2019a). This method statement covered: the archaeological assessment of UXO survey data; diver assessment of potential archaeological anomalies identified through geophysical survey data; a Protocol for Archaeological Discoveries (the Protocol); quay side archaeological monitoring; a watching brief (should backhoe dredger be used) and an archaeological assessment of geophysical survey data. An additional method statement was produced for the recovery of potential archaeological material (Wessex Archaeology 2019b), once the details of the recovery vessel were known. The work was undertaken in line with these method statements, and industry best practice, and the results of the three surveys were reported in a combined report (Wessex Archaeology 2019c).
- 4.1.2 Although quay side archaeological monitoring and an on-board dredger watching brief were recommended in the method statement (Wessex Archaeology 2019a), neither were undertaken for the following reasons. The quay side archaeological monitoring was not required, as finds of archaeological interest that had been recovered by the UXO divers were reviewed by the dive team during the diving operations. An archaeological watching brief on board a dredger was not required, as a backhoe dredger was not utilised. The dredging methods utilised did not permit a watching brief, and however the Protocol was in place for any unexpected archaeological discoveries.

#### *Archaeological method statement for works in the intertidal zone*

- 4.1.3 A separate method statement was produced for the intertidal watching brief (Wessex Archaeology 2019e), during piling operations. The results of the watching brief did not form a separate report, but are compiled in this report, in **Section 4.6**.

### 4.2 The Protocol for Archaeological Discoveries

- 4.2.1 The Protocol was put in place for any unexpected archaeological finds made during the pre-construction, construction and dredging activities. It enabled project staff, contractors and sub-contractors to report archaeological finds in a manner that was both convenient to their everyday work and effective with regards to curatorial requirements. The Protocol was implemented throughout the UXO survey, dredging works, construction and post-dredging works and across the full geographical extent of the project.



- 4.2.2 In order to ensure the success of the Protocol, awareness training was undertaken to ensure that project staff understood what constituted an archaeological find and how to report finds of archaeological potential. Training was undertaken before works commenced, and the dates of training are provided in **Table 2**.

**Table 2** Awareness training dates

Activity	Description	Date
UXO Survey	Awareness visit for Fellows UXO divers	25 February 2019
Water Injection Dredging	Awareness conference call for Van Oord staff	14 May 2019
THSD	Awareness conference call for Boskalis staff	12 June 2019

### 4.3 Archaeological assessment of UXO targets

- 4.3.1 The methodology for the UXO survey was set out in the marine Works Contract Method Statement and the Marine Works Contract: Piling Method Statement (Graham 2019a and b) and formed the basis for the archaeological assessment (Wessex Archaeology 2019a).
- 4.3.2 The UXO survey was undertaken by Fellows UXO divers from 25 February to 28 March 2019, and the divers were in regular contact with Wessex Archaeology regarding the discovery of material. The results are detailed in an archaeological investigation report (Wessex Archaeology 2019c) and are summarised here.
- 4.3.3 The UXO survey methodology proposed nine targets for investigation (Wessex Archaeology 2019a: Table 2). Of the nine targets, the UXO survey investigated eight, as the ninth was in the approach and was discarded as it was beyond the area of impact of the development works or dredging (**Figures 7-8**).
- 4.3.4 Discoveries of archaeological potential were reported to Wessex Archaeology for further assessment, along with the initial report and photographs, and material was retained for inspection. All of the target investigation reports were reviewed, as well as the final report (Fellows 2019).
- 4.3.5 Of the eight targets investigated and recovered, none were of archaeological interest. The targets comprised a guard rail stanchion, a section of wooden beam/pile and possible peat, additional possible peat, various entangled scrap metal and hose, a possible part of a gantry frame, and three sections of steel wire rope (Wessex Archaeology 2019c: Table 2). Although the possible peat could have been of archaeological interest, the archaeological assessment undertaken when the Wessex Archaeology divers joined the UXO divers, determined that the material was not in fact of interest. The material is all consistent with the late 20th century use of the jetties.

### 4.4 Diver survey and the recovery of potential archaeological material

- 4.4.1 In addition to the UXO targets, 45 additional targets were selected for archaeological assessment, based on the archaeological assessment of geophysical survey data (**Figures 7-8**) (Wessex Archaeology 2019a: Table 3). The list comprised material visible on the seabed, as well as the most distinct magnetometer anomalies. However, four anomalies within the approach pocket were not investigated, as dredging plans changed to omit the pocket, and therefore those anomalies were not at risk of impact.
- 4.4.2 The diver survey was undertaken by Wessex Archaeology surface supply divers, embedded in the existing dive team, and utilising vessels and other equipment already mobilised for

Tilbury 2 marine UXO investigations. Diving was undertaken 26 March to 9 April 2019. All diving complied with the Diving at Work Regulations and utilised a five-person team using surface supply diving techniques. Diving was subject to site and Port of London Authority permits to work. Diving was only possible during slack water, and visibility was limited to 300 mm at most, with most assessment undertaken by touch.

- 4.4.3 The archaeological diving survey began in tandem with the end of the UXO survey and focussed on the 41 targets of archaeological potential that had been identified through the archaeological assessment of geophysical survey data (Wessex Archaeology 2017b) and that were at risk of impact. The results are detailed in an archaeological investigation report (Wessex Archaeology 2019c) and are summarised here.
- 4.4.4 Material that was encountered on the seabed was generally consistent with the side scan sonar and magnetometer descriptions. The objects comprised: an unidentified buried target that was too deep for excavation; a modern concretion; 30 features described as modern debris; one piece of natural timber, and eight targets where nothing was found, some of which were described in the geophysical report as long curvilinear features, which turned out to be previous dredge marks in the natural clay (Wessex Archaeology 2019c: Table 1).
- 4.4.5 All objects that were encountered are thought likely to have been either natural or consistent with the late 20th century use of the jetties. Much of the debris found is similar to that visible at low water in the intertidal zone north of the Tilbury A/B jetty. No objects or deposits through to be of archaeological significance were found.
- 4.4.6 Five finds were recovered during the archaeological diving operations or were retained during the UXO excavation for archaeological assessment. They are detailed in the archaeological results report (Wessex Archaeology 2019c: Table 3). One was a ferrous metal fragment that appeared to be a flat metal bar, which was returned to the seabed following assessment. The remaining four were timber and were transported to Wessex Archaeology's Salisbury office. The finds were reported to HM Receiver of Wreck (RoW). The finds will be retained for the year required for the RoW to determine ownership, if possible, and then they will likely be discarded, as further assessment has shown them to not be of archaeological interest.

#### **4.5 Archaeological assessment of post WID dredge marine geophysical survey data**

- 4.5.1 Geophysical surveys were undertaken following dredging to assess any material that may have been exposed on the seabed by the dredging works. Surveys comprised a bathymetric re-survey of each of the dredging pockets (West and East). The survey work was undertaken by Randall Survey LLP, as per the methodology set out in the RAMS (Randall Surveys LLP 2018).
- 4.5.2 The archaeological procedure for marine geophysical investigations was set out in the WSI (POTLL/T2/EX/228 Wessex Archaeology August 2018: Section 9.6).
- 4.5.3 The MBES data were processed, and the data set assessed for quality and suitability for archaeological purposes. The data was rated as 'Good'.
- 4.5.4 The geophysical data were the archaeologically assessed to identify features of archaeological potential relating to maritime and aviation activity that may have been exposed during the dredging operations.
- 4.5.5 A number of features were identified in the MBES data, but these were likely related to the geophysical targets identified in the previous archaeological assessment of geophysical

survey data (Wessex Archaeology 2017e), and that had undergone investigation during the UXO survey and archaeological diver investigations (Wessex Archaeology 2019c).

- 4.5.6 It was recommended that if any objects of archaeological interest were recovered during groundwork operations, they should be reported to the Retained Archaeologist using the agreed Protocol.

#### **4.6 Watching brief for intertidal works**

- 4.6.1 An archaeological method statement for an intertidal watching brief was developed (Wessex Archaeology 2019e), as recommended by the WSI (POTLL/T2/EX/228 Wessex Archaeology August 2018).

- 4.6.2 Works in the intertidal zone comprised the piling of six tubular piles for the bank seat (**Figure 9**). The piles were driven by a vibratory hammer. During installation, the spud legs of the *Haven Seariser 2* were deployed in the intertidal zone. Prior to the piling activities taking place, a drone survey was undertaken at low tide covering the foreshore affected by the works, and a secondary survey was undertaken at the end of the works.

- 4.6.3 The WSI (POTLL/T2/EX/228 Wessex Archaeology August 2018) indicated that a watching brief would monitor the construction of the conveyor hopper platform, conveyor supports, the Ro-Ro off-ramp, the bank seat for the Ro-Ro ramp and the excavation of the surface water runoff for the Ro-Ro compound. However, changes to the design to minimise impact on the seabed resulted in only the piling for the bank sea having an impact in the intertidal zone. The other pilings were undertaken below low water and therefore had already been covered by the archaeological assessment of geophysical survey data (Wessex Archaeology 2017b) and the UXO and archaeological diver surveys (Wessex Archaeology 2019c).

- 4.6.4 The intention was to review any excavated surfaces or cast-up material at low tide. However, the method statement (Wessex Archaeology 2019e) noted that the construction methodology had changed, and due to the soft sediment of the intertidal area, pile position examination pits were not required, and therefore the watching brief would be undertaken only during piling operations, to review any material that may be exposed during piling.

- 4.6.5 Piling works took place on 7 and 11 September, with an archaeological watching brief during operations. Piling operations comprised six piles, which measured 30 m in length and 1.20 m in diameter. Four of the piles were positioned vertically into the seabed and the remaining two were positioned diagonally. However, the archaeological works covered a monitoring of only three piles. The piling operations were not being undertaken at lowest tide, and no sites or deposits of archaeological interest were exposed or visible during the works. Therefore, with consultation and permission of Historic England, the watching brief was completed at that stage.

- 4.6.6 No artefacts were recovered during the watching brief.

## **5 CONCLUSION**

- 5.1.1 The archaeological potential suggested by previous archaeological assessments and discussed in the desk-based assessment (Wessex Archaeology 2017c) was investigated through appropriate mitigation measures, as set out in industry best practice (Gane and Cooper 2016); the WSI (POTLL/T2/EX/228 Wessex Archaeology August 2018) and in the associated method statements (Wessex Archaeology 2017d; 2019a and b).



- 5.1.2 The results of the geoarchaeological investigations, that were incorporated within the WSI, proved inconclusive due to the nature of the peat lenses, and no further geotechnical work was recommended.
- 5.1.3 Although the archaeological assessment of geophysical anomalies indicated the presence of anomalies of potential archaeological interest (A2s), the UXO and diver surveys demonstrated that they were generally either modern debris related to 20th century activities at the jetty, or else were natural features. No features of archaeological interest were identified.
- 5.1.4 The archaeological assessment of post-WID dredge marine geophysical survey data did not identify any further features of possible archaeological interest.
- 5.1.5 The intertidal watching brief was undertaken for the commencement of piling works, however was determined not to be required due to the piling methodology that was employed.
- 5.1.6 Apart from the finds that were identified during the UXO survey and reported through the archaeological protocol, no further finds were reported.
- 5.1.7 In conclusion, the archaeological mitigation recommended due to the potential of the development site was appropriately implemented, and ensured that any sites of potential archaeological interest were sufficiently investigated and that a safety net was in place had any unexpected archaeological material been discovered.

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Wessex Archaeology 2019c *Tilbury 2: Archaeological diving assessment of marine geophysical anomalies and archaeological assessment of UXO survey data*. Unpublished Client Report Ref: 116222.04

Wessex Archaeology 2019d *Tilbury 2: Archaeological Assessment of Post WID Dredge Marine Geophysical Survey Data*. Unpublished Client Report Ref: 116222.05

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## Appendix 1: OASIS record form

### Project Details:

<b>Project name</b>	Tilbury 2: Final Archaeological Report		
<b>Project code</b>	116222		
<b>OASIS ID</b>	wessexar1-		
<b>Type of project</b>	Desk-based assessment		
<b>Project description</b>	Wessex Archaeology was commissioned by RPS and the Port of Tilbury London Ltd. to produce a final report for all mitigation undertaken as part of the Tilbury 2 Development. This report summarises the results of the: archaeological protocol; archaeological assessment of UXO survey; archaeological diving survey; archaeological assessment of post WID dredge marine geophysical survey data; and the watching brief for intertidal works. No material of archaeological interest was encountered.		
<b>Project dates</b>	<b>Start:</b> 01/01/2018	<b>End:</b> 31 Dec 2019	
<b>Previous work</b>	Yes: 116220, 116222		
<b>Future work</b>	No		
<b>Site status</b>	N/A		
<b>Land use</b>	Coastland 1 – Marine and Coastland 2: Inter-tidal		
<b>Monument type</b>	N/A	<b>Period</b>	Modern

### Project Location:

<b>County</b>	Essex	<b>District</b>	Marine	<b>Parish</b>	Marine
<b>Site name</b>	Tilbury 2: Final Archaeological Report				
<b>Study area (m<sup>2</sup>)</b>	224,353 m <sup>2</sup>				
<b>Site co-ordinates</b>	565432 175123 BNG 566725 175133 BNG				

### Project Creators:

<b>Name of organisation</b>	Wessex Archaeology		
<b>Project brief originator</b>	RPS	<b>Project design originator</b>	Wessex Archaeology
<b>Project manager</b>	Dan Atkinson	<b>Project supervisor</b>	Andrea Hamel

### Project Archive and Bibliography:

<b>Physical archive</b>	N/A	<b>Digital archive</b>	Yes, report, GIS	<b>Paper archive</b>	N/A
<b>Report title</b>	Tilbury 2: Final Archaeological Report			<b>Year</b>	2019
<b>Author</b>	Wessex Archaeology	<b>Place of issue</b>	Salisbury	<b>Report ref.</b>	116222.07

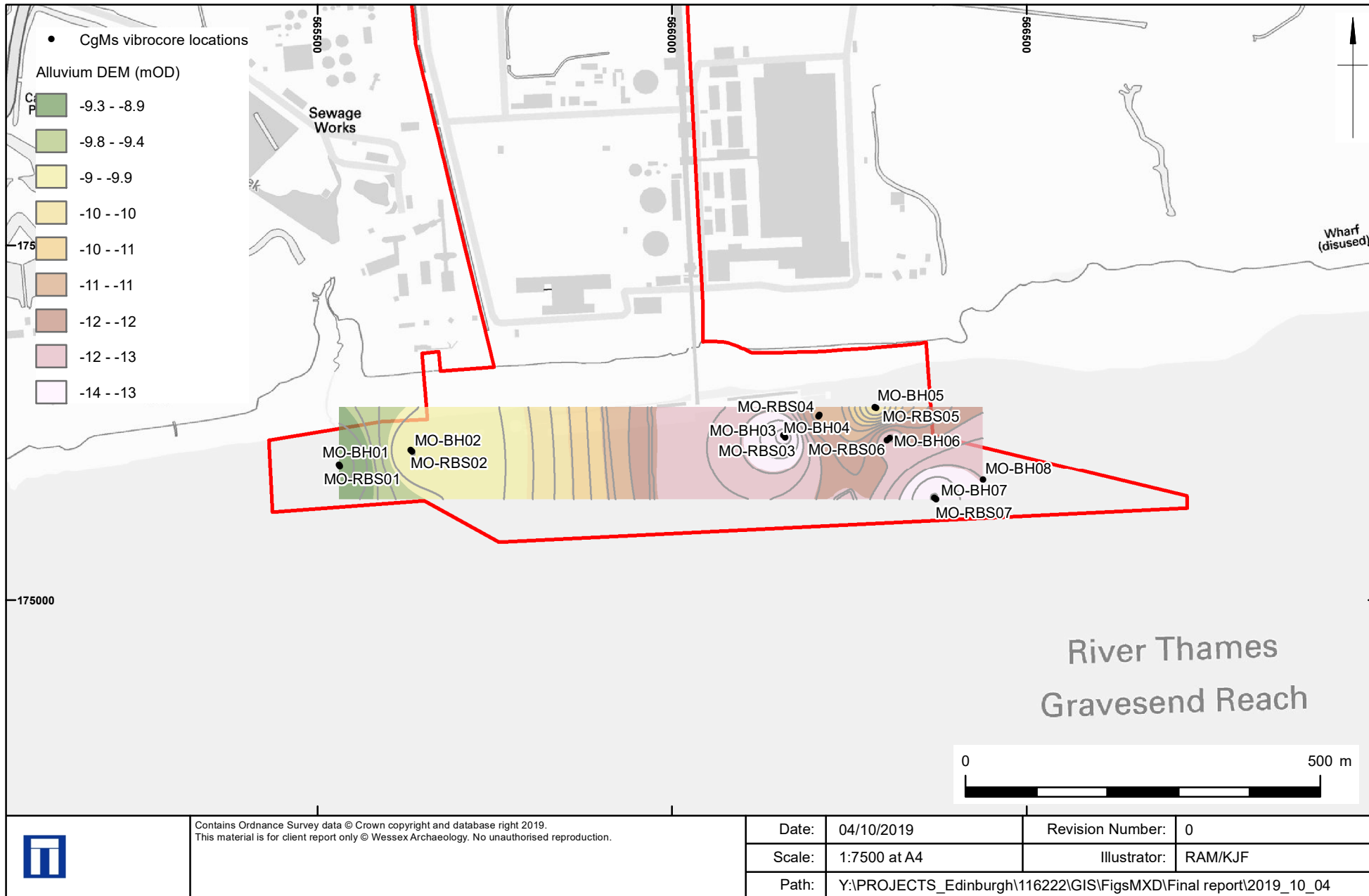




Location map

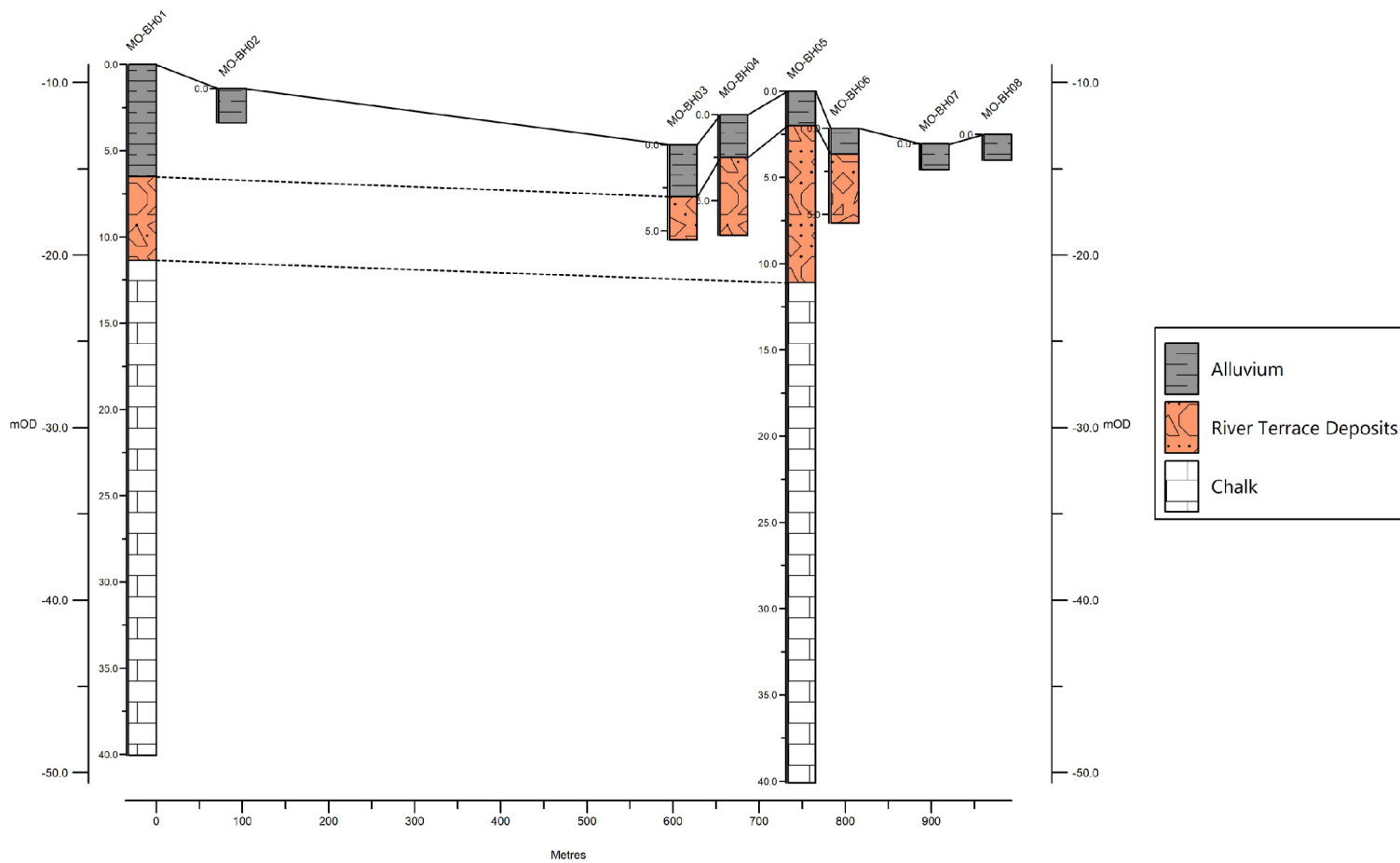
Figure 1





Location of vibrocores and key deposits

Figure 2

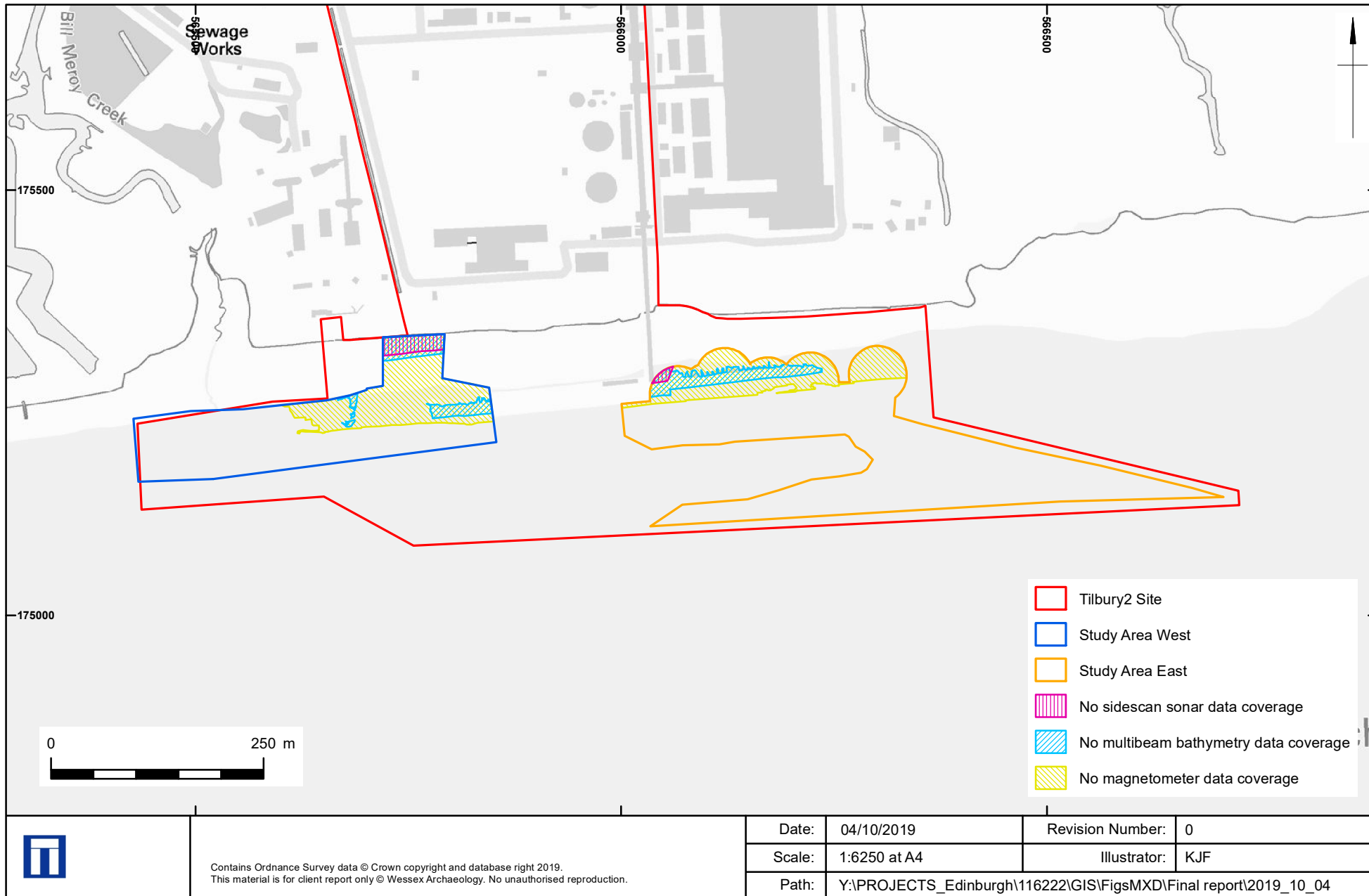


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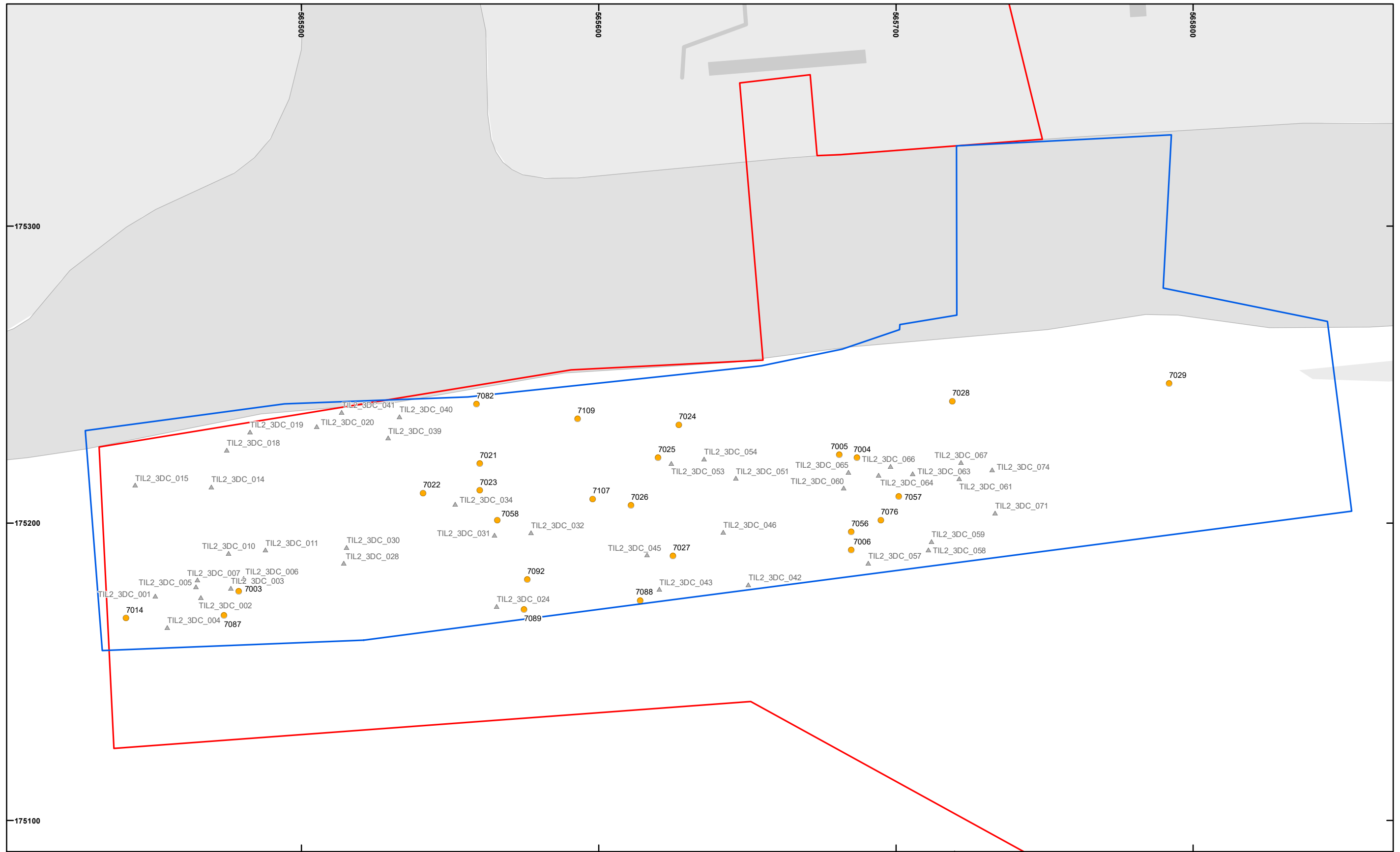
Transect across vibrocores

Figure 3



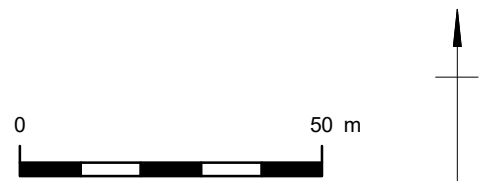
Geophysical data coverage

Figure 4



- Tilbury2 Site
  - Study Area West
  - Study Area East
- Geophysical Anomalies**
- A2 (Uncertain origin of possible archaeological interest)
  - ▲ Potential buried features (SAND 2017)

Coordinate system:  
OSGB36 (OSTN15/OSGM15)

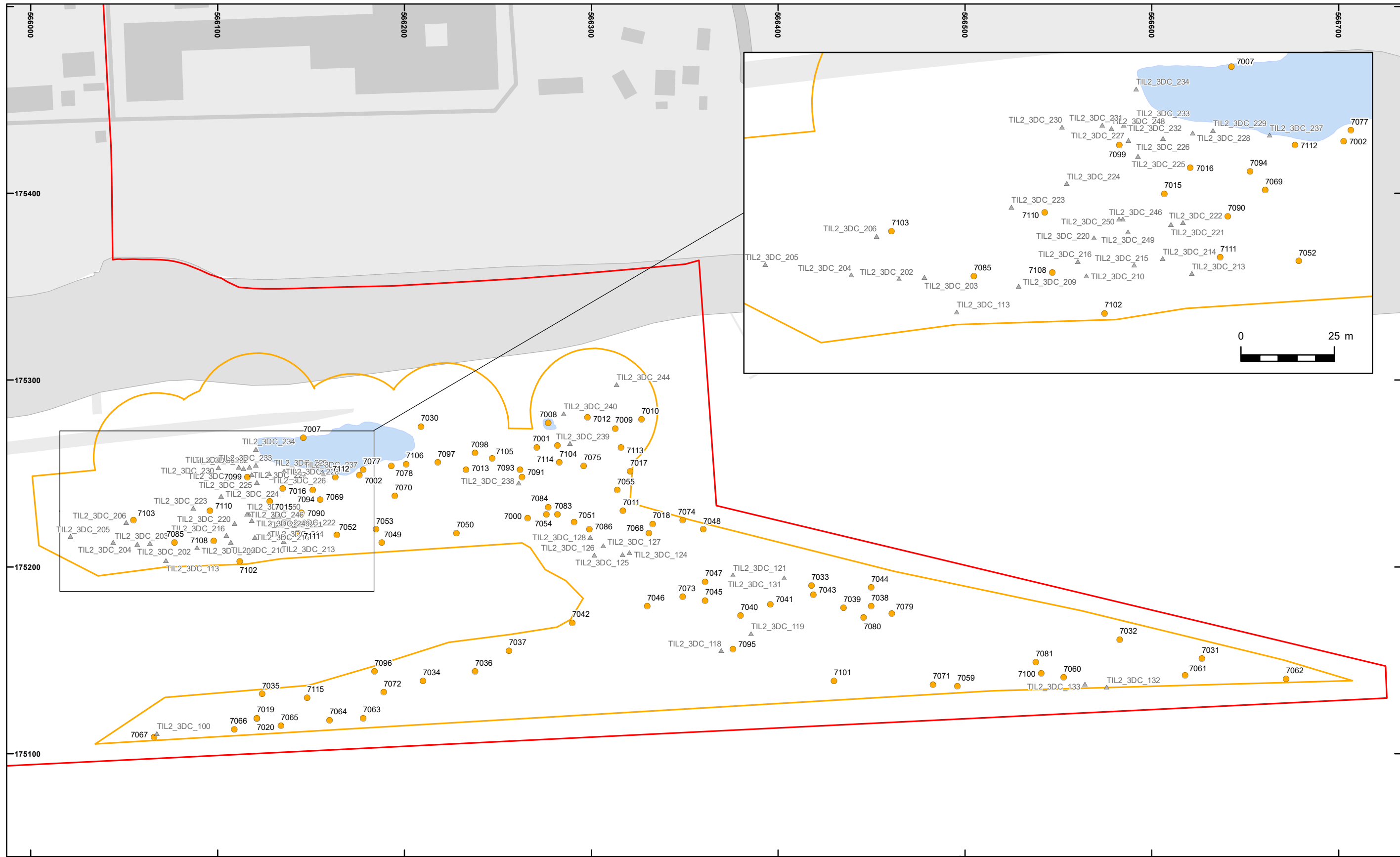


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Geophysical seabed features of archaeological potential (Study Area West)

Figure 5



Coordinate system:  
OSGB36 (OSTN15/OSGM15)

- Tilbury2 Site
- Study Area West
- Study Area East
- Debris field extents

- Geophysical Anomalies**
- A2 (Uncertain origin of possible archaeological interest)
  - ▲ Potential buried features (SAND 2017)

0 50 m




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Geophysical seabed features of archaeological potential (Study Area East)

Figure 6




 Coordinate system:  
 OSGB36 (OSTN15/OSGM15)

- Tilbury2 Site
- Study Area West
- Study Area East
- Extent of Berth Dredging
- Targets archaeologically dived
- UXO targets assessed
- ▲ Potential buried anomalies (SAND)
- Geophysical anomalies not archaeologically assessed; A2 (Uncertain origin of possible archaeological interest)

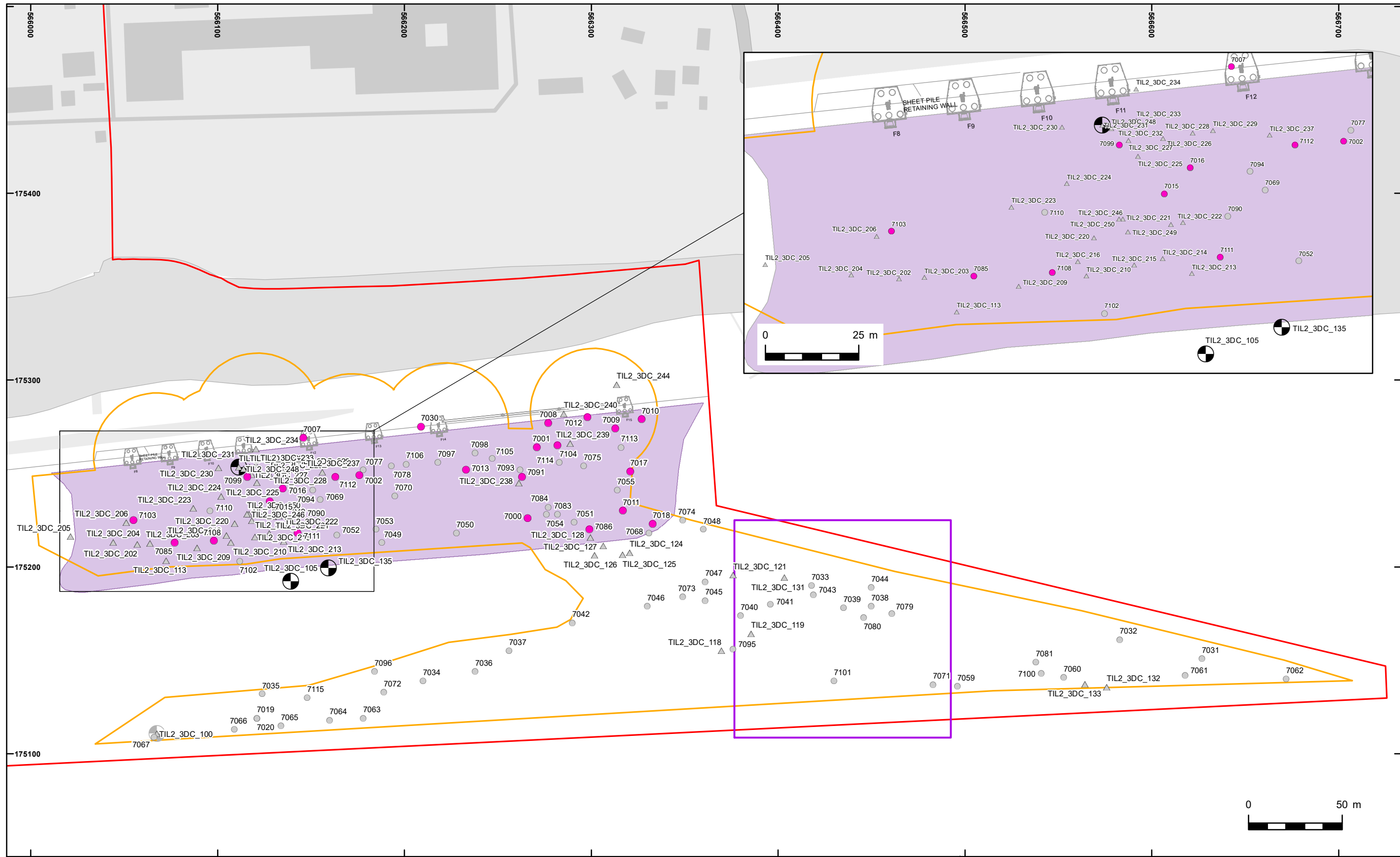


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UXO and diver survey features (Study Area West)

Figure 7



Coordinate system:  
OSGB36  
(OSTN15/OSGM15)

- Tilbury2 Site
- Study Area West
- Study Area East
- Exclusion Zone
- Extent of Berth Dredging
- Targets archaeologically dived
- + UXO targets assessed
- + UXO target not assessed
- ▲ Potential buried anomalies (SAND)
- Geophysical anomalies not archaeologically assessed; A2 (Uncertain origin of possible archaeological interest)
- ⊕ UXO target not assessed

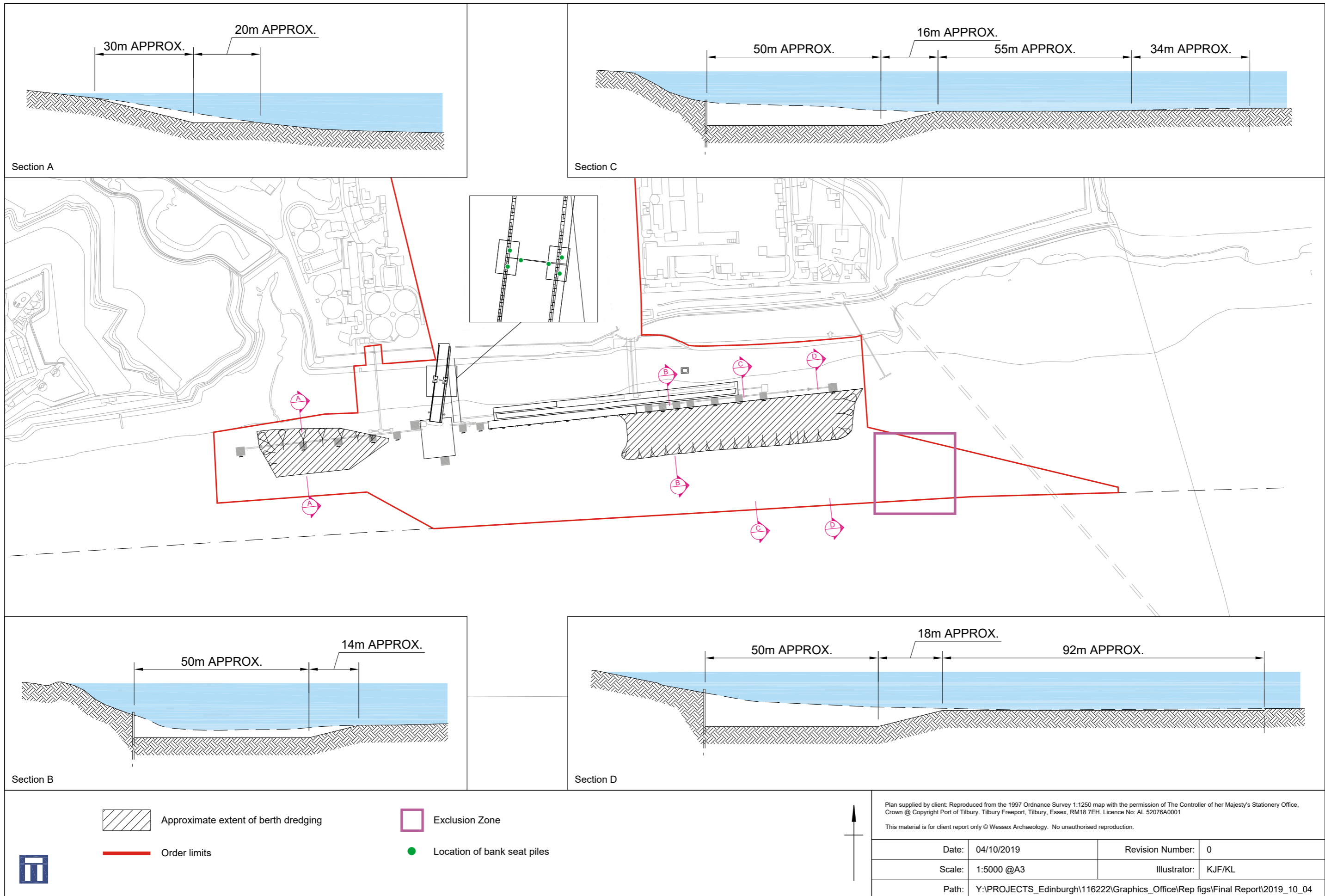
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UXO and diver survey features (Study Area East)

Figure 8









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