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Anholt Offshore Wind Farm

Underwater Archaeology

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RAMBØLL

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Abbreviations

KUAS	Kulturarvsstyrelsen (Heritage Agency of Denmark)
MSL	mean sea level
ROV	remotely operated vehicle
GEUS	Geological Survey of Denmark and Greenland
SSS	side scan sonar
DP	dynamically positioned
BP	before present

1. Summaries

1.1 Dansk resumé

De marinarkæologiske forekomster indenfor projektområdet og kabelkorridoren er beskrevet på baggrund af de geofysiske undersøgelser og Kulturarvsstyrelsen database med registreringer af fortidsminder. I alt syv uidentificerede objekter blev observeret i side scan sonar dataene (seks indenfor projektområdet og et indenfor kabel korridoren). Ved en senere visuel inspektion blev fire af disse objekter konkluderet som værende ikke relevante i relation til kulturarv. De resterende tre objekter (indenfor projektområdet) samt de magnetiske anomalier er ikke undersøgt nærmere og det vides derfor ikke, hvorvidt disse er af marinarkæologisk interesse. Oversvømmede stenalderbopladser kan være til stede indenfor projektområdet og kabelkorridoren, idet områderne omfattet af projektet har været landjord i de ældre perioder af stenalderen. En nærmere tolkning af stenalderlandskabet, skibsvrag og kulturhistoriske enkelt-objekter afventer det ansvarlige marinarkæologiske museums gennemgang af datagrundlaget.

Eventuelle marinarkæologiske forekomster kan under konstruktionsarbejdet blive påvirket af etableringen af vindmølle fundamenter, etableringen af erosionshæmmende foranstaltninger, opankring af arbejdsfartøjer, placeringer af 'ben' fra jack up platforme samt nedgravning af kabler. I driftsfasen kan marinarkæologiske forekomster blive påvirket af erosion omkring vindmøllefundamenter og opankring af servicefartøjer. En vurdering af effekten på eventuelle oversvømmede stenalderbopladser, skibsvrag og kulturhistoriske enkelt-objekter afventer det ansvarlige marinarkæologiske museums evaluering.

1.2 Summary

The cultural heritage of the project area and cable corridor has been described on the basis of geophysical surveys and available registers of maritime cultural heritage. A total of seven unidentified single objects were seen in the side scan sonar data (six within the project area and one within the cable corridor). During later visual inspections four of these were dismissed. The nature of the remaining three unidentified objects (all within the project area) and the magnetic anomalies is not confirmed and may therefore be objects of cultural heritage interest. Submerged Stone Age settlements may present within the project area and cable corridor, as these part of Kattegat have been dry land during the oldest stages of the Stone Age. The evaluation of the palaeolandscape, ship wrecks and single objects/anomalies awaits an expert review by the responsible maritime archaeological museum.

Cultural heritage may be impacted during construction by installation of wind turbine foundation, installation of scour protection, anchoring of vessel, positioning of jack up rigs and placement/burial of cable. During operation cultural heritage may be impacted by scouring around wind turbine foundations and anchoring of service vessels. The assessment of impact on the potential submerged Stone Age sites, ship

wrecks and single cultural heritage objects awaits the evaluation of survey data material by the responsible maritime archaeological museum.

2. Introduction

2.1 Background

In 1998 the Ministry of Environment and Energy empowered the Danish energy companies to build offshore wind farms of a total capacity of 750 MW, as part of fulfilling the national action plan for energy, Energy 21. One aim of the action plan, which was elaborated in the wake of Denmark's commitment to the Kyoto agreement, is to increase the production of energy from wind power to 5.500 MW in the year 2030. Hereof 4.000 MW has to be produced in offshore wind farms.

In the years 2002-2003 the two first wind farms was established at Horns Rev west of Esbjerg and Rødsand south of Lolland, consisting of 80 and 72 wind turbines, respectively, producing a total of 325,6 MW. In 2004 it was furthermore decided to construct two new wind farms in proximity of the two existing parks at Horns rev and Rødsand. The two new parks, Horns rev 2 and Rødsand 2, are going to produce 215 MW each and are expected to be fully operational by the end 2010.

The 400 MW Anholt Offshore Wind Farm constitutes the next step of the fulfilment of aim of the action plan. The wind farm will be constructed in 2012, and the expected production of electricity will cover the yearly consumption of approximately 400.000 households. Energinet.dk on behalf of the Ministry of Climate and Energy is responsible for the construction of the electrical connection to the shore and for development of the wind farm site, including the organization of the impact assessment which will result in the identification of the best suitable site for constructing the wind farm. Rambøll with DHI and other sub consultants are undertaking the site development including a full-scale Environmental Impact Assessment for the wind farm.

The present report is a part of a number of technical reports forming the base for the Environmental Impact Assessment for Anholt Offshore Wind Farm.

The Environmental Impact Assessment of the Anholt Offshore Wind Farm is based on the following technical reports:

- Technical Description
- Geotechnical Investigations
- Geophysical Investigations
- Metocean data for design and operational conditions
- Hydrography including sediment spill, water quality, geomorphology and coastal morphology
- Benthic Fauna
- Birds
- Marine mammals
- Fish
- Substrates and benthic communities

- Benthic habitat
- Underwater archaeology
- Visualization
- Commercial fishery
- Tourism and Recreational Activities
- Risk to ship traffic
- Noise calculations
- Air emissions

2.2 Content of specific memo

Cultural heritage can largely be defined as the record of past and present human activity – in this case with the focus on marine cultural environments, especially ship wrecks and submerged settlement sites from the Stone Age. It must be recognised that cultural heritage resources are finite, irreplaceable and non-renewable; each site may contain information that is both unique and previously unknown.

When planning a large-scale construction project, such as an offshore wind farm, it is important to pay appropriate attention to cultural-heritage sites in the region. Towards that end, desktop investigations and geophysical surveys have been performed to locate registered, previously unknown and potential cultural heritage sites.

This memo describes the results of the baseline investigations and assessment of impact on cultural heritage within the project area for the Anholt Offshore Wind Farm.

The underwater cultural heritage in the area has been described based on geophysical surveys and available archive information/databases. Furthermore the potential impact during construction, operation and decommissioning of a wind farm has been assessed.

3. Offshore wind farm

3.1 Project description

This chapter describes the technical aspects of the Anholt Offshore Wind Farm. For a full project description reference is made to /10/. The following description is based on expected conditions for the technical project; however, the detailed design will not be done until a developer of the Anholt Offshore Wind Farm has been awarded.

3.1.1 Site location

The designated investigation area for the Anholt Offshore Wind Farm is located in Kattegat between the headland Djursland of Jutland and the island Anholt - see Figure 3.1. The investigation area is 144 km^2, but the planned wind turbines must not cover an area of more than 88 km^2. The distance from Djursland and Anholt to the project area is 15 and 20 km, respectively. The area is characterised by fairly uniform seabed conditions and water depths between 15 and 20 m.

3.1.2 Offshore components

3.1.2.1 Foundations

The wind turbines will be supported on foundations fixed to the seabed. The foundations will be one of two types; either driven steel monopiles or concrete gravity based structures. Both concepts have successfully been used for operating offshore wind farms in Denmark /1/, /2/.

The monopile solution comprises driving a hollow steel pile into the seabed. A steel transition piece is attached to the pile head using grout to make the connection with the wind turbine tower.

The gravity based solution comprises a concrete base that stands on the seabed and thus relies on its mass including ballast to withstand the loads generated by the offshore environment and the wind turbine.

3.1.2.2 Wind turbines

The maximum rated capacity of the wind farm is by the authorities limited to 400 MW /3/. The farm will feature from 80 to 174 turbines depending on the rated energy of the selected turbines corresponding to the range of 2.3 to 5.0 MW.

Preliminary dimensions of the turbines are not expected to exceed a maximum tip height of 160 m above mean sea level for the largest turbine size (5.0 MW) and a minimum air gap of approximately 23 m above mean sea level. An operational sound power level is expected in the order of 110 dB(A), but will depend on the selected type of turbine.

The wind turbines will exhibit distinguishing markings visible for vessels and aircrafts in accordance with recommendations by the Danish Maritime Safety Administration

and the Danish Civil Aviation Administration. Safety zones will be applied for the wind farm area or parts hereof.

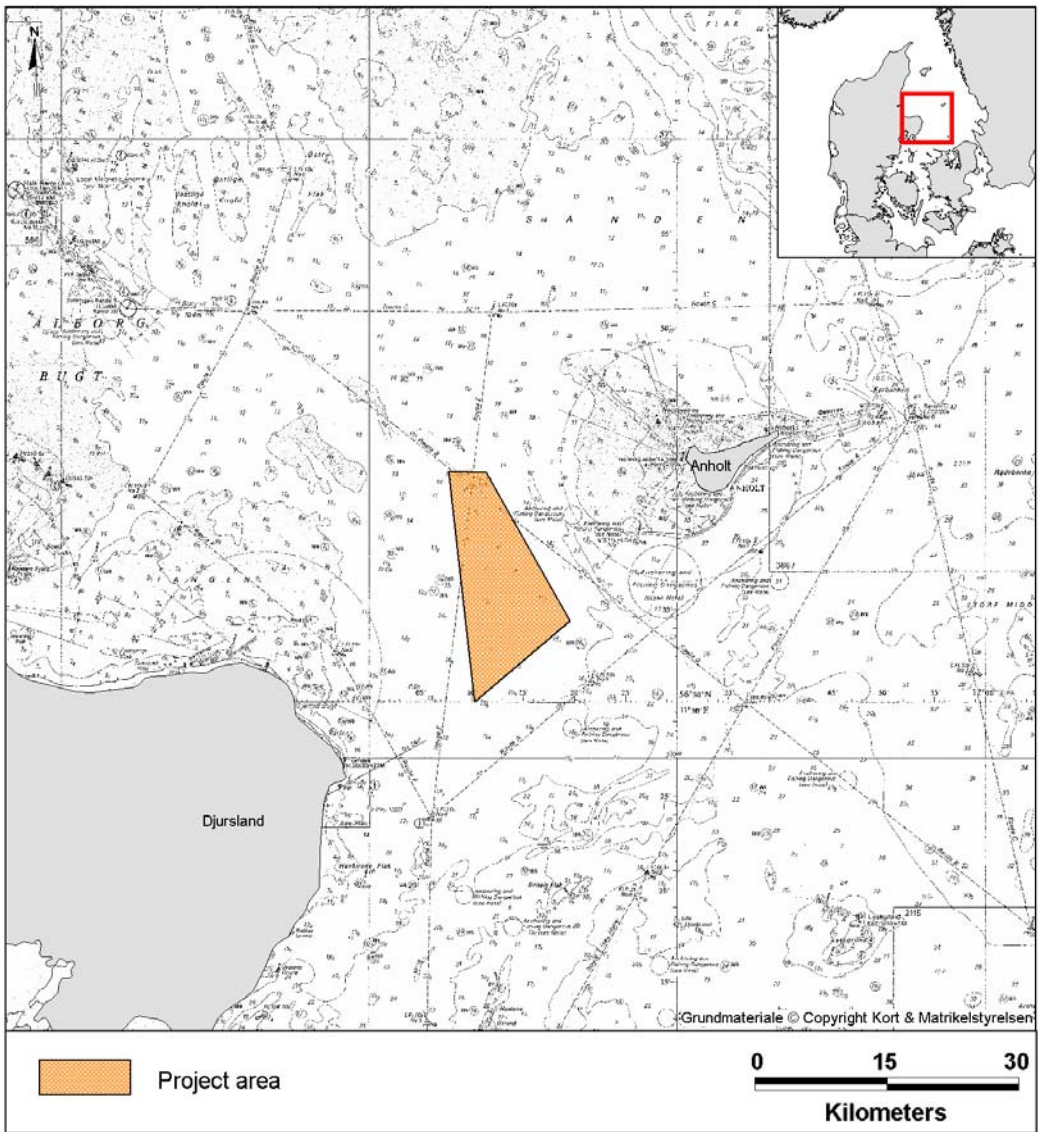


Figure 3.1 Location of the Anholt Offshore Wind Farm project area.

3.1.3 Installation

The foundations and the wind turbine components will either be stored at an adjacent port and transported to site by support barge or the installation vessel itself, or transported directly from the manufacturer to the wind farm site by barge or by the installation vessel.

The installation will be performed by jack-up barges or floating crane barges depending on the foundation design. A number of support barges, tugs, safety vessels and personnel transfer vessels will also be required.

Construction activity is expected for 24 hours per day until construction is complete. Following installation and grid connection, the wind turbines are commissioned and are available to generate electricity.

A safety zone of 500 m will be established to protect the project plant and personnel, and the safety of third parties during the construction and commissioning phases of the wind farm. The extent of the safety zone at any one time will be dependent on the locations of construction activity. However the safety zone may include the entire construction area or a rolling safety zone may be selected.

3.1.3.1 Wind turbines

The installation of the wind turbines will typically require one or more jack-up barges. These vessels stand on the seabed and create a stable lifting platform by lifting themselves out of the water. The area of seabed taken by a vessels feet is approximately 350 m^2 (in total), with leg penetrations of up to 2 to 15 m (depending on seabed properties). These holes will be left to in-fill naturally.

3.1.3.2 Foundations

The monopile concept is not expected to require any seabed preparation.

The installation of the driven monopiles will take place from either a jack-up platform or an anchored vessel. In addition, a small drilling spread may be adopted if driving difficulties are experienced. After transportation to the site the pile is transferred from the barge to the jack-up and then lifted into a vertical position. The pile is then driven until target penetration is achieved, the hammer is removed and the transition piece is installed.

For the gravity based foundations the seabed needs most often to be prepared prior to installation, i.e. the top layer of material is removed and replaced by a stone bed. The material excavated during the seabed preparation works will be loaded onto split-hopper barges for disposal. There is likely to be some discharge to water from the material excavation process. A conservative estimate is 5% material spill, i.e. up to 200 m^3 for each base, over a period of 3 days per excavation.

The installation of the concrete gravity base will likely take place using a floating crane barge, with attendant tugs and support craft. The bases will either be floated and towed to site or transported to site on a flat-top barge. The bases will then be lowered from the barge onto the prepared stone bed and filled with ballast.

After the structure is placed on the seabed, the base is filled with a suitable ballast material, usually sand. A steel ‘skirt’ may be installed around the base to penetrate into the seabed and to constrain the seabed underneath the base.

3.1.4 Protection systems

3.1.4.1 Corrosion

Corrosion protection on the steel structure will be achieved by a combination of a protective paint coating and installation of sacrificial anodes on the subsea structure. The anodes are standard products for offshore structures and are welded onto the steel structures.

3.1.4.2 Scour

If the seabed is erodible and the water flow is sufficient high a scour hole will form around the structure. The protection system normally adopted for scour consists of rock placement in a ring around the in-situ structure. The rock will be deployed from the host vessel either directly onto the seabed from the barge, via a bucket grab or via a telescopic tube.

For the monopile solution the total diameter of the scour protection is assumed to be 5 times the pile diameter. The total volume of cover stones will be around 850-1,000 m^3 per foundation. For the gravity based solution the quantities are assessed to be 800–1100 m^3 per foundation.

3.2 Baseline study

3.2.1 General

The cultural heritage in Kattegat primarily consists of two broad categories of underwater cultural heritage sites: ship wreck sites and submerged settlements/landscapes.

3.2.1.1 Ship wrecks

Ship wreck sites reflect a very varied group of vessels distributed in age, sizes and types. Some ship wrecks are of no archaeological interest, whereas others are unique for one reason or another. The integrity of ship wreck sites depends on a number of factors, in particular the manner in which the vessel was wrecked, the conditions on the seabed and later disturbances such as trawling.

A ship wreck must however not necessarily be intact in order to be of archaeological interest. Some even largely degraded ship wrecks can yield valuable information by thorough investigations of hull remains, equipment, cargo and other artefacts belonging to the wreck. It is therefore important to recognize that the “ancient monument area” of a wreck-site is not only the hull itself, but includes the total deposit and distribution area of remains from a broken wreck, which in many cases is substantially larger than the actual hull.

Side scan sonar (SSS) is one of the preferred instruments in locating wreck sites. Wrecks with high relief or of large dimensions are easily located during SSS surveys. Smaller and/or degraded wrecks are less obvious on the sea bed, especially in areas with many irregular bottom features (rocky outcrops or boulders).

Ship wrecks sunk more than 100 years ago are protected according to Danish legislation (Museumsloven).

3.2.1.2 Submerged settlements and landscapes

Since the last glaciation the Kattegat has undergone major environmental changes. The global warming at the end of the last glacial period led to rising sea levels, which combined with isostatic changes of land masses caused great changes in the coastlines of Denmark /Reference 6, Reference 7/. These changes were neither uniform nor constant. The changing sea levels caused some former land areas to become submerged, thus also submerging human settlements, monuments and the landscapes around them, whereas other areas have been raised above sea level.

The preservation potential of submerged settlements is in many cases far better than that of sites on dry land. Particularly organic materials may be preserved in a fine state. The submerged settlements therefore represent a unique opportunity to gain knowledge of former ways of living.

3.2.2 Methods

3.2.2.1 Data

The baseline study is a combined desk top and field study and is based on an evaluation of survey data gathered in relation to the project and an evaluation of data from finds database /Reference 9/.

3.2.2.2 Field survey

A geophysical survey was conducted by GEUS in April 2009 within the 144 km^2 project area and along the cable corridor. The survey data was acquired using the following instruments: side scan sonar, chirp, sparker, multibeam echosounder and marine caesium magnetometer. The geophysical survey served many purposes, but in relation to cultural heritage the survey was aimed at locating targets from the side scan sonar data, locating magnetic anomalies with the magnetometer and mapping the Quaternary surface using chirp and sparker (seismic instruments). The seismic survey was performed according to specifications requested by Moesgaard Museum and KUAS. For further specific information on the survey campaigns the reader is referred to Reference 1 and Reference 2.

In addition to the geophysical survey a number of locations were inspected visually, either by diver or ROV.

3.2.2.3 Archival research

An inventory of known archaeological sites within the project area has been made on the basis of available data. Data has been extracted from the finds databases of KUAS /Reference 9/ and the local responsible museum (Moesgaard Museum) has been requested for additional information.

3.2.3 Baseline description

In the following sections the baseline conditions within the project area in relation to cultural heritage are presented. The baseline descriptions are based on the data material described in the sections above. Baseline conditions related to the cable corridor and substation are described in chapter 4.

3.2.3.1 Results of side scan sonar survey

In the initial review of side scan sonar data a total of 7 unidentified objects were pointed out by GEUS from the material. At a later stage this number was revised to 6 objects, as two objects (WF_0004 and WF_005) turned out to be the same object (picked out from parallel survey lines) /Reference 1/.

No wrecks or clusters of objects were observed in the side scan sonar data /Reference 1/.

The unidentified objects are illustrated in appendix 1 and their location can be seen in Figure 3-2.

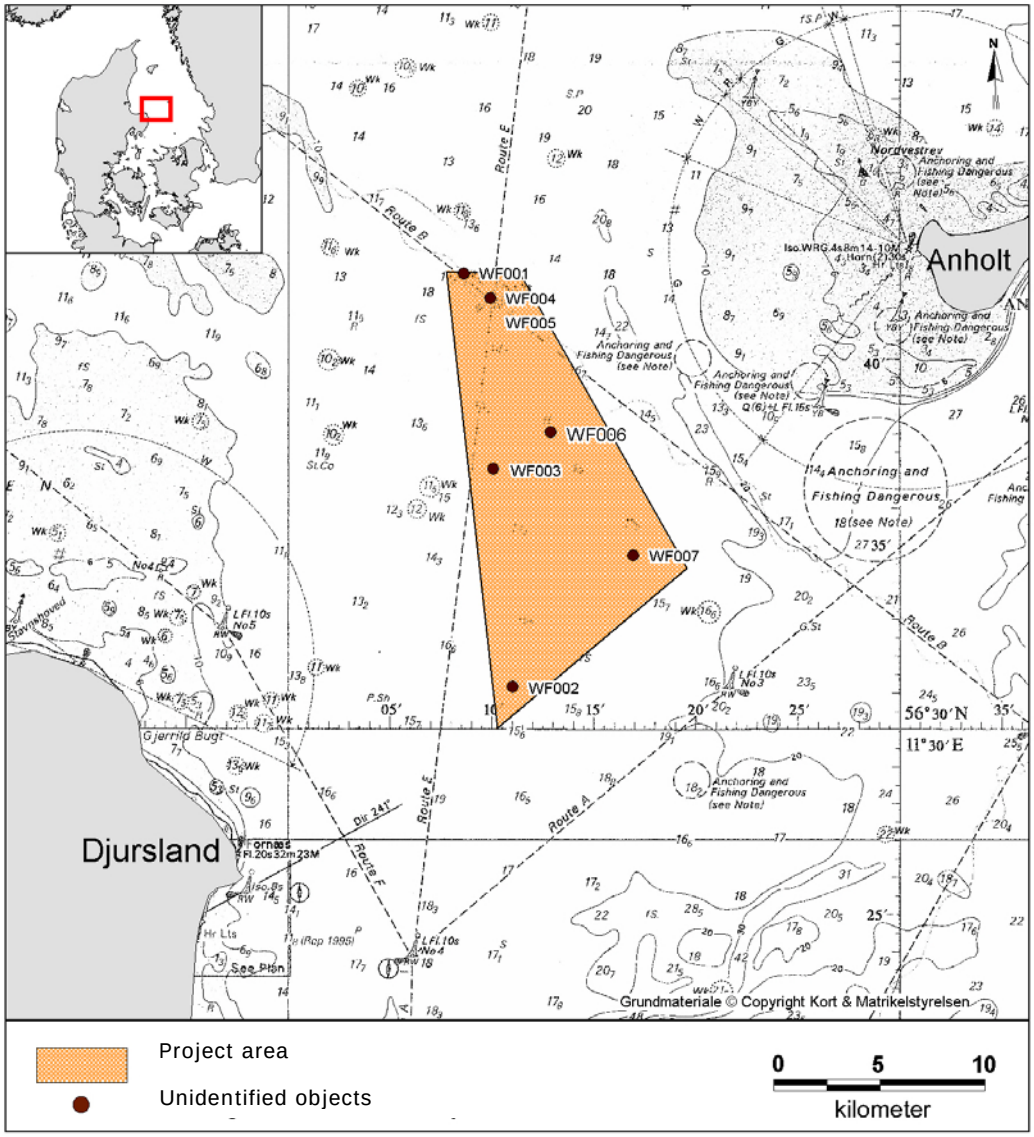


Figure 3-2 Location of unidentified objects located by side scan sonar

3.2.3.2 **Results of magnetometer survey**

A total of 133 magnetic anomalies were picked out by GEUS from the survey material /Reference 1/. Each anomaly was compared to the corresponding side scan sonar image from the location. In most cases no clear objects were observed in the side scan images at the locations of the anomalies. The causes of the anomalies are therefore unknown and probably hidden in the sediments. Magnetic anomalies smaller than +/- 20 nT are usually dismissed as being insignificant /Reference 3/.

Within the project area two negative and four positive magnetic anomalies are larger than 20 nT. The location and magnitude of the anomalies is illustrated in Figure 3-3 below. A list of anomalies larger than 20 nT can be seen in appendix 2.

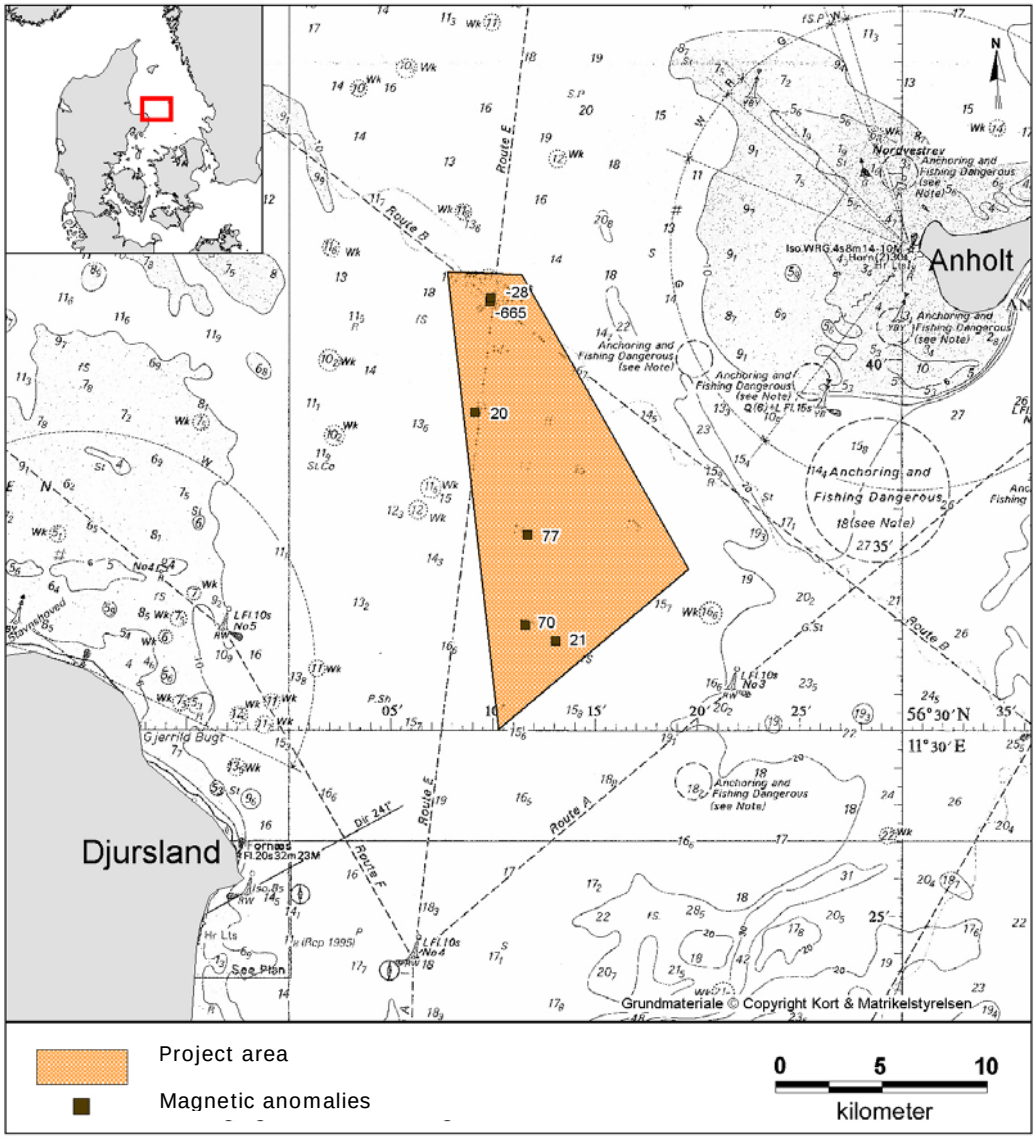


Figure 3-3 Location and magnitude (nT) of magnetic anomalies within the project area

The two magnetic anomalies situated in the northern part of the project area correspond to the unidentified objects WF_004/WF_005. The remaining anomalies do not correspond to objects from side scan sonar or the KUAS database.

3.2.3.3 **Results of seismic survey**

Contour maps of the top glacial surface and top late glacial (bottom Holocene) surfaces have been compiled from the combined sparker and chirp data. The maps can be seen in appendix 3 and 4 and in /Reference 1/.

The contour map of the top glacial (appendix 3) illustrates that the glacial surface is located deepest in the northern part of the project area and shallowest in the southern part of the project area. The top of the glacial surface is nowhere within the project area situated shallower than 16 meters below MSL.

The bottom Holocene map in appendix 4 shows that the upper surface of the late glacial deposits is located 14 meters below MSL or deeper within the project area.

3.2.3.4 **Results of visual inspections**

Two of the locations, where unidentified objects were located during the side scan survey, were visually inspected by diver or ROV in May 2009 /Reference 8/.

A diver searched the location of object WF_002, but no object was observed. Object WF_003 was visually inspected by ROV. The object turned out to be a large boulder.

Furthermore the location of object WF_004/WF_005 corresponded with a navigational buoy and is therefore believed to be the mooring block and chain of the buoy /Reference 8/.

Objects WF_001, WF_006 and WF_007 from the sidescan sonar survey and the magnetic anomalies have not been visually inspected and identified.

3.2.3.5 **Finds database (KUAS)**

A total of 14 registrations are present within the project area /Reference 9/. None of the registrations can be directly correlated with the results of the geophysical survey.

Figure 3-4 gives an overview of the distribution of registrations within the project area. The registrations from the finds database can be seen in appendix 5.

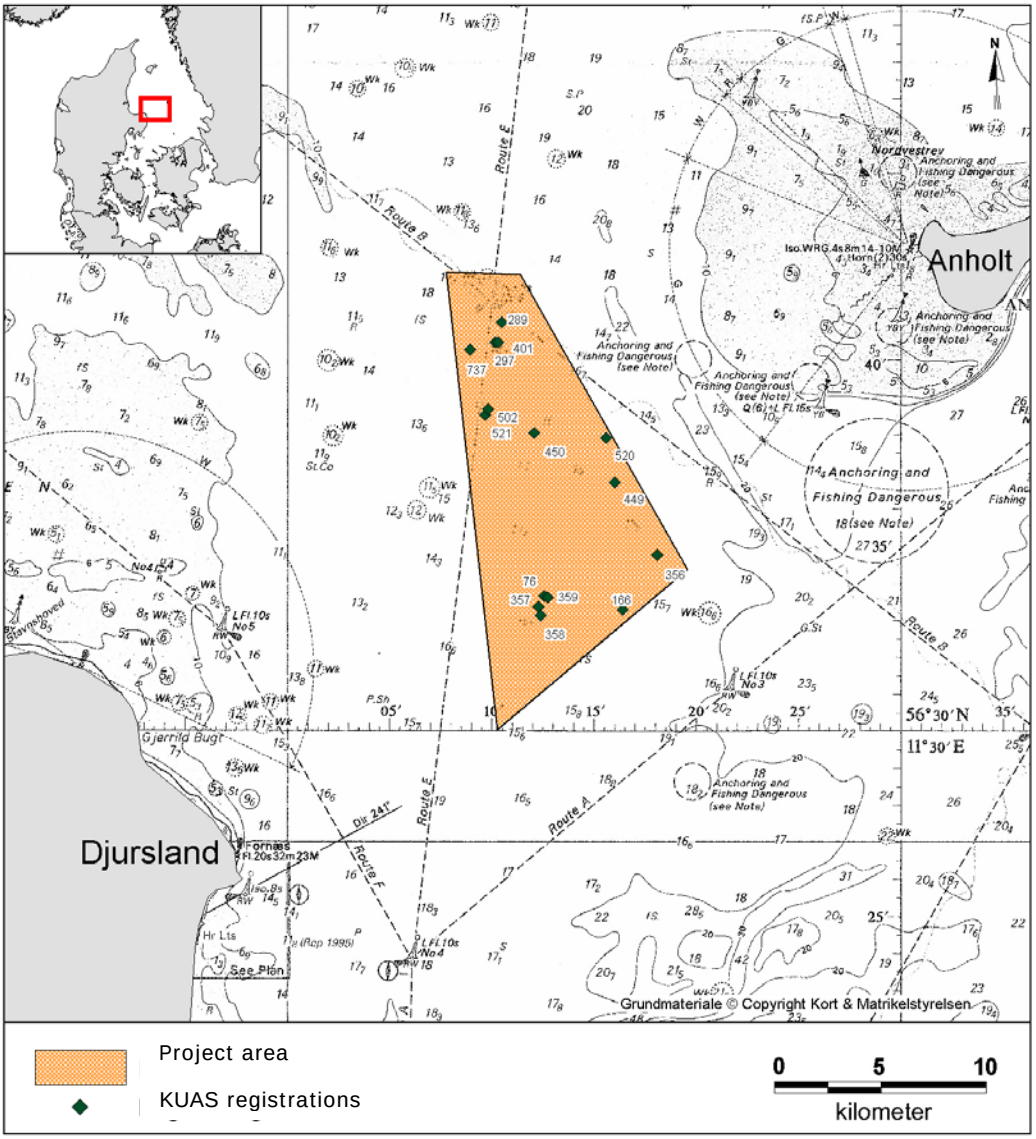


Figure 3-4 Location of registrations from the finds database

Two of the registrations refer to a ship wreck, which has been salvaged and no longer is present within the project area (loc.no. 297 and 401).

Other two registrations (loc.no. 166 and 737) are ‘snag registrations’, reported by fishermen. The snags may or may not be of archaeological interest as their nature has not been confirmed before registration in the finds database. When investigated ‘snag registrations’ often turn out to be boulders, dumped objects from contemporary shipping or something completely different. The positions of the snags may also be uncertain because of imprecise positioning (approximate location of trawl at the time of ‘snagging’, imprecise Decca-readings, etc.).

Registration loc.no. 356 and 359 refer to a WWII landing craft and an iron wreck respectively.

Two registrations (loc.no. 76 and 357) refer to the vessel 'Agnete'. The vessel was wrecked in august 1898 and its mast was removed by Farvandsvæsenet in 1898. The location reported at that time is naturally somewhat imprecise, as positioning methods were crude at the time. A search for the wreck by Farvandsvæsenet in 1979 was unsuccessful and the wreck registration was removed from the navigational maps. It is therefore most likely, that the wreck is situated somewhere outside the surveyed project area.

The remaining registrations are unspecified wreck registrations. The registrations are based on reports from one or more fishermen in the area. The undefined wreck registrations are to be considered with the same scepticism as the snag registrations.

3.2.3.6 Summary – wrecks and objects

Due to the uncertainties connected with the 'snag' data and the wreck registrations from the finds database (described in section 3.2.2.3), the registrations have only been presented as reference. It is for example highly unlikely that the WWII landing craft would not have been found in the geophysical survey, if it in fact was situated within the project area. It is much more likely that the reported location of its sinking is imprecise.

No obvious wrecks or clusters of anthropogenic objects have been located during the geophysical survey, even though the finds database contains a number of wrecks registered /Reference 9/.

Three single unidentified objects located by GEUS during the geophysical surveys have not been investigated (WF_001, WF_006 and WF_007). Object WF_001 is oblong and located at the northernmost boarder of the project area. Object WF_006 is located approximately in the middle of the project area. Object WF_007 resembles a rope or similar and may therefore be lost fishing or anchoring equipment. The side scan images of the unidentified objects are presented in appendix 1.

However the three objects (from sidescan sonar) and the four southernmost magnetic anomalies have not been inspected visually and their nature is unknown.

3.2.3.7 Summary – Submerged Stone Age landscapes

A review of relative sea level changes and the late glacial and glacial surfaces is presented below in order to assess the possible presence of submerged Stone Age settlements and landscapes within the project area.

The geological facies interpreted from the bottom penetrating geophysical survey indicates that the late glacial geology consist of proximal to distal glaciogenic sediments (non-marine) changing gradually into an ice lake environment /Reference 1/. This corresponds well to Figure 3-5 where the area between Anholt and Djursland is illustrated as being dry land at around 11.500 BP /Reference 6/. It must however be

noted, that the map presented below originates from a project focused on the Baltic Sea and southern parts of Kattegat.

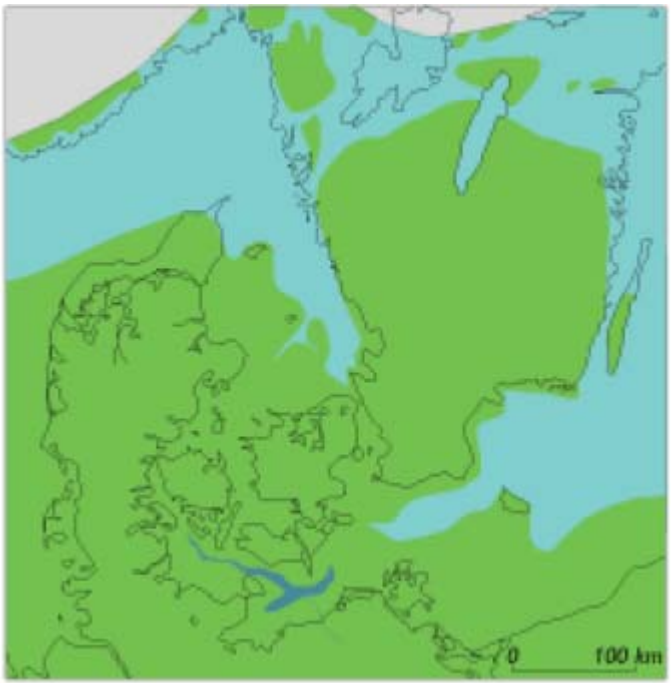


Figure 3-5 Palaeogeographical map of conditions at 11.500 BP (From Reference 6)

As illustrated above the project area has been dry land during the oldest parts of the Stone Age. An assessment of the potential presence of submerged Stone Age settlement sites therefore needs further interpretations of the features of the palaeolandscape.

If the relief of the Stone Age landscape is not destroyed by erosion, it is usually possible to make predictions about the likely locations of submerged Stone Age settlements. Through the last decades “the fishing site model” has been successfully used to predict locations of submerged Stone Age settlements. The model is based on the knowledge that the Stone Age population was largely dependent on gaining food from the sea. Experience has shown that the Stone Age people had very clear preferences for locations of settlements in specific landscape settings that were favourable for fishing /Reference 5/. However for the earliest stages of the Stone Age it is believed that the hunters tracked the reindeer herds and that settlement remains therefore are usually to be found along the reindeer migration routes in the higher parts of the landscape.

Before an interpretation of the Stone Age palaeolandscape has been made by the responsible maritime archaeological museum, the potential presence of submerged Stone Age settlement sites cannot be neither confirmed nor dismissed.

3.3 Environmental impacts

3.3.1 Method for impact assessment

For the following impact assessment a 'worst case scenario' is anticipated as the final layout of the wind farm is not known. With regards to cultural heritage a 'worst case scenario' will imply the largest number of wind turbines with the deepest and widest foundations, largest number of cables with the deepest placement, largest number of jack up rigs and anchor positioned vessels.

A summary of the overall significance of the potential impacts are given at the end of each section.

Table 3-1 Criteria used in the environmental impact assessment for the off-shore wind farm.

Intensity of effect	Scale of effect	Duration of effect	Overall significance of impact[1]
No	Local	Short-term	No impact
Minor	Regional	Medium-term	Minor impact
Medium	National	Long-term	Moderate impact
Large	Transboundary		Significant impact

[1]: Evaluation of overall significance of impact includes an evaluation of the variables shown and an evaluation of the sensitivity of the resource/receptor that is assessed.

3.3.2 Impacts during the construction phase

The following potential impacts, which might occur during construction, have been assessed:

- impact from installation of wind turbine foundations and scour protection
- impact from positioning of jack up rigs and anchoring of vessels
- impact from placement and burying of cables between wind turbines

3.3.2.1 Impact from installation of wind turbine foundation and scour protection

As described in section 3.1 the foundations for the wind turbines of the wind farm are likely to be either driven steel monopiles or concrete gravity base foundations. Gravity base foundations occupy a larger area on the sea bed, but penetrate less into the sea bed than the driven steel monopiles, which penetrate up to 30 meters into the sea floor. The physical impact of installation of either type of foundations may cause damage to cultural heritage, if any are present where the foundations are placed.

Installation of scour protection in the form of dumped gravel/rocks or mats may damage cultural heritage by the physical impact of its placement on the sea bed. Cultural heritage sites or objects covered by scour protection will also be rendered inaccessible, thereby hindering future archaeological investigation.

3.3.2.2 Impact from positioning of jack up rigs and anchoring of vessels

Cultural heritage can be damaged by anchoring. Even small ships generate great force on their anchors and can cause significant damage to objects, if the anchor gets hold of it /Reference 4/. Positioning of the support legs of jack-up barges may also cause damage to cultural heritage objects or sites, if any are located underneath the jack-up barge. The damage is both immediate and long term. The immediate damage is obvious, as the object's structure may be broken apart by the forces exerted to it. On the long term the structures of objects not immediately broken are weakened due to the forces previously exerted on it, leading to an accelerated collapse.

3.3.2.3 Impact from placement and burying of cables between wind turbines

All sub-sea cables will be buried in order to provide protection of the cables. The expected burial depth is minimum one meter. Burial of cables is likely to be done by underwater plough or high pressure water jets. In either case cultural heritage sites or objects situated along the cable routes between the wind turbines will be disturbed and (in the worst case) destroyed, if any such are present along the cable routes.

3.3.2.4 Summary of impact on cultural heritage during construction

Table 3-2 shows a summary of the impacts on wrecks during construction.

Table 3-2 Summary of impact on cultural heritage during construction

Impact	Intensity of effect	Scale/geographical extent of effect	Duration of effect	Overall significance of impact
Installation of foundations and scour protection	*	Local	Long-term	*
Anchoring of vessels and positioning of jack up rigs	*	Local	Long-term	*
Placement and burial of cables	*	Local	Long-term	*

* Before an interpretation of the Stone Age palaeolandscape and the un-inspected objects/anomalies has been made by the responsible maritime archaeological museum, the potential presence of submerged Stone Age settlement sites, ship wrecks and single cultural heritage objects cannot be neither confirmed nor dismissed. Consequently the impact during construction on the underwater cultural heritage cannot be assessed at the current level of knowledge.

3.3.3 Impacts during the operation phase

The following potential impacts, which might occur during operation, have been assessed:

- indirect impact from changed sedimentation/erosion pattern around turbine foundations
- direct impact from anchoring of vessel during servicing

3.3.3.1 Indirect impact from changes in sedimentation pattern

The placement of wind turbine foundations on the sea floor may lead to a localised removal of sediments around the base of the wind turbine foundation. In wind turbine design the scour problem can be addressed by either allow for scour in the design of the foundation or by installing scour protection around the foundations.

If the design allows for scour, then cultural heritage objects may be exposed by the removal of sediments within the scour zone. Exposure of objects may lead to an accelerated degradation of particularly objects made of organic materials.

3.3.3.2 Direct impact from anchoring of vessel during servicing

The impact on cultural heritage from anchoring of vessels during servicing is similar to the impact of anchoring of vessels during construction, described in the section above.

3.3.3.3 Summary of impact on cultural heritage during operation

Table 3-3 shows a summary of the impacts on cultural heritage during operation.

Table 3-3 Summary of impacts on cultural heritage during operation

Impact	Intensity of effect	Scale / geographical extent of effect	Duration of effect	Overall significance of impact
Changed sedimentation/erosion pattern	*	Local	Long-term	*
Anchoring of vessels	*	Local	Long-term	*

*Before an interpretation of the Stone Age palaeolandscape and the un-inspected objects/anomalies has been made by the responsible maritime archaeological museum, the potential presence of submerged Stone Age settlement sites, ship wrecks and single cultural heritage objects cannot be neither confirmed nor dismissed. Consequently the impact during operation on underwater cultural heritage cannot be assessed at the current level of knowledge.

3.4 Mitigation measures

By engaging in detailed geophysical surveying and desktop investigations potential impact has been mitigated in the sense, that locating cultural heritage sites is a prerequisite for avoiding impact.

Furthermore an expert evaluation by the responsible maritime archaeological museum will ensure the best possible evaluation of the cultural heritage conditions within the project area.

If sites of for example submerged Stone Age settlements, ship wrecks or single cultural heritage objects are located during the expert evaluation, a plan for the safeguarding of the archaeological information will be devised in cooperation with the responsible maritime archaeological museum and KUAS.

3.5 Cumulative effects

No negative cumulative effects on cultural heritage sites, ship wrecks or objects are expected.

3.6 Decommissioning

The potential impact from decommissioning is similar the potential impact from the construction phase.

3.7 Technical deficiencies or lack of knowledge

The survey data and reports on which the impact assessment has been made has not yet been analysed by the responsible maritime archaeological museum, Moesgaard Museum. An expert evaluation of the underwater cultural heritage is therefore not part of the present impact assessment and will be conducted before establishing the wind farm.

3.8 Conclusions concerning Anholt Offshore Wind Farm

A summary of the overall potential impact on underwater cultural heritage within the project area is given below in Table 3-4.

Table 3-4 Summary of overall potential impact

Impacts	Overall significance of impact	Quality of available data
IMPACTS ON SUBMERGED STONE AGE SITES, SHIP WRECKS AND SINGLE OBJECTS		
See below *	*	1

*Before an interpretation of the Stone Age palaeolandscape and the un-inspected objects/anomalies has been made by the responsible maritime archaeological museum, the potential presence of submerged Stone Age settlement sites, ship wrecks or single cultural heritage objects cannot be neither confirmed nor dismissed. Consequently the impact of the Anholt Offshore Wind Farm on underwater cultural heritage cannot be assessed at the current level of knowledge.

The principles for the evaluation of potential impacts, the significance rating of the assessed impacts and the quality of data/documentation, which the impact assessment is based on, are presented below in Table 3-5.

Table 3-5 Rating of data quality

Quality of availably data

In order to evaluate the quality and significance of data and documentation for the impact assessment a significance rating of data and documentation should be evaluated within the specific technical subject topics using the following categories:

- 1 – Limited (scattered data, some knowledge)
- 2 – Sufficient (scattered data, field studies, documented)

- 3 – Good (time series, field studies, well documented)

For the EIA-document an impact arising from a planned activity will, depending on its magnitude and the environmental sensitivity, be given a significance rating as follows:

: No impact	*No impact*: There will be no impact on structure or function in the affected area;
: Minor impact	*Minor impact*: The structure or functions in the area will be partially affected, but there will be no impacts outside the affected area;
: Moderate Impact	*Moderate Impact*: The structure or function in the area will change, but there will be no significant impacts outside the affected area;
: Significant impact	*Significant impact*: The structure or function in the area will change, and the impact will have effects outside the area as well;

4. Transformer platform and offshore cable

4.1 Project description

An offshore transformer platform will be established to bundle the electricity produced at the wind farm and to convert the voltage from 33 kilovolts to a transmission voltage of 220 kilovolts, so that the electric power generated at the wind farm can be supplied to the Danish national grid.

4.1.1 Transformer platform

Energinet.dk will build and own the transformer platform and the high voltage cable which runs from the transformer platform to the shore and further on to the existing substation Trige, where it is connected to the existing transmission network via 220/440 kV transformer.

The transformer platform will be placed on a location with a sea depth of 12-14 metres. The length of the export cable from the transformer station to the shore of Djursland will be approximately 25 km. On the platform the equipment is placed inside a building. In the building there will be a cable deck, two decks for technical equipment and facilities for emergency residence.

The platform will have a design basis of up to 60 by 60 metres. The top of the platform will be up to 25 metres above sea level. The foundation for the platform will be a floating caisson, concrete gravitation base or a steel jacket.

4.1.2 Subsea cabling

The wind turbines will be connected by 33 kV submarine cables, so-called inter-array cables. The inter-array cables will connect the wind turbines in groups to the transformer platform. There will be up to 20 cable connections from the platform to the wind turbines. From the transformer platform a 220 kV export cable is laid to the shore at Saltbæk north of Grenå. The cables will be PEX insulated or similar with armouring.

The installation of the cables will be carried out by a specialist cable lay vessel that will manoeuvre either by use of a four or eight point moving system or an either fully or assisted DP (Dynamically Positioned) operation.

All the subsea cables will be buried in order to provide protection from fishing activity, dragging of anchors etc. A burial depth of minimum one meter is expected. The final depth of burial will be determined at a later date and will vary depending on more detailed soil condition surveys and the equipment selected.

The cables will be buried either using an underwater cable plough that executes a simultaneous lay and burial technique that mobilises very little sediment; or a Remotely Operated Vehicle (ROV) that utilises high-pressure water jets to fluidise a

narrow trench into which the cable is located. The jetted sediments will settle back into the trench.

4.1.3 Onshore components

At sea the submarine cable is laid from a vessel with a large turn table. Close to the coast, where the depth is inadequate for the vessel, floaters are mounted onto the cable and the cable end is pulled onto the shore. The submarine cable is connected to the land cable close to the coast line via a cable joint. Afterwards the cables and the cable joint are buried into the soil and the surface is re-established.

On shore the land cable connection runs from the coast to compensation substation 2-3 km from the coast and further on to the substation Trige near Århus. At the substation Trige a new 220/400 kV transformer, compensation coils and associated switchgear will be installed. The onshore works are not part of the scope of the Environmental Statement for the Anholt Offshore Wind Farm. The onshore works will be assessed in a separate study and are therefore not further discussed in this document.

4.2 Baseline study

4.2.1 Method

Investigations similar to the project area have been made within the cable corridor between the project area and landfall. The reader is therefore referred to section 3.2.2 for description of methods. An overview of the cable corridor and the substation can be seen in Figure 4-1.

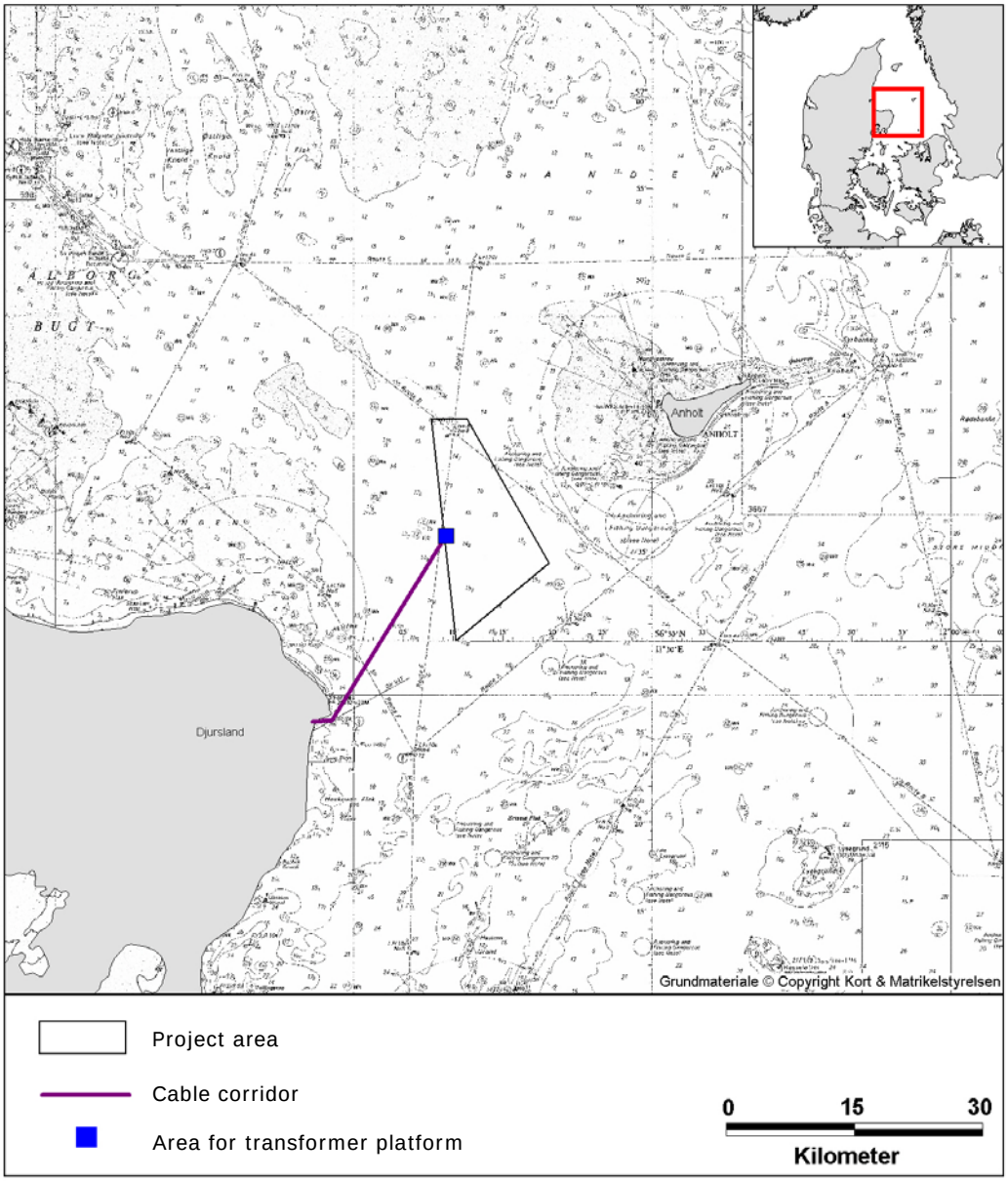


Figure 4-1 Cable corridor and location of substation

4.2.2 Baseline description

In the following section the baseline conditions related to cultural heritage within the cable corridor are presented. The baseline description of the cable corridor is based on the survey described in /Reference 2/. The baseline description of the substation is based on /Reference 1, Reference 8, Reference 9/.

4.2.2.1 Wrecks and objects

Cable corridor:

No magnetic anomalies larger than 20 nT (+/-) were identified within the cable corridor.

Within the cable corridor 1 unidentified object was picked out by GEUS from the SSS data, see figure below. The object was later identified as a broken fishery wire during the diver inspections /Reference 2/.

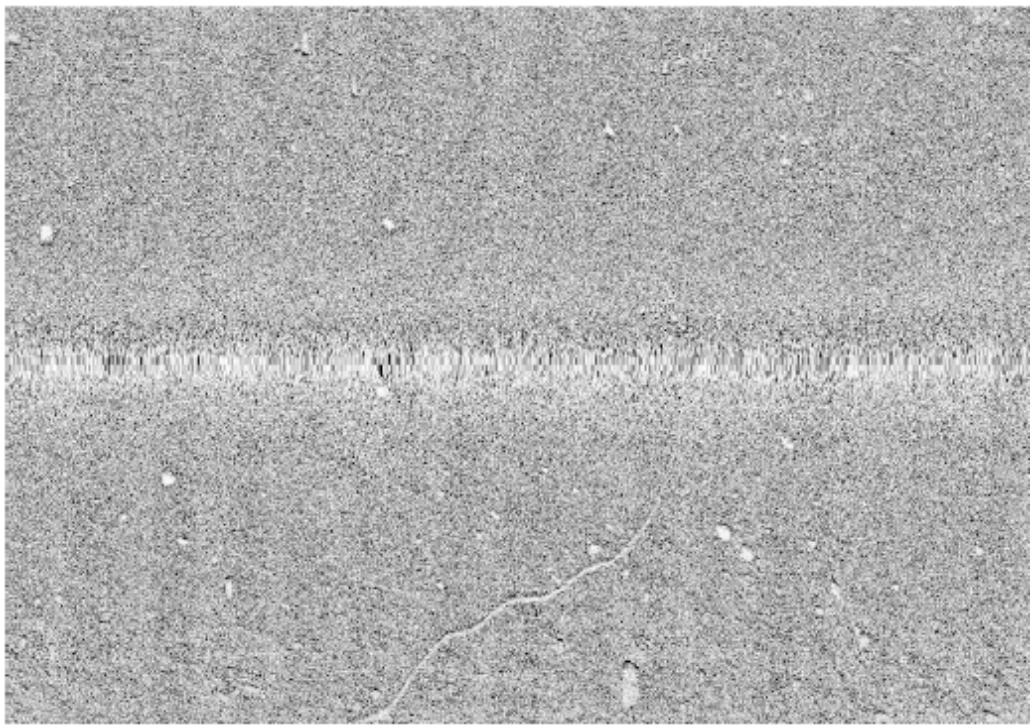


Figure 4-2 Object identified as broken fishery wire /Reference 2/

Transformer platform:

At the planned location of the substation objects or magnetic anomalies have been identified from survey or the KUAS finds database /Reference 1, Reference 9/.

4.2.2.2 Submerged Stone Age landscapes

Cable corridor:

The cable corridor stretches across various ranges of water depth from the project area to the landfall. As illustrated in section 3.2.3 the relative sea level was once lower than the present day sea level. The cable corridor therefore crosses the palaeocoastlines between the project area and the landfall and submerged Stone Age settlements may be present along the cable route.

Transformer platform:

Conditions related to the Stone Age palaeolandscape are similar to those described in section 3.2.3 as the substation is situated within the project area.

4.3 Environmental impacts

4.3.1 Method

For the following impact assessment a 'worst case scenario' is anticipated. With regards to cultural heritage a 'worst case scenario' will imply the deepest and widest foundation for the substation, the deepest burial of cables and the use of anchor positioned vessels.

A summary of the overall significance of the potential impacts are given at the end of each section. The criteria used are similar to those presented in table 3.1.

4.3.2 Impacts during the construction phase

The following potential impacts, which might occur during construction, have been assessed:

- Direct impact from placement and burial of cables
- Direct impact from anchoring of cable laying vessel
- Direct impact from installation of substation foundation

4.3.2.1 Impact from placement and burying of cables

All sub sea cables will be buried in order to provide protection of the cables. The expected burial depth is minimum one meter. Burial of cables is likely to be done by underwater plough or high pressure water jets. In either case cultural heritage sites or objects within the cable corridor will be disturbed and (in the worst case) destroyed, if any such are present along the cable routes.

4.3.2.2 Impact from anchoring of cable laying vessel

Underwater cultural heritage can be damaged by anchoring. Even small ships generate great force on their anchors and can cause significant damage to objects, if the anchor gets hold of them /Reference 4/. The damage is both immediate and long term. The immediate damage is obvious, as the object's structure may be broken apart by the forces exerted to it. On the long term the structures of objects not immediately broken are weakened due to the forces previously exerted on it, leading to an accelerated collapse. If a DP vessel is used, there will be no impact from anchoring.

4.3.2.3 Impact from installation of substation foundation

The potential impact from installation of the substation foundation will be similar to the potential impact from construction of the wind turbine foundations, see section 3.3.2.1.

4.3.2.4 Summary of impact on cultural heritage

Table 4-1 shows a summary of the impacts on cultural heritage during construction.

Table 4-1 Summary of impact on cultural heritage during construction

Impact	Intensity of effect	Scale / geographical extent of effect	Duration of effect	Overall significance of impact
Anchoring of cable laying vessel	*	Local	Long-term	*
Placement and burial of cables	*	Local	Long-term	*
Installation of substation foundation	*	Local	Long-term	*

*Before an interpretation of the Stone Age palaeolandscape and an assessment of the survey data has been made by the responsible maritime archaeological museum, the potential presence of submerged Stone Age settlement sites, ship wrecks or single cultural heritage objects cannot be neither confirmed nor dismissed. Consequently the impact during construction on underwater cultural heritage cannot be assessed at the current level of knowledge.

4.3.3 Impacts during the operation phase

Activities such as routine inspections of subsea cables and maintenance works at the substation do not interfere with the seabed in the cable corridor or at the substation. Hence no impact during the operation phase is anticipated.

4.4 Mitigation measures

By engaging in detailed geophysical surveying and desktop investigations potential impact has been mitigated in the sense, that locating cultural heritage sites is a prerequisite for avoiding impact.

Furthermore an expert evaluation by the responsible maritime archaeological museum will ensure the best possible evaluation of the cultural heritage conditions within the project area.

If sites of for example submerged Stone Age settlements, ship wrecks or single cultural heritage objects are located during the expert evaluation, a plan for the safeguarding of the archaeological information will be devised in cooperation with the responsible maritime archaeological museum and KUAS.

4.5 Cumulative effects

No cumulative effects are anticipated.

4.6 Decommissioning

The potential impacts from decommissioning are similar to the potential impacts from the construction phase.

4.7 Technical deficiencies or lack of knowledge

The survey data and reports on which the impact assessment has been made has not yet been analysed by the responsible maritime archaeological museum, Moes-

gaard Museum. An expert evaluation of for example the underwater cultural heritage is therefore lacking.

4.8 Conclusions concerning substation and offshore cable

A summary of the overall potential impact on underwater cultural heritage related to substation and cable corridor is given below in Table 4-2.

Table 4-2 Summary of impact concerning substation and offshore cable

Impacts	Overall significance of impact	Quality of available data
IMPACTS ON SUBMERGED STONE AGE SITES, SHIP WRECKS AND SINGLE OBJECTS		
See below *	*	1

*Before a review and an interpretation of the survey data has been made by the responsible maritime archaeological museum, the potential presence of submerged Stone Age settlement sites, ship wrecks or single cultural heritage objects cannot be neither confirmed nor dismissed. Consequently the impact of the Anholt Offshore Wind Farm on underwater cultural heritage cannot be assessed at the current level of knowledge.

The principles for the evaluation of potential impacts, the significance rating of the assessed impacts and the quality of data/documentation, which the impact assessment is based on, are presented below in Table 4-3.

Table 4-3 Rating of data quality

Quality of availably data

In order to evaluate the quality and significance of data and documentation for the impact assessment a significance rating of data and documentation should be evaluated within the specific technical subject topics using the following categories:

- 1 – Limited (scattered data, some knowledge)
- 2 – Sufficient (scattered data, field studies, documented)
- 3 – Good (time series, field studies, well documented)

For the EIA-document an impact arising from a planned activity will, depending on its magnitude and the environmental sensitivity, be given a significance rating as follows:

: No impact	*No impact*: There will be no impact on structure or function in the affected area;
: Minor impact	*Minor impact*: The structure or functions in the area will be partially affected, but there will be no impacts outside the affected area;
: Moderate Impact	*Moderate Impact*: The structure or function in the area will change, but there will be no significant impacts outside the affected area;
: Significant impact	*Significant impact*: The structure or function in the area will change, and the impact will have effects outside the area as well;

5. Decommisioning

The objectives of the decommissioning process are to minimize both the short and long term effects on the environment whilst making the sea safe for others to navigate. These obligations are stipulated in the United Nations Convention of the Law of the Sea (UNCLOS).

There are no specific international regulations or guidelines on the decommissioning of offshore installations. Decommissioning will have to consider individual circumstances, such as comparative decommissioning options, removal or partial removal in a way that causes no significant adverse effects on the environment, the likely deterioration of the material involved, possibilities for re-use or recycling as well as its present and future effect on the marine environment.

Based on current available technology, today's practice for decommissioning would imply to remove the wind turbines completely and to remove all other structures and substructures to the natural seabed level. Infield and export cables would be removed, left safely in-situ, buried to below the natural seabed level or protected by rock placement depending on the hydrodynamic conditions. Scour protection would be left in-situ.

The wind turbines, structures and cables would be dismantled using similar craft and methods as deployed during the construction phase. However the operations would be carried out in reverse order. The recovered materials would be transported to shore for later material reuse, recycle or disposal.

The decommissioning programme will be developed during the operations phase, as regulatory controls and industry practices most likely will have changed in 25 years' time, when the wind farm will be decommissioned. Regardless of decommissioning method, decommissioning will comply with all applicable legal requirements regarding decommissioning at that time.

6. References

Reference 1
Danmarks og Grønlands Geologiske Undersøgelse Rapport 2009/45: Anholt Offshore Wind Farm Marine Geophysical Investigations.

Reference 2
Danmarks og Grønlands Geologiske Undersøgelse Rapport 2009/47: Anholt Offshore Wind Farm Marine Geophysical Investigations – The Cable Corridors.

Reference 3
Informed in email dated 06-08-2009 from Jørgen Dencker, Archaeologist and Head of the Maritime Archaeology Department at Vikingeskibsmuseet, Roskilde.

Reference 4
Edney, Joanna 2006: *Impacts of recreational scuba diving on shipwrecks in Australia and the Pacific*. Micronesion – Journal of Humanities and Social Sciences, Vol. 5, no. 1/2.

Reference 5
Fischer, A. (2007): "Coastal fishing in Stone Age Denmark - evidence from below and above the present sea level and from human bones" in "Shell middens in Atlantic Europe", eds. Milner, N., Craig, O.E. and Bailey, G.N. (2007), Oxford.

Reference 6
Jensen, J.B., Kuijpers, A., Bennike, O. and Lemke, K. (2002): BALKAT – Østersøen uden grænser, Geologi Nyt fra GEUS, nr. 4-2002.

Reference 7
Jensen, J.B., Bennike, O., Lemke, W. and Kuijpers, A. (2005): The Storebælt gate-way to the Baltic. In: Geological Survey of Denmark and Greenland Bulletin 7, pp. 45-48

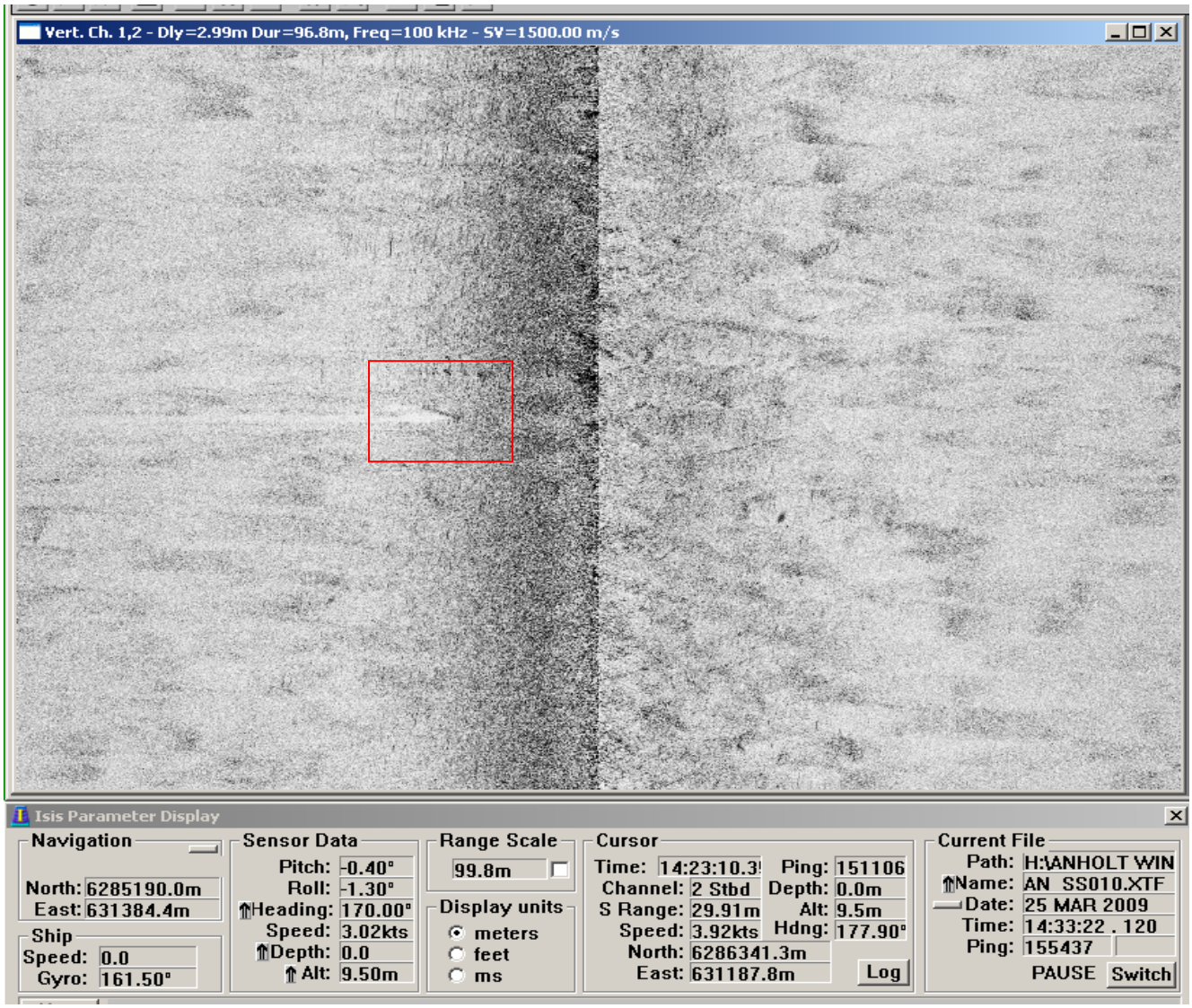
Reference 8
Ramboll Oil & Gas, 2009: Anholt Offshore Wind Farm: Mapping of Substrates and Benthic Community Types. Case no. Y977201, doc.no. 0550_05_5_5_001_08

Reference 9
www.dkconline.dk

Reference 10
Ramboll, September 2009. Project Description of The Anholt Offshore Wind Farm.

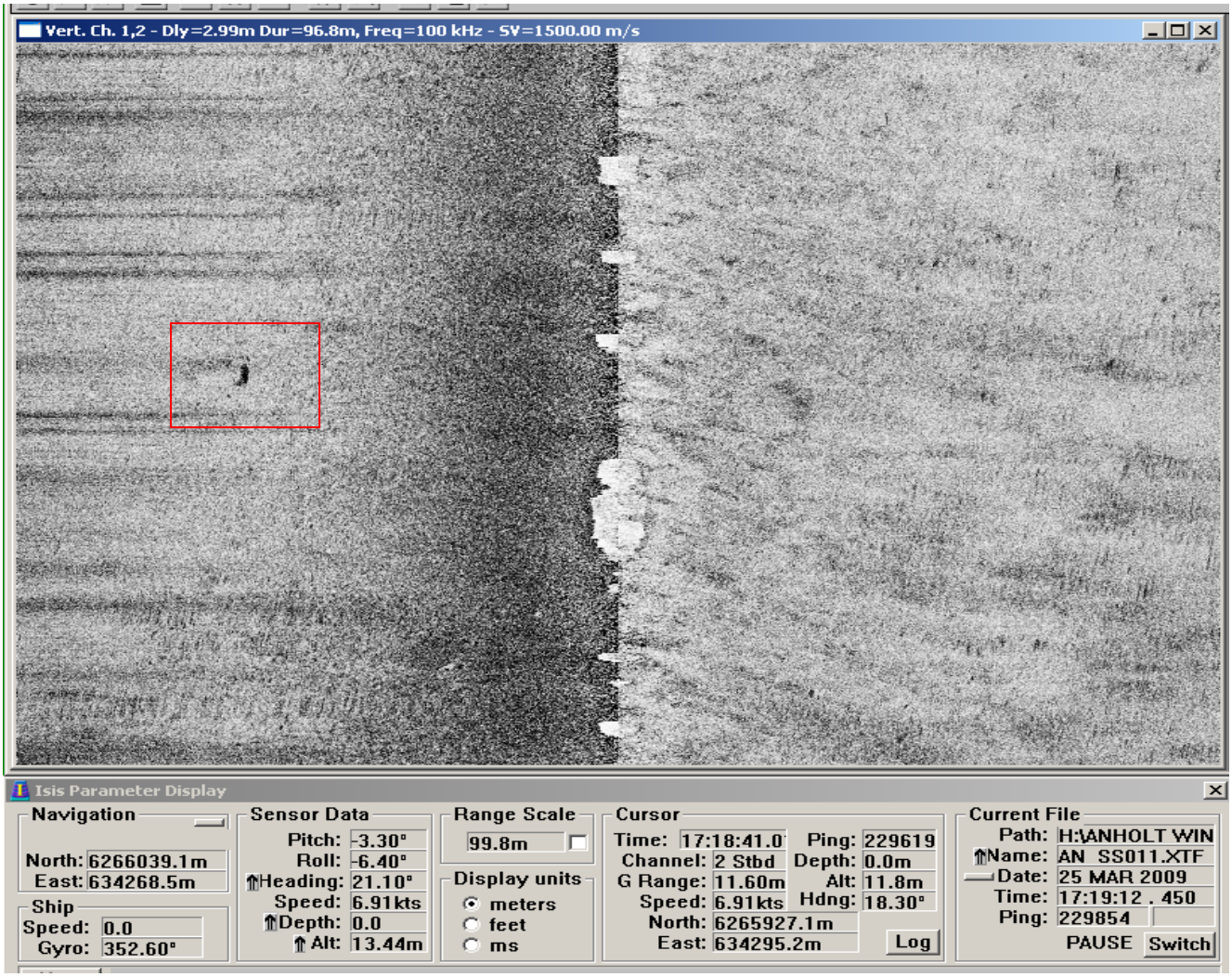
APPENDIX 1

Appendix 1 Unidentified objects from side scan sonar



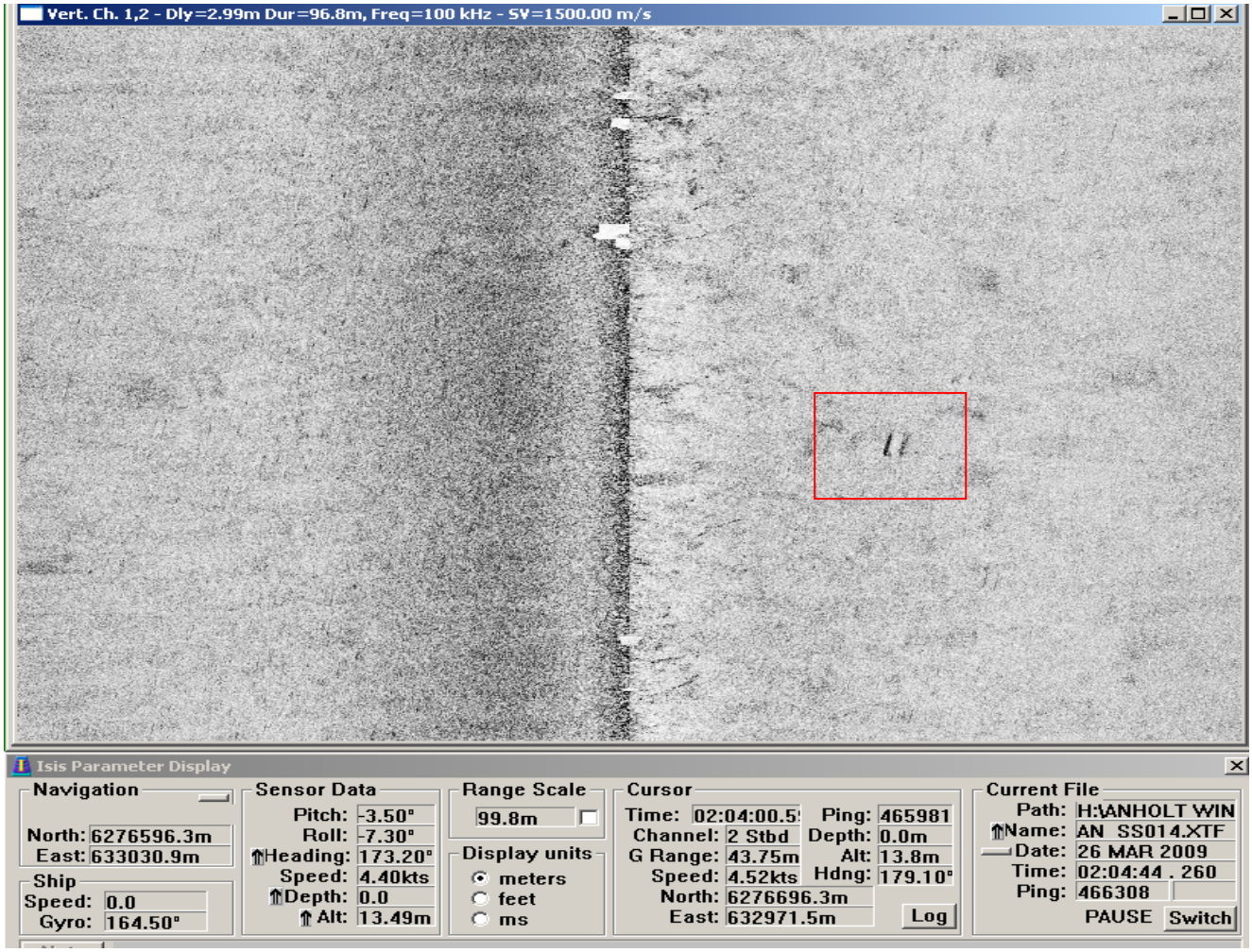
Object 1:
N 6286341 E 631187

Appendix 1 Unidentified objects from side scan sonar



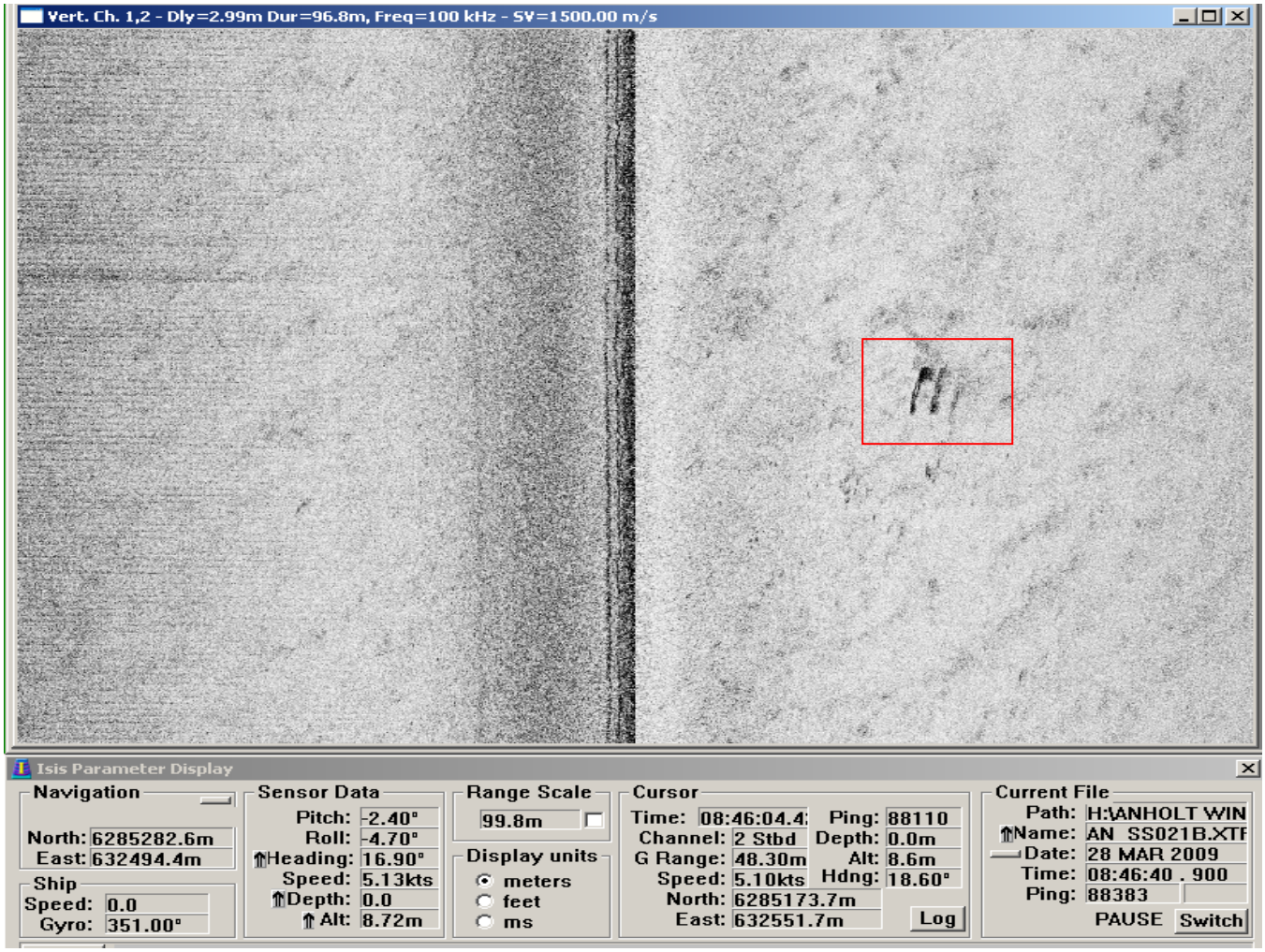
Object 2
N 6265927
E 634295

Appendix 1 Unidentified objects from side scan sonar



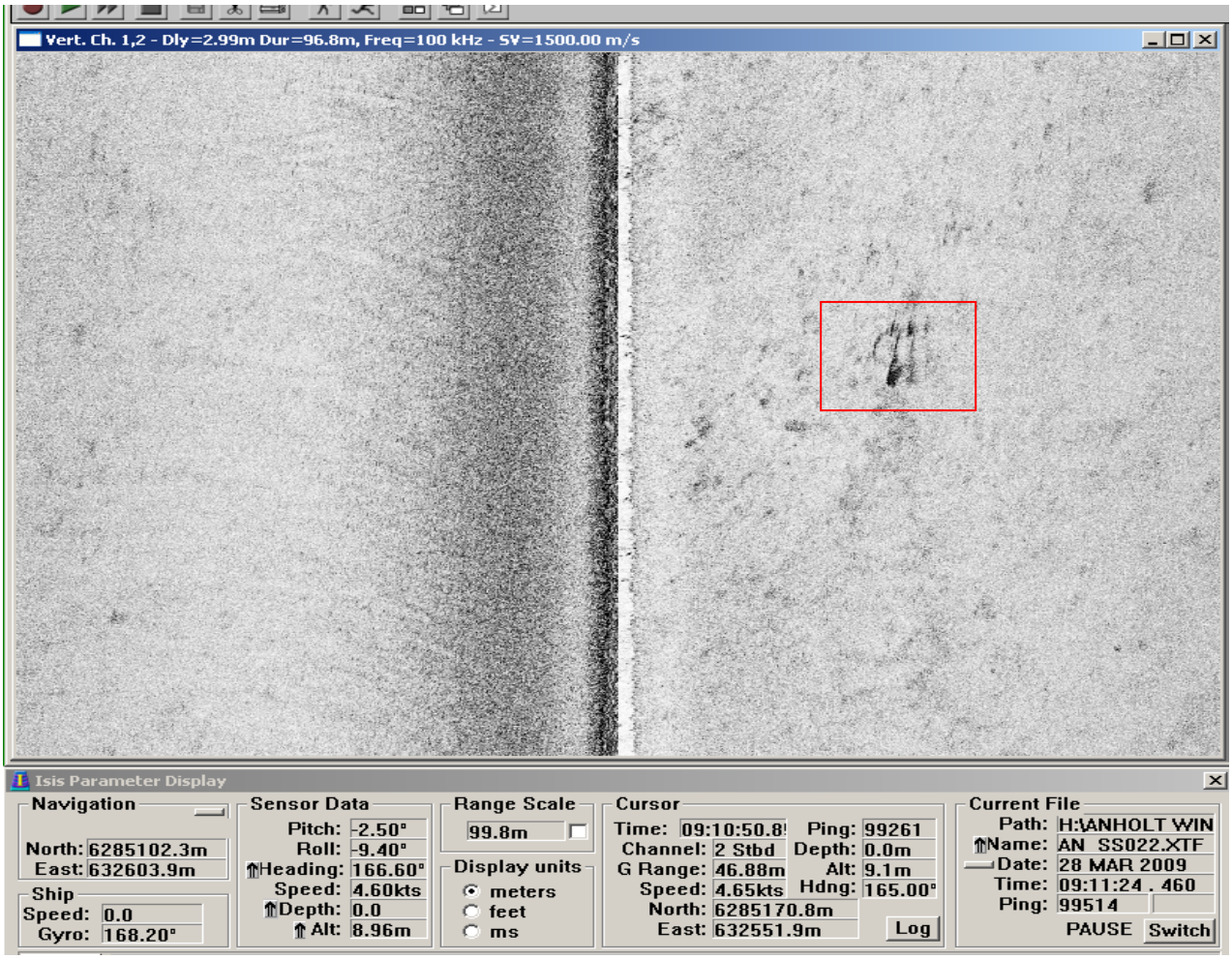
Object 3:
N 6276696
E 632971

Appendix 1 Unidentified objects from side scan sonar



Object 4:
N 6285173
E 632551

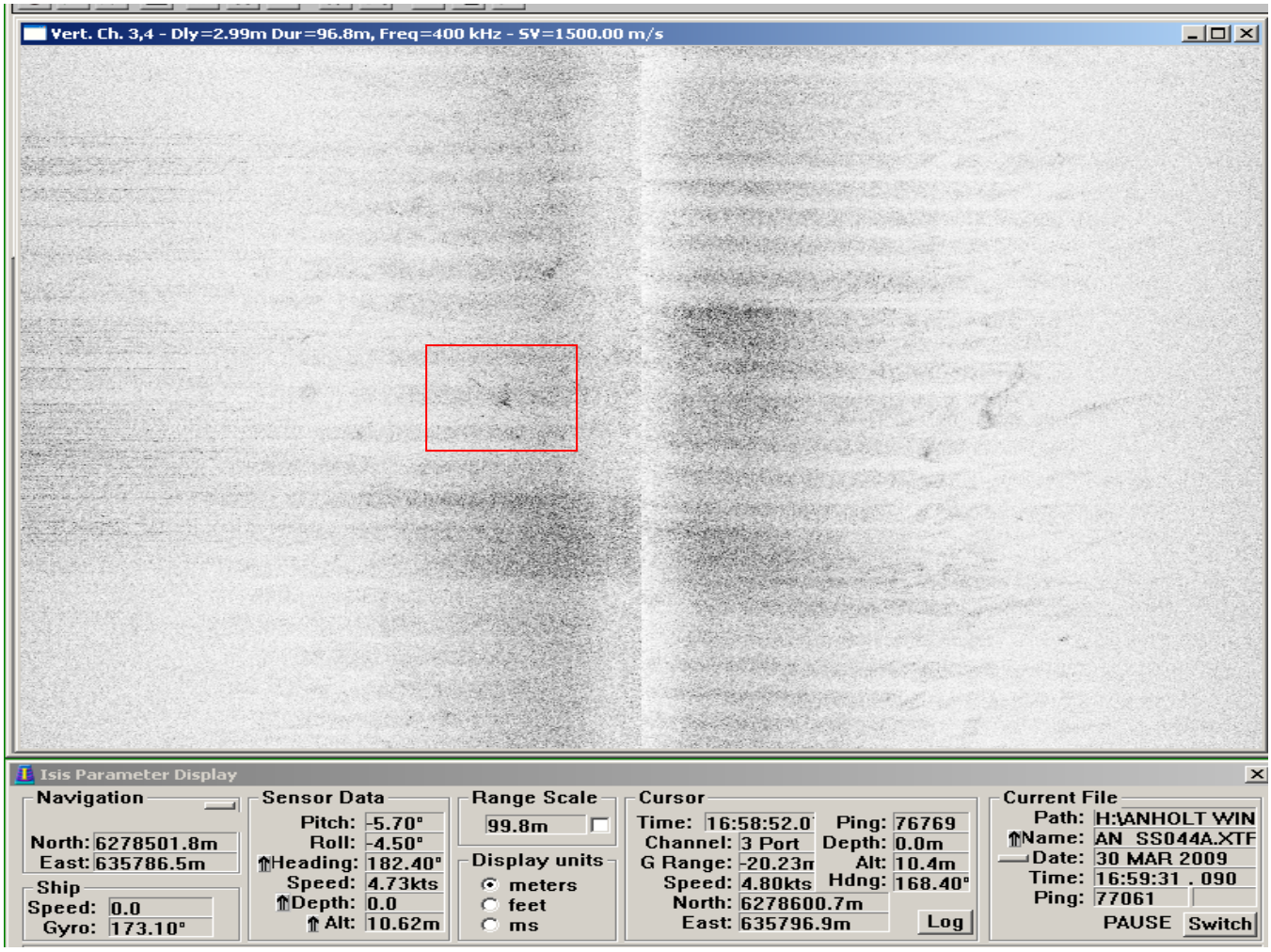
Same as Object 5



Object 5:
N 6285170
E 632551

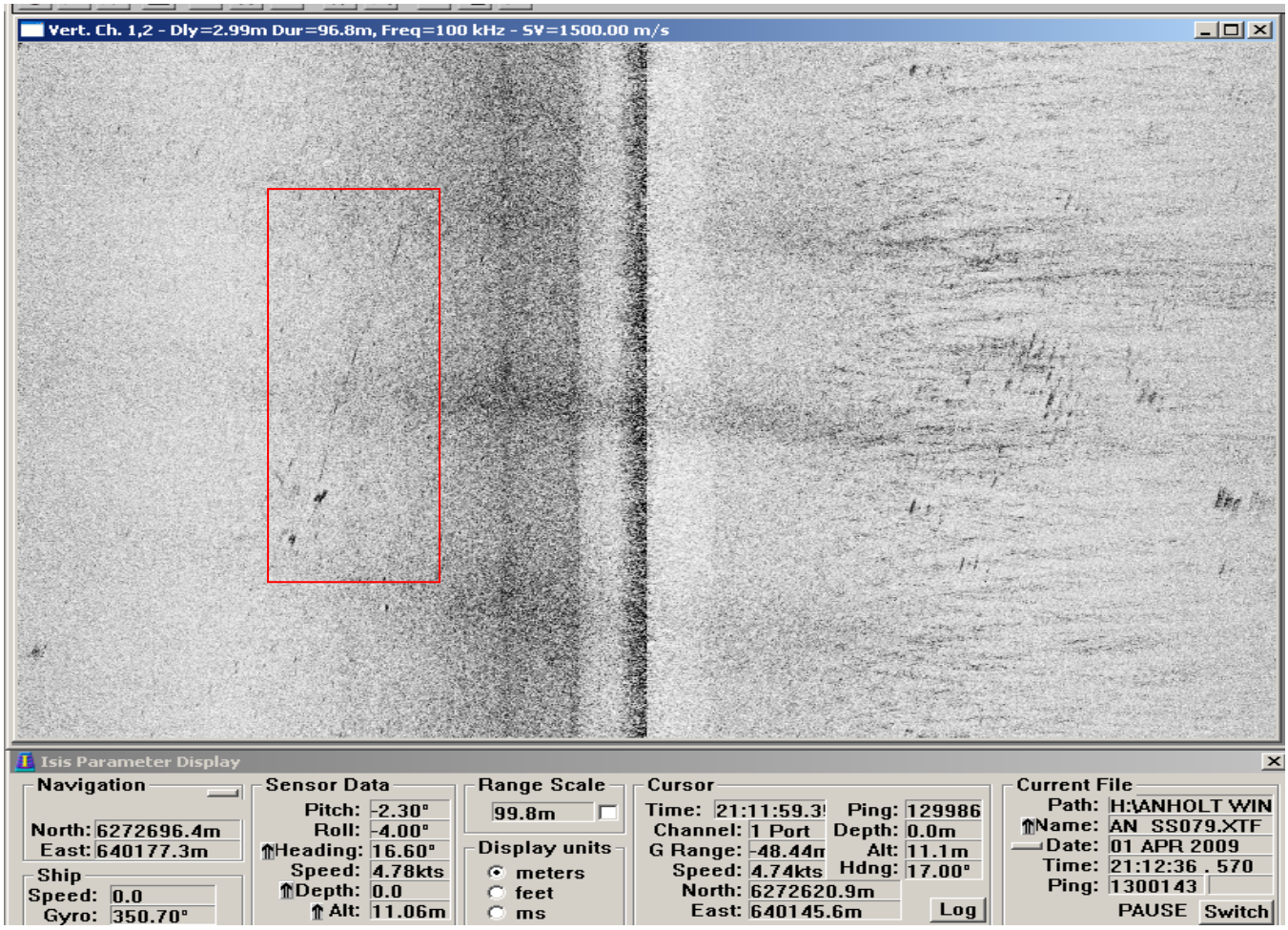
Same as Object 4

Appendix 1 Unidentified objects from side scan sonar



Object 6:
N 6278600
E 635796

Appendix 1 Unidentified objects from side scan sonar



Object 7:
N 6272620
E 640145

APPENDIX 2

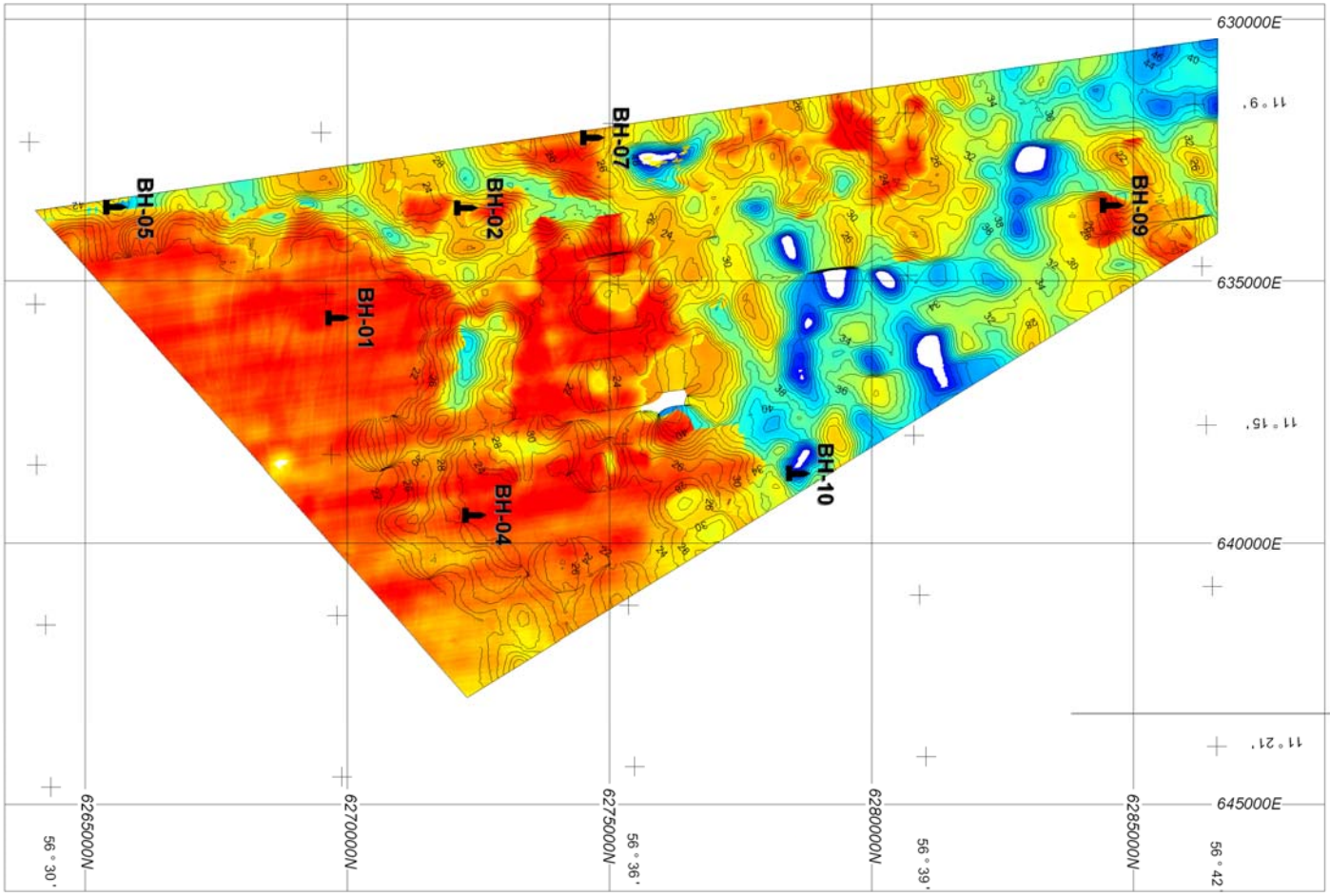
Appendix 2

Magnetic anomalies larger than 20 nT

Anom#	Magnitude	Mag-BG	LocalAnom	Easting wgs84 zone32N	Northing	Longitude	Latitude	Line #	R e m a r k s	
11	50441,99	50421,15	20,84	631911,81	6279490,31	11,1509942	56,6409721	SS-007		Angular ripple marks
19	50310,4	50239,43	70,97	634742,06	6269039,25	11,1916673	56,5463422	SS-020	dipole	Parallel ripple marks
83	50302,72	50331,14	-28,42	632478,54	6285012,02	11,1630670	56,6903837	AW-020	negative anomaly	Minor ridgeripple marks
86	50487	50409,64	77,36	634733,01	6273515,67	11,1938461	56,5865320	AW-026		Minor ripple marks, stones
87	50244,9	50223,5	21,4	636309,03	6268304,77	11,2167481	56,5392967	AW-034A		Minor ripple marks, stones
113	49669,18	50334,89	-665,71	632527,55	6285199,3	11,1639632	56,6920511	Large negative anom. A power cable?? Line AW-021		Minor parallel ripple marks, stones, large

APPENDIX 3

Appendix 3 Contour map - top glacial



Map legend

metres

16.0 - 18.0
18.0 - 20.0
20.0 - 22.0
22.0 - 24.0
24.0 - 26.0
26.0 - 28.0
28.0 - 30.0
30.0 - 32.0
32.0 - 34.0
34.0 - 36.0
36.0 - 38.0
38.0 - 40.0
40.0 - 42.0
42.0 - 44.0
44.0 - 46.0
46.0 - 48.0
48.0 - 50.0
50.0 - 52.0

Boreholes

0 2.5 5
kilometers

Reference level MSL (DVR 90)
Datum : EUREF 89 Projection : UTM Zone 32

Job:
Geophysical investigations of the Anholt Windfarm, Kattegat

Map theme:
Top Glacial contour map - combined Sparker and Chirp data

Client:
Ramboll Oil and Gas
Teknikerbyen 31
DK-2830 Virum
Denmark

Scale at A1 size: 1:50.000
Date: 01 July 2009

Drawn : JOL/BNO
Approved: SLO/PG

Geological Survey of Denmark og Greenland
Øster Voldgade 10
DK-1350 Copenhagen K
Denmark

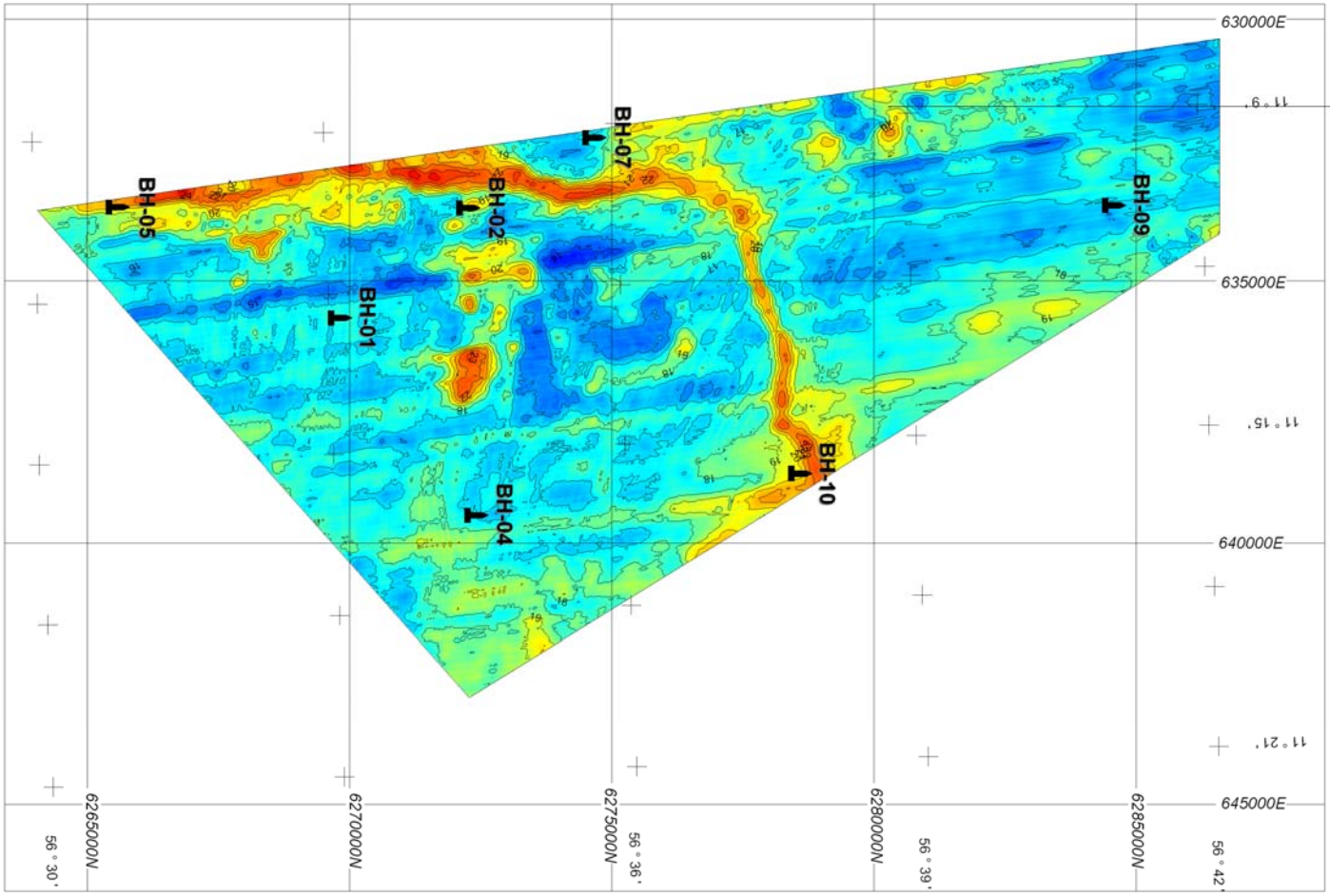
G E U S

Drawing number:
C2.1

RAMBØLL

APPENDIX 4

Appendix 4 Contour map - bottom Holocene



Map legend

metres
14.0 - 15.0
15.0 - 16.0
16.0 - 17.0
17.0 - 18.0
18.0 - 19.0
19.0 - 20.0
20.0 - 21.0
21.0 - 22.0
22.0 - 23.0
23.0 - 24.0

Boreholes

0 2.5 5
kilometers

Reference level MSL (DVR 90)
Datum : EUREF 89 Projection : UTM Zone 32

Job:
Geophysical investigations of the Anholt Windfarm, Kattegat

Map theme:
Bottom Holocene contour map

Client:
Ramboll Oil and Gas
Teknikerbyen 31
DK-2830 Virum
Denmark

Scale at A1 size: 1:50.000
Date: 01 July 2009

Drawn : JOL
Approved: SLO/PG

Geological Survey of Denmark og Greenland
Øster Voldgade 10
DK-1350 Copenhagen K
Denmark

G E U S

Drawing number:
C5

RAMBØLL

APPENDIX 5

Appendix 5 KUAS finds database

400120c-76

MA 76	**Farvandsområde: Kattegat V, mellem Djursland, Anholt, Læsø**
Status	Lokaliteten er færdigregistreret
	Kulturhistorisk stedfæstet punkt
	Farvandsvæsenets vrag-id: 1458, Farvandsvæsenet (2005)
Kort	UTM: 635809 / 6270734 Zone: 32
	Div. navigationsmetoder
Stednavne	Kattegat V (1898)
Omgivelser	Hav, fjord, strandsø (1898)
Anlæg	
1	TRANSPORT, VRAG. Antal: 1
	1850 - 1900
Fartøj	Fartøjstype: Vrag
	Fartøjsnavn: AGNETE Hjemsted: Ommel, DK
	Betegnelse: jagt
Konstruktion	
Begivenheder	
1	USPEC. REGISTRERING AF FORLIS (BEGIVENHEDSDATO OG OMSTÆNDIGHEDER)
	1898
	Farvandsvæsenet (Farvandsvæsenets Vragbog). Journalnr: 207
	Andre arkiver: EFS 1062/1979
	Forkortet originaltekst og resumé:
	Vragbog: Forlist aug. 1898.
2	FORGÆVES EFTERSØGT OBJEKT PÅ MARINT OMRÅDE
	11. juli 1979
	Farvandsvæsenet (Efterretninger for Søfarende). Journalnr: EFS 1062/1979
	Forkortet originaltekst og resumé:
	Vrag forgæves eftersøgt. Udtages af søkort.
3	USPEC. MINDRE BESKADIGELSE (F.X. BORTTAGNING AF RIG/SKORSTENE/STEN/AFGRAVNING)
	1. august 1898
	Farvandsvæsenet (Farvandsvæsenets Vragbog). Journalnr: 207
	Andre arkiver: EFS 1062/1979
	Forkortet originaltekst og resumé:
	Mast udtaget
4	REGISTRERING AF INSTITUTIONS SAG MED JOURNALISERING
	1898 til 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: KS-894
	Forkortet originaltekst og resumé:
	Reg. af fisker på samme position.

Se søkort i 1:850.000

Forrige lokalitet Marinnummer: 75 Næste lokalitet Marinnummer: 77

Til toppen

RAMBØLL

Appendix 5 KUAS finds database

400120c-166

MA 166	**Farvandsområde: Kattegat V, mellem Djursland, Anholt, Læsø**
Status	Lokaliteten er færdigregistreret
	Uspecificeret stedfæstet punkt
	Hold-base: 400120c - 1928, Skov- og Naturstyrelsen, 10. kontor (2000)
Kort	UTM: 639770 / 6270173 Zone: 32
	DECCA
Stednavne	Kattegat V (1986)
Omgivelser	Hav, fjord, strandsø (1986)

Anlæg

1	UNDERVANDSHINDRING AF UVIS ART. Antal: 1
	Udateret

Begivenheder

1	REGISTRERING AF INSTITUTIONS SAG MED JOURNALISERING
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: PD-377
	Forkortet originaltekst og resumé:
	Objekt af uvis art reg. af fisker.

Se søkort i 1:850.000

Forrige lokalitet Marinnummer: 165 Næste lokalitet Marinnummer: 167

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RAMBØLL

Appendix 5 KUAS finds database

400120c-289

MA 289	**Farvandsområde: Kattegat V, mellem Djursland, Anholt, Læsø**
Status	Lokaliteten er færdigregistreret
	Kulturhistorisk stedfæstet punkt
	Hold-base: 400120c - 5465, Skov- og Naturstyrelsen, 10. kontor (2000)
Kort	UTM: 633247 / 6284205 Zone: 32
	Div. navigationsmetoder
Stednavne	Kattegat V (1986)
Omgivelser	Hav, fjord, strandsø (1986)

Anlæg

1	TRANSPORT, VRAG. Antal: 1
	Nyere tid (1660 -)
Fartøj	Fartøjstype: Vrag
	Betegnelse: ukendt
Konstruktion	

Begivenheder

1	USPEC. REGISTRERING AF FORLIS (BEGIVENHEDSDATO OG OMSTÆNDIGHEDER)
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: RTC-211
	Forkortet originaltekst og resumé:
	Position på vrag, uvis forlisdato, reg. af fisker. (Uden ref. til EFS)
2	REGISTRERING AF INSTITUTIONS SAG MED JOURNALISERING
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: RTC-211

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Forrige lokalitet Marinnummer: 288 Næste lokalitet Marinnummer: 290

Til toppen

RAMBØLL

Appendix 5 KUAS finds database

400120c-297

MA 297	**Farvandsområde: Kattegat V, mellem Djursland, Anholt, Læsø**
Status	Lokaliteten er færdigregistreret
	Kulturhistorisk stedfæstet punkt
	Hold-base: 400120c - 5846, Skov- og Naturstyrelsen, 10. kontor (2000)
Kort	UTM: 632972 / 6283194 Zone: 32
	Div. navigationsmetoder
Stednavne	Kattegat V (1943)
Omgivelser	Hav, fjord, strandsø (1943)
Anlæg	
1	TRANSPORT, VRAG. Antal: 1
	1939-45, 2. Verdenskrig
Fartøj	Fartøjstype: Vrag
	Fartøjsnavn: VITUS BERING Hjemsted: DK
	Betegnelse: motorsejlskib
Konstruktion	
Begivenheder	
1	USPEC. REGISTRERING AF FORLIS (BEGIVENHEDSDATO OG OMSTÆNDIGHEDER)
	25. juni 1943
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: MW-640110
	Forkortet originaltekst og resumé:
	Vrag sunket efter minesprængning. Hævet. Position og oplysninger reg. af fisker. (Uden ref. til EFS)
2	USPEC. FJERNELSE AF OBJEKT (IKKE I FORB. MED LAND- ELLER SKOVBRUG)
	25. juni 1943
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: MW-640110
	Forkortet originaltekst og resumé:
	Hævet.

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Forrige lokalitet Marinnummer: 296 Næste lokalitet Marinnummer: 298

Til toppen

RAMBØLL

Appendix 5 KUAS finds database

400120c-356

MA 356	**Farvandsområde: Kattegat V, mellem Djursland, Anholt, Læsø**
Status	Lokaliteten er færdigregistreret
	Kulturhistorisk stedfæstet punkt
	Hold-base: 400120c - 6630, Skov- og Naturstyrelsen, 10. kontor (2000)
Kort	UTM: 641418 / 6272922 Zone: 32
	DECCA
Stednavne	Kattegat V (1942)
Omgivelser	Hav, fjord, strandsø (1942)

Anlæg

1	TRANSPORT, VRAG. Antal: 1
	1939-45, 2. Verdenskrig
Fartøj	Fartøjstype: Vrag
	Fartøjsnavn: POSEIDON
	Betegnelse: landgangsfartøj
Konstruktion	

Begivenheder

1	USPEC. REGISTRERING AF FORLIS (BEGIVENHEDSDATO OG OMSTÆNDIGHEDER)
	1942
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: GB-674A
	Forkortet originaltekst og resumé:
	Position på vrag og forlisdato reg. af fisker. (Uden ref. til EFS)
2	REGISTRERING AF INSTITUTIONS SAG MED JOURNALISERING
	1942 til 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: GB-674A

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Forrige lokalitet Marinnummer: 355 Næste lokalitet Marinnummer: 357

Til toppen

RAMBØLL

Appendix 5 KUAS finds database

400120c-357

MA 357	**Farvandsområde: Kattegat V, mellem Djursland, Anholt, Læsø**
Status	Lokaliteten er færdigregistreret
	Kulturhistorisk stedfæstet punkt
	Hold-base: 400120c - 6631, Skov- og Naturstyrelsen, 10. kontor (2000)
Kort	UTM: 635551 / 6270184 Zone: 32
	DECCA
Stednavne	Kattegat V (1986)
Omgivelser	Hav, fjord, strandsø (1986)

Anlæg

1	TRANSPORT, VRAG. Antal: 1
	Nyere tid (1660 -)
Fartøj	Fartøjstype: Vrag
	Fartøjsnavn: AGNETE ?
	Betegnelse: ukendt
Konstruktion	

Begivenheder

1	USPEC. REGISTRERING AF FORLIS (BEGIVENHEDSDATO OG OMSTÆNDIGHEDER)
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: GB-675
	Forkortet originaltekst og resumé:
	Position på vrag reg. af fisker (uden ref. til EFS). Fartøjsnavn/identitet usikker. Uvis forlisdato.
2	REGISTRERING AF INSTITUTIONS SAG MED JOURNALISERING
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: GB-675
	Forkortet originaltekst og resumé:
	Position på vrag reg. af fisker (uden kildehenvisning til EFS).

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Forrige lokalitet Marinnummer: 356 Næste lokalitet Marinnummer: 358

Til toppen

RAMBØLL

Appendix 5 KUAS finds database

400120c-358

MA 358	**Farvandsområde: Kattegat V, mellem Djursland, Anholt, Læsø**
Status	Lokaliteten er færdigregistreret
	Kulturhistorisk stedfæstet punkt
	Hold-base: 400120c - 6632, Skov- og Naturstyrelsen, 10. kontor (2000)
Kort	UTM: 635641 / 6269765 Zone: 32
	DECCA
Stednavne	Kattegat V (1986)
Omgivelser	Hav, fjord, strandsø (1986)

Anlæg

1	TRANSPORT, VRAG. Antal: 1
	Nyere tid (1660 -)
Fartøj	Fartøjstype: Vrag
	Betegnelse: ukendt
Konstruktion	

Begivenheder

1	USPEC. REGISTRERING AF FORLIS (BEGIVENHEDSDATO OG OMSTÆNDIGHEDER)
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: GB-675A
	Forkortet originaltekst og resumé:
	Position på vrag, uvis forlisdato, reg. af fisker. (Uden ref. til EFS)
2	REGISTRERING AF INSTITUTIONS SAG MED JOURNALISERING
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: GB-675A

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Forrige lokalitet Marinnummer: 357 Næste lokalitet Marinnummer: 359

Til toppen

Appendix 5 KUAS finds database

400120c-359

MA 359	**Farvandsområde: Kattegat V, mellem Djursland, Anholt, Læsø**
Status	Lokaliteten er færdigregistreret
	Kulturhistorisk stedfæstet punkt
	Hold-base: 400120c - 6633, Skov- og Naturstyrelsen, 10. kontor (2000)
Kort	UTM: 635992 / 6270645 Zone: 32
	DECCA
Stednavne	Kattegat V (1986)
Omgivelser	Hav, fjord, strandsø (1986)
Anlæg	
1	TRANSPORT, VRAG. Antal: 1
	Nyere tid (1660 -)
Fartøj	Fartøjstype: Vrag
	Betegnelse: ukendt
Konstruktion	Materiale: jern
Begivenheder	
1	USPEC. REGISTRERING AF FORLIS (BEGIVENHEDSDATO OG OMSTÆNDIGHEDER)
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: GB-675B
	Forkortet originaltekst og resumé:
	Position og oplysninger reg. af fisker. (Uden ref. til EFS). Uvis forlisdato.
2	REGISTRERING AF INSTITUTIONS SAG MED JOURNALISERING
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: GB-675B
	Forkortet originaltekst og resumé:
	Vrag af jern.

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Forrige lokalitet Marinnummer: 358 Næste lokalitet Marinnummer: 360

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Appendix 5 KUAS finds database

400120c-401

MA 401	**Farvandsområde: Kattegat V, mellem Djursland, Anholt, Læsø**
Status	Lokaliteten er færdigregistreret
	Kulturhistorisk stedfæstet punkt
	Hold-base: 400120c - 14249, Skov- og Naturstyrelsen, 10. kontor (2000)
	Hold-base: 400120c - 16566, Skov- og Naturstyrelsen, 10. kontor (2000)
	Hold-base: 400120c - 7261, Skov- og Naturstyrelsen, 10. kontor (2000)
Kort	UTM: 633114 / 6283217 Zone: 32
	Div. navigationsmetoder
Stednavne	Kattegat V (1943)
Omgivelser	Hav, fjord, strandsø (1943)

Anlæg

1	TRANSPORT, VRAG. Antal: 1
	1939-45, 2. Verdenskrig
Fartøj	Fartøjstype: Vrag
	Fartøjsnavn: VITUS BERING Hjemsted: DK
	Betegnelse: motorsejlskib
Konstruktion	

Begivenheder

1	USPEC. REGISTRERING AF FORLIS (BEGIVENHEDSDATO OG OMSTÆNDIGHEDER)
	25. juni 1943
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: SBP-144
	Forkortet originaltekst og resumé:
	Position på vrag og forlisdato reg. af fisker. (Uden ref. til EFS)
2	REGISTRERING AF INSTITUTIONS SAG MED JOURNALISERING
	1943 til 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: SBP-144
3	REGISTRERING AF INSTITUTIONS SAG MED JOURNALISERING
	1943 til 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: BL-911
	Forkortet originaltekst og resumé:
	Reg. af fisker på samme position.
4	REGISTRERING AF INSTITUTIONS SAG MED JOURNALISERING
	1943 til 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: NATI-245
	Forkortet originaltekst og resumé:
	Reg. af fisker på samme position.
5	DIV. SAGSBEHANDLING
	1. februar 2007
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: BL-911
	Forkortet originaltekst og resumé:
	Alternativ position p.g.a. usikkerhed om konvertering GS 1880/ED 50: N 56 40 37, E 11 10 34

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Forrige lokalitet Marinnummer: 400 Næste lokalitet Marinnummer: 402

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RAMBØLL

Appendix 5 KUAS finds database

400120c-449

MA 449	**Farvandsområde: Kattegat V, mellem Djursland, Anholt, Læsø**
Status	Lokaliteten er færdigregistreret
	Kulturhistorisk stedfæstet punkt
	Hold-base: 400120c - 9145, Skov- og Naturstyrelsen, 10. kontor (2000)
Kort	UTM: 639154 / 6276460 Zone: 32
	DECCA
Stednavne	Kattegat V (1986)
Omgivelser	Hav, fjord, strandsø (1986)

Anlæg

1	TRANSPORT, VRAG. Antal: 1
	Nyere tid (1660 -)
Fartøj	Fartøjstype: Vrag
	Betegnelse: ukendt
Konstruktion	

Begivenheder

1	USPEC. REGISTRERING AF FORLIS (BEGIVENHEDSDATO OG OMSTÆNDIGHEDER)
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: GB-1335
	Forkortet originaltekst og resumé:
	Position på vrag, uvis forlisdato, reg. af fisker. (Uden ref. til EFS)
2	REGISTRERING AF INSTITUTIONS SAG MED JOURNALISERING
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: GB-1335

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Forrige lokalitet Marinnummer: 448 Næste lokalitet Marinnummer: 450

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Appendix 5 KUAS finds database

400120c-450

MA 450	**Farvandsområde: Kattegat V, mellem Djursland, Anholt, Læsø**
Status	Lokaliteten er færdigregistreret
	Kulturhistorisk stedfæstet punkt
	Hold-base: 400120c - 9146, Skov- og Naturstyrelsen, 10. kontor (2000)
Kort	UTM: 635057 / 6278781 Zone: 32
	DECCA
Stednavne	Kattegat V (1986)
Omgivelser	Hav, fjord, strandsø (1986)

Anlæg

1	TRANSPORT, VRAG. Antal: 1
	Nyere tid (1660 -)
Fartøj	Fartøjstype: Vrag
	Betegnelse: ukendt
Konstruktion	

Begivenheder

1	USPEC. REGISTRERING AF FORLIS (BEGIVENHEDSDATO OG OMSTÆNDIGHEDER)
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: GB-1336
	Forkortet originaltekst og resumé:
	Position på vrag, uvis forlisdato, reg. af fisker. (Uden ref. til EFS)
2	REGISTRERING AF INSTITUTIONS SAG MED JOURNALISERING
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: GB-1336

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Forrige lokalitet Marinnummer: 449 Næste lokalitet Marinnummer: 451

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RAMBØLL

Appendix 5 KUAS finds database

400120c-502

MA 502	**Farvandsområde: Kattegat V, mellem Djursland, Anholt, Læsø**
Status	Lokaliteten er færdigregistreret
	Kulturhistorisk stedfæstet punkt
	Hold-base: 400120c - 9826, Skov- og Naturstyrelsen, 10. kontor (2000)
Kort	UTM: 632700 / 6279870 Zone: 32
	DECCA
Stednavne	Kattegat V (1986)
Omgivelser	Hav, fjord, strandsø (1986)

Anlæg

1	TRANSPORT, VRAG. Antal: 1
	Nyere tid (1660 -)
Fartøj	Fartøjstype: Vrag
	Betegnelse: ukendt
Konstruktion	

Begivenheder

1	USPEC. REGISTRERING AF FORLIS (BEGIVENHEDSDATO OG OMSTÆNDIGHEDER)
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: GB-1886
	Forkortet originaltekst og resumé:
	Position på vrag, uvis forlisdato, reg. af fisker. (Uden ref. til EFS)
2	REGISTRERING AF INSTITUTIONS SAG MED JOURNALISERING
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: GB-1886

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Forrige lokalitet Marinnummer: 501 Næste lokalitet Marinnummer: 503

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Appendix 5 KUAS finds database

400120c-520

MA 520	**Farvandsområde: Kattegat V, mellem Djursland, Anholt, Læsø**
Status	Lokaliteten er færdigregistreret
	Kulturhistorisk stedfæstet punkt
	Hold-base: 400120c - 10452, Skov- og Naturstyrelsen, 10. kontor (2000)
	Hold-base: 400120c - 5222, Skov- og Naturstyrelsen, 10. kontor (2000)
	Hold-base: 400120c - 6175, Skov- og Naturstyrelsen, 10. kontor (2000)
	Hold-base: 400120c - 9864, Skov- og Naturstyrelsen, 10. kontor (2000)
Kort	UTM: 638667 / 6278638 Zone: 32
	DECCA
Stednavne	Kattegat V (1986)
Omgivelser	Hav, fjord, strandsø (1986)

Anlæg

1	TRANSPORT, VRAG. Antal: 1
	Nyere tid (1660 -)
Fartøj	Fartøjstype: Vrag
	Betegnelse: ukendt
Konstruktion	

Begivenheder

1	USPEC. REGISTRERING AF FORLIS (BEGIVENHEDSDATO OG OMSTÆNDIGHEDER)
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: GB-2320
	Forkortet originaltekst og resumé:
	Position på vrag, uvis forlisdato, reg. af fisker. (Uden ref. til EFS)
2	REGISTRERING AF INSTITUTIONS SAG MED JOURNALISERING
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: GB-2320
3	REGISTRERING AF INSTITUTIONS SAG MED JOURNALISERING
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: GB-1925
	Forkortet originaltekst og resumé:
	Reg. af fisker på samme position.
4	REGISTRERING AF INSTITUTIONS SAG MED JOURNALISERING
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: GB-159
	Forkortet originaltekst og resumé:
	Reg. på afvigende position af fisker. N 56 37,810, E 11 15,620 (ED 50).
5	REGISTRERING AF INSTITUTIONS SAG MED JOURNALISERING
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: TB-48
	Forkortet originaltekst og resumé:
	Reg. af fisker på samme position.

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Forrige lokalitet Marinnummer: 519 Næste lokalitet Marinnummer: 521

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Appendix 5 KUAS finds database

400120c-521

MA 521	**Farvandsområde: Kattegat V, mellem Djursland, Anholt, Læsø**
Status	Lokaliteten er færdigregistreret
	Kulturhistorisk stedfæstet punkt
	Hold-base: 400120c - 10453, Skov- og Naturstyrelsen, 10. kontor (2000)
Kort	UTM: 632547 / 6279596 Zone: 32
	DECCA
Stednavne	Kattegat V (1986)
Omgivelser	Hav, fjord, strandsø (1986)
Anlæg	
1	TRANSPORT, VRAG. Antal: 1
	Nyere tid (1660 -)
Fartøj	Fartøjstype: Vrag
	Betegnelse: ukendt
Konstruktion	
Begivenheder	
1	USPEC. REGISTRERING AF FORLIS (BEGIVENHEDSDATO OG OMSTÆNDIGHEDER)
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: GB-2321
	Forkortet originaltekst og resumé:
	Position på vrag, uvis forlisdato, reg. af fisker. (Uden ref. til EFS)
2	REGISTRERING AF INSTITUTIONS SAG MED JOURNALISERING
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: GB-2321

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Forrige lokalitet Marinnummer: 520 Næste lokalitet Marinnummer: 522

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Appendix 5 KUAS finds database

400120c-737

MA 737	**Farvandsområde: Kattegat V, mellem Djursland, Anholt, Læsø**
Status	Lokaliteten er færdigregistreret
	Uspecificeret stedfæstet punkt
	Hold-base: 400120c - 18981, Skov- og Naturstyrelsen, 10. kontor (2000)
Kort	UTM: 631710 / 6282818 Zone: 32
	DECCA
Stednavne	Kattegat V (1986)
Omgivelser	Hav, fjord, strandsø (1986)

Anlæg

1	UNDERVANDSHINDRING AF UVIS ART. Antal: 1
	Udateret

Begivenheder

1	REGISTRERING AF INSTITUTIONS SAG MED JOURNALISERING
	Før 1986
	Skov- og Naturstyrelsen, 10. kontor (HOLD-arkivmateriale, SNS/NMU). Journalnr: NH-3643
	Forkortet originaltekst og resumé:
	Objekt af uvis art reg. af fisker.

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Forrige lokalitet Marinnummer: 736 Næste lokalitet Marinnummer: 738

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