Program of Requirements

Periplus Archeomare

Name project		
Location	**NCP**	**North Sea, offshore blocks G16, G17 & G18**
	Place	**North Sea (Dutch EEZ)**
	Toponym	**Ten noorden van de Waddeneilanden Wind Farm Zone**
Project	**TNWWFZ – Archaeological Field Survey**	

Position within the Archaeological Process
Prospective Field Survey (Geophysical stage)

Authors			
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Client			
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Authority Approval			
Name	Address, Telephone and Email	Date	Initials
Cultural Heritage Agency (Rijksdienst voor het Cultureel Erfgoed = Advisor Authority)	Representing Cultural Heritage Agency: Mw. M. Snoek (Dhr. B. Smit / Dhr. J. Opdebeeck) Postbus 1600 3800 BP Amersfoort +31 (0) 6 1265160 m.snoek@cultureelerfgoed.nl	24-06-2019	

Contents

1. Administrative data			
1	Project name	Ten noorden van de Waddeneilanden WFZ - Archaeological Field Survey	
2	Province	n.a.	
3	Council	n.a.	
4	Place	North Sea (NCP, Dutch EEZ), offshore blocks G16, G17 & G18	
5	Toponym	Wind Farm Zone Ten noorden van de Waddeneilanden (TNWWFZ)	
6	Chart	1801-01	
7	Coordinates Geodetic datum: ETRS89 Projection: UTM31N ESPG 25831	Centre	E 647300.0 - N 5.989500.0
		IA_01	E 645668.5 - N 5985917.1
		IA_02	E 645573.4 - N 5989846.9
		IA_03	E 684166.9 - N 5993451.0
		IA_04	E 688960.9 - N 5987405.3
8	ARCHIS-ozk melding / CIS-code	4637018100 (archaeological desk study)	
9	Surface investigation area	153 km^2	
10	Present use	Shipping, fishing, military	
11	Oceanographic Parameters	Tidal currents, salt water, depth varying between 33.2 and 38.8 meter LAT; average 36.0 meter LAT	
12	Area Administrator	Department of Waterways and Public Works - Team Sea and Delta (Rijkswaterstaat Zee en Delta)	
13	Authorities	Netherlands Enterprise Agency (RVO) advised by the Cultural Heritage Agency (Rijksdienst voor Cultureel Erfgoed, RCE)	

2. Motive	
Objective	The purpose of the archaeological assessment is to test the desk study based predictive model for archaeological remains in the area. The expectancy covers remains of shipping related objects (wrecks), airplanes from World War II and prehistoric settlements. The goals set for this assessment are: • To determine the historical or archaeological value of contacts found in the geophysical survey; • The validate the locations of known wrecks; • Preliminary assessment of the prehistoric landscape based on the seismic data.
Motive for this survey in relation to the activities planned	The activities planned comprise the installation of the offshore wind farm Ten noorden van de Waddeneilanden. Cables interconnecting the foundations and connecting the wind farm area to shore will be trenched into the seabed. These activities can affect archaeological remains. Also after installation of the wind farm scouring around the monopoles can affect archeological remains. Based on this aim legislation (Erfgoedwet 2016) has been put in place which postulates that archaeological research shall be carried out in case a disturbance of the seabed is foreseen in the course of activities planned. The motive for the current survey stems from the aim to strive for *in situ* preservation of archaeological remains. The desk study summarizes that ship wrecks, World war II related objects and prehistoric landscapes are potentially affected.
Selection Decision	The assessment of the survey data shall result in an advice with respect to potential further research by the development and use of the windfarm in accordance with the criteria set by the Dutch Archaeological Quality Standard (in Dutch: KNA Waterbodems 4.1)[1]

[1] Dutch: Kwaliteitsnorm Nederlandse Archeologie Waterbodems (KNA-WB 4.1).

3. Previous research	
2015	Archaeological desk study (2013) and assessment (2015) Offshore Windfarm Gemini Cattrysse, A. and D. Howel, 2015. The Gemini Project: Deskbased Assessment and Side Scan Sonar Analysis of the Underwater Cultural Heritage in the Project Area (KP0-15.5). Adede archaeological report 65
2017	Archaeological desk study Neuconnect cable Van den Brenk, S., en van Lil, R., 2017. Archaeological desk study NeuConnect Interconnector. Periplus Archeomare report 17A022.
The results are incorporated in the archaeological desk study below	

Archaeological desk study	
Contractor	Periplus Archeomare
Period	2019
Publication	Brenk, S. van den, R. van Lil and R. Cassée, Amsterdam 2019: Archaeological Desk study Ten noorden van de Waddeneilanden Wind Farm Zone. Periplus Archeomare report 18A031-02

Results

Within the investigated area of the wind farm zones (remains of) ship wrecks and WWII plane wrecks are to be expected. Locally in situ remains of Paleolithic and Early Mesolithic camp sites might be present, as well as parts of the prehistoric landscape.

Shipwrecks

A total of nine shipwrecks are known in, or in the immediate vicinity of, the research area. Two wrecks have been identified. One wreck is recent (1979) and does not represent an archaeological value. The second identified wreck is a German submarine from World War I. The German submarine and a wooden wreck discovered during the development of the Offshore Wind Farm Gemini, presumably are of archaeological value, although their value has not been determined during a formal archaeological investigation yet. For the other six wreck reportings, details like names, types and date of sinking are not known, nor are the exact locations. Further research is needed to determine the archaeological value of the wrecks and assess whether undiscovered shipwrecks are present.

Plane wrecks

During World War II, many airplanes crashed into the North Sea. Several sources are ambiguous about the number of aircraft still missing, but it is at least hundreds. Remains are found on a regular base by fishermen. It is quite possible to expect (remains of) plane wrecks within the research area.

Prehistory

In the research area it is expected that parts of prehistoric landscapes and landforms are likely to be present. If these landforms are preserved prehistoric camp sites and remains of prehistoric activities are likely to be preserved. Remains of in situ prehistoric camp sites are expected within the context of the following lithostratigraphic units:

<u>Boxtel Formation (Late Palaeolithic and Mesolithic)</u>

Late Palaeolithic and Mesolithic camp sites and inhumations can occur in the cover sand dunes and ridges (top of Wierden Member and embedded Usselo Bed), and along the valleys of small streams (Singraven Member). The covering Basal Peat Bed and Velsen Bed can contain well-preserved lost objects, intentional depots and dumps.

<u>Brown Bank Member</u>

Remains of Neanderthal camp sites can be expected along the shores of fresh water lakes and beaches of lagoons which developed at the transition from Eemian to Weichselian. The sediments (clay and sand) are part of the Brown Bank Member. Within the peat of the covering Woudenberg Formation well-preserved lost objects, intentional depots and dumps can be encountered.

<u>Drente Formation (Middle Paleolithic – occurrence uncertain)</u>

Remains of Neanderthal camp sites can be expected at the moraine ridges and at the shores of melt water lakes which remained after retreat of the glaciers at the transition from Saalian to Eemian to Weichselian.

The moraine ridges (boulder clay and sand) are part of the Gieten Member; the laminated lacustrine clays and sands are part of the Uitdam Member.

All archaeological levels of interest are located under a cover of Holocene deposits of the Western Mud Hole, the Terschellingerbank Member and possible local occurrences of the Basal Peat bed and the Wormer Member.

At this stage little is known about the integrity of the Pleistocene landscape. By means of subbottom profiling the occurrence of geological units (both horizontal as vertical) and archaeological levels herein can be mapped. The character of layer boundaries (erosive or non-erosive) can be interpreted. It is unlikely however that archaeological remains of Paleolithic and Mesolithic camp sites can be identified with sufficient certainty (based on the geophysical and geotechnical surveys) to impose restrictions on wind farm development. This applies to all the above-mentioned archaeological levels (moraine hills, Brown Bank Member and Boxtel Formation). At this stage focus should therefore not be put on tracing prehistoric camp sites but on a pragmatic employment of geophysical techniques in order to obtain a better insight in (the integrity of) the Pleistocene landscape. The insights gained shall be used to a) further specify the predictive model and b) allocate areas where in situ prehistoric remains are to be expected.

In accordance with the AMZ cycle it is advised to conduct an exploratory field research (in Dutch 'Inventariserend veldonderzoek opwaterfase') in order to test and further specify the archaeological predictive model in terms of the character, spatial distribution, integrity and preservation of wreck sites, prehistoric landscapes and potential archaeological levels herein.

In general, an exploratory research comprises a geophysical survey with side scan sonar, magnetometer and subbottom profiler. The resulting data should be archaeologically assessed after the general processing, interpretation and reporting has been performed by the survey contractor.

Based on the processed seismic data the survey contractor will advise on the borehole sample locations to acquire the information on soil parameters needed for construction purposes.

The archaeological contractor will advise whether borehole sample analysis is to be recommended to assess the presence of prehistoric remains and weigh the probability that remains will be affected by the planned activities. Alike the geophysical survey a geotechnical survey including borehole sampling and/or cone penetration tests is part of the archaeological phase of exploratory field research. If the competent authorities decide that an additional research by borehole sample analysis shall be carried out it is advised to consult with the archaeological contractor and the RCE to determine the sample locations and sample strategy. Preferably the 'archaeological' sample locations should fit in the program of data acquisition for engineering purposes, which will be the primary objective of the borehole sampling.

The archaeological assessment of the data has to be conducted by a geophysical specialist (KNA prospector Waterbodems). The data quality from the surveys needs to match the demands for this archaeological assessment. To ensure compatibility between the site investigation and the required quality for this assessment it is recommended to define a Program of Requirements (In Dutch: 'Programma van Eisen') in accordance with the 'KNA' (the Dutch quality standards for archaeological research), to be authorized by the competent authority.

During the installation of the wind turbines and construction of the infield cables archaeological remains may be encountered that were fully covered by sediment or not identified as archaeological remains during the geophysical survey. In accordance with the Erfgoedwet (2016) it is required to report those findings to the competent authority. This notification for archaeological finds should be included in the specifications or scope of work.

4. Archaeological expectation based on preliminary investigations	
Maritime related finds	(Parts of) vessel construction, cargo, ballast materials, inventory and personal effects.
WWII related remains	Remains of ship wrecks, airplanes and conventional unexploded ordinance
Prehistory	Drowned Prehistoric Human Habitats

Goal and Research Questions	
4.1 Goal	The purpose of the archaeological assessment is to test the desk study based predictive model for archaeological remains in the area. The expectancy covers remains of shipping related objects (wrecks), airplanes from World War II and prehistoric settlements. The goals set for this assessment are: • To determine the historical or archaeological value of contacts found in the geophysical survey; • To validate the locations of known wrecks; • Preliminary assessment of the prehistoric landscape based on the seismic data.
4.2 Primary Question	Are any archaeological remains present within the Area of Interest and to what extent are these remains traceable?
4.3 Research Questions	With respect to side scan sonar, magnetometer and multibeam survey: • Are there any phenomena visible on the seabed? If so: • What is the description of these phenomena? • Do these phenomena have a man-made or natural origin? If these phenomena can be designated to be man-made: • What classification can be attached? If these phenomena can be classified as archaeological: • Is it possible to interpret the nature of the archaeological objects? If these phenomena can be identified as natural: • What is the nature of these natural phenomena? • Based on the acoustic image is it possible to designate zones of high, middle or low marine activity on the seabed? If so: • How can these zones be interpreted? General: • What is the relation between the observed objects and the topography of the seabed? Based on this relationship can risk-prone areas be marked selectively? • If no acoustic phenomena can be observed, are there any clues that this is a consequence of either natural erosion, sedimentation or human interference? <u>With respect to subbottom profiler- and sampling:</u> • Based on seismic profiles and geotechnical data is it possible to map the Pleistocene landscape? If so: • What is the depth of the Pleistocene landscape compared to the present seabed?

	• From Pleistocene to Holocene deposits is the transition gradual or instantaneous (erosive)? • Can zones be identified where prehistoric settlement remains can be expected? If so: • Could these expected settlement remains be effected by the installation of the cables based on their vertical position related to the seabed? • Are there any indications observed on the seismic profiles for the presence of buried (man-made) objects? If so: • Based on the presence of buried objects and its correlation with side scan sonar, magnetometer en multibeam data can something be said about the nature of these buried objects?
4.4 Restrictions	Investigation 'with restrictions' is not applicable (for explanation, see: memoRIA 2 en 6 (Dutch Inspection Agency for Archaeology).

5. Methodology and Techniques	
5.1 Methodology and Techniques: strategy	Generally the Dutch Archaeological Quality Standard (KNA wb 4.1) is applicable. For surface mapping the seabed of the area of interest is to be recorded fully covered by means of high-resolution side scan sonar and multibeam echosounder. For the mapping of ferro-metalic, buried or exposed objects a magnetometer is required. For the modelling of the subsurface a sub-bottom profiler is required. For the interpretation of the seismic profiles the results of the geotechnical sampling and CPS's are being used.
5.2 Methodology and Techniques: execution	For a standard inventory of the remains of airplanes, shipwrecks and maritime objects the following conditions are applicable: • Frequency of the Side Scan Sonar minimally at 400 kHz; • Maximum range setting of 50 meter for he side scan sonar; • A vessel track distance of maximally 40 meters is allowed to ensure at least 100% overlay between adjacent lines • A vessel track distance for the magnetometer of maximally 40 meter to ensure the detection of sizeable ferromagnetic (iron) wreck remains. For the reconstruction of the drowned prehistoric landscape the seismic profiles at least need to penetrate the seabed to the level of disturbance The survey vessel requires an accurate positioning system (preferably RTK). The possible offset between the GPS antennae and the survey equipment need to be verified through calibration relative to a fixed point of reference. Prior to and after the acquisition of data a sounding profile needs to be recorded to determine the velocity of sound in the water column. At a traveling speed of 4 knots the highest possible resolution of data is guaranteed. In order to meet the goals set for this stage of archaeological research, which comprises a refinement of the archaeological predictive model and allocation of areas with a high archaeological expectancy, it is advised to discuss the survey operations with the survey contractor, the archaeological contractor and the RCE prior to the execution of the survey.

5.3 Restrictions	Due to the sizeable extent of the area of interest (>150 km^2) and its location at sea it is practically not achievable to hold on to the above mentioned conditions for this field investigation. Therefore the proposition is to adhere to the following minimal conditions: • Fully surface covering multibeam data set conform IHO (2008) norm 1A • Fully surface covering side scan sonar records with a maximum vessel track distance of 100 meter and an overlap of minimally 100 % to ensure that all objects larger than 0.5 meter can be detected; • track distance between adjacent survey lines of maximal 100 meter; • The vessel speed should not exceed 6 knots. The presence of shallow gas, i.e. related to peat in the Holocene sediments, can result in acoustic blanking of the seismic signal. As a result the Pleistocene landscape will not be visible at these locations. The presence of boulders can make it difficult to distinguish buried wreck remains, unless phenomena such as scouring on the seabed are observed, that provide additional information about the dimensions and nature of the buried object. Also results from the magnetometer can add to the interpretation of the buried object. Positioning using RTK may not achievable at sea. Deliverables: • georeferenced side scan sonar images of all contacts; • georeferenced side scan sonar mosaic; • a side scan sonar listing containing (at least) all identified contacts including their number, center location, description and interpretation; • a grid file (geotiff) of the interpolated total field residual anomalies; • a magnetometer listing containing (at least) all identified anomalies including their number, location, total field residual anomaly and description (dipole / monopole); • ArcInfo ASCII grid files (or equivalent xyz-grid format) of all the interpreted seismostratigraphic units (in mLAT); • examples of seismic profiles which illustrate the seismostratigraphic and geological constellation; • a subbottom profiler listing containing (at least) all identified targets including their number, location (ETRS89 UTM31 easting and northing) and depth of burial; • special correlation of side scan sonar contacts, magnetic anomalies and subbottom profiler target with known infrastructure and one another. • full survey report including alignment charts.

6. Analysis	
6.1 Processing and analysis of geophysical data	The (comprehensive) data set must be processed and analyzed in order to provide answers the research questions posed. Geophysical data shall be analyzed by an experienced geophysicist (KNA status prospector maritime archaeology). A senior prospector maritime archaeology or a senior maritime archaeologist evaluates the data analysis and the reported results, conclusions and the advice.
6.2 Limitations	None

7. Final product: reporting and depositing	
7.1 deliverables	A comprehensive report is part of the assignment. The final report shall be drawn up in accordance to KNA specification VS05wb. An English written report is to be delivered including a Dutch summary. The contractor produces a draft version of the report to the authority. The authority will review quality of the content of report delivered. Along with the final product a receipt of the delivery of documentation will be handed over by the receiving party. Along with the final report digital data carrier is delivered containing: • A listing of contacts of potential archaeological interest including positions and dimensions (in GIS format); • Images of all sonar and/or multibeam contacts of archaeological interest; • Digital maps of the interpreted magnetometer, side scan sonar data, subbottom profiler data; • Subbottom profiler data of archaeological interest. If during the survey results in additional information with respect to objects known from the NCN-database or if man-made objects are encountered which have not been found before, this information shall be delivered digitally in a standard format to the area administrator (Department of Waterways and Public Works - Team Sea and Delta).
7.2 Content final report	Refer to KNA VS05wb. For this project in particular side scan sonar, magnetometer, subbottom profiler and multibeam recordings play an important role in the interpretation of phenomena under water.
7.3 Publication and format of final report	The final report is issued by the contracting party. The report is part of the in house publication series of the contractor. The report is delivered to the Cultural Heritage Agency (digitally and analogue), the area administrator Department of Waterways and Public Works - Team Sea and Delta, the Royal Library and the digital archive DANS.
7.4 Deposition	Relevant results shall be registered in Archis within two months after completion of the standard report. Digital data will be handed over to the e-depot (www.edna.nl) within two years after completion of the field survey.
7.5 Limitations	None

8. Prerequisites	
8.1 Personnel	The survey must carried out or supervised by an archaeological company which is in the possession of a license to perform archaeological research in Dutch waters. The survey shall be supervised by a senior prospector maritime archaeology or a senior archaeologist with a solid background in analogues projects at sea. Both for field work as for the analysis and reporting an experienced project leader with specific knowledge of the area is required.
8.2 Lead-time field work	In consultation with company
8.3 Work conditions	In agreement with ARBO law.
8.4 Quality control, supervision, consultation and evaluation	The Netherlands Enterprise Agency (RVO) and the Cultural Heritage Agency (RCE) supervise the process of archaeological research. Solely RVO and RCE are entitled to change the Program of Requirements.
8.5 Selection Procedure during field work	n.a.
8.6 Field work period; deadline draft report	Field work: Summer 2019 Draft report: End of 2019
8.7 Procedure QC final	The Netherlands Enterprise Agency (RVO), the Cultural Heritage Agency and

product by authorities	the company review quality of the content of the draft version of the report. After finalizing the survey the period of time applicable for the QC is agreed upon.

9. Change of plans	
9.1 Changes during field survey	In consultation with the survey company and authorities.
9.2 Procedure for change after completion of field survey	Not applicable.
9.3 Procedure for change during analysis, reporting or conservation	In consultation with the survey company and authorities.

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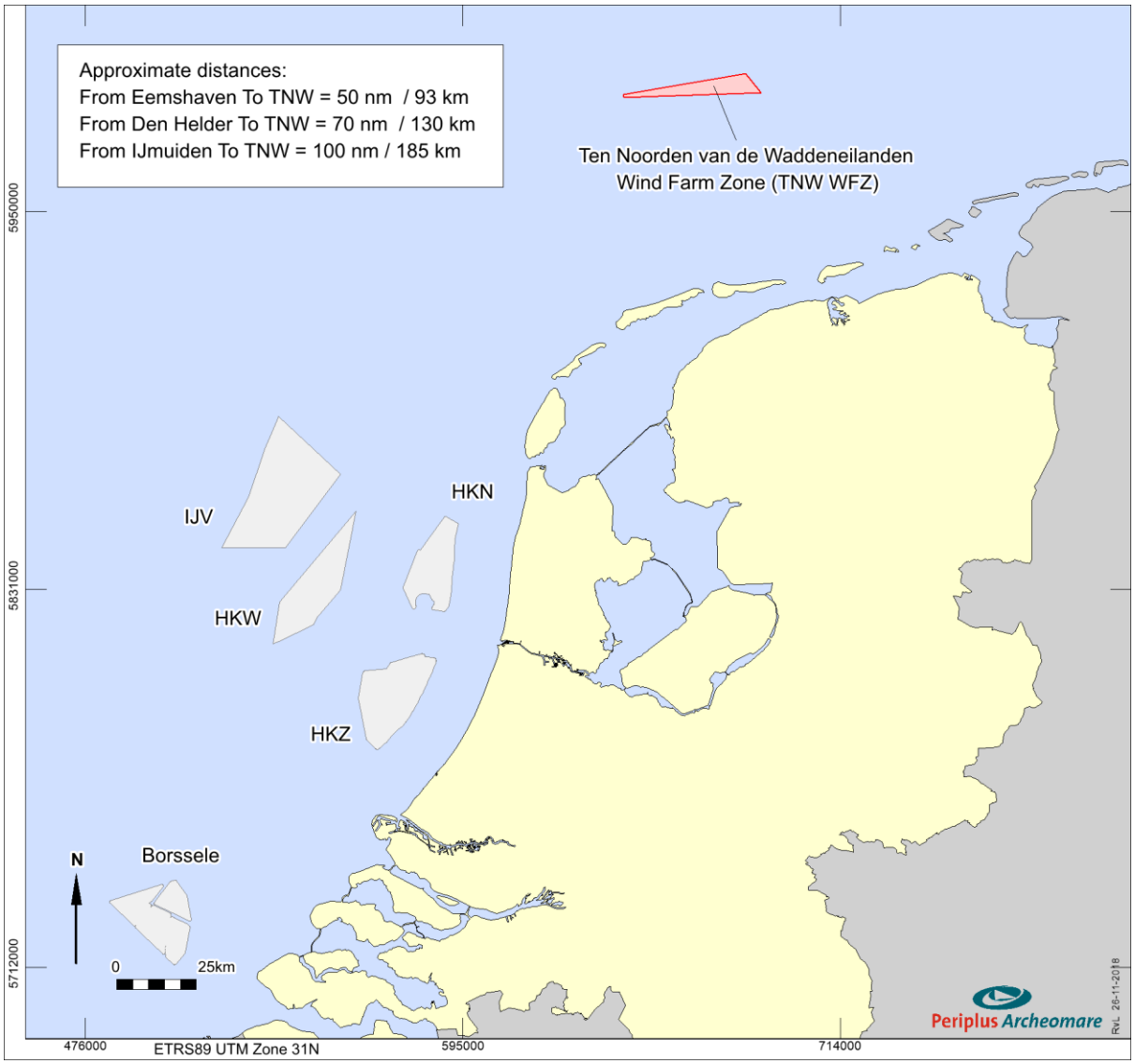
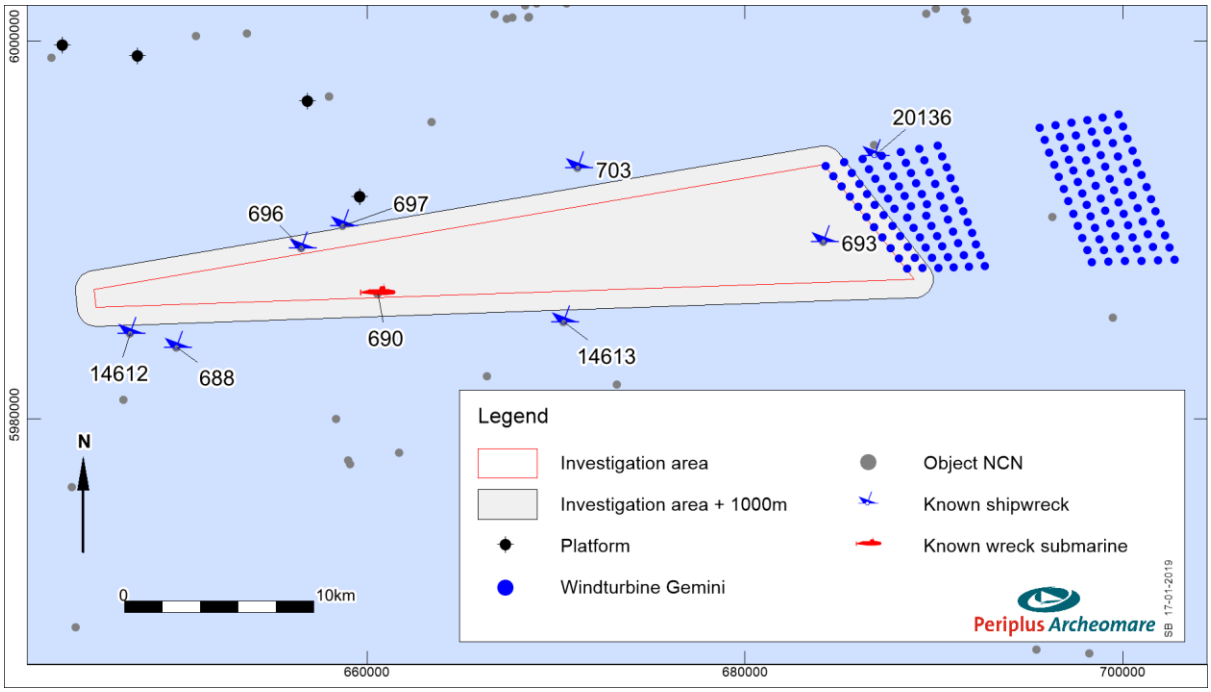
Appendix 1. Location map



Appendix 2. Known objects in the research area (from archaeological desk study)



NCN	DHY	Easting	Northing	R95	Description	Ident.	Arch. value
690	248	545017	540029	5	Wreck of German WO I submarine U-75. Sunk on 13-12-1917 after it struck a mine. 52.8x11.4x2.1 meter	Yes	Presumably High*
693	252	581122	540199	5	Possible wreck of the Insulaner. Sunk in 1979, reason unknown. 21.1x12.2x0.7 meter	Yes	None
696	256	539001	54026	5	HY10509; 15.1x7.8x0.5 meter	No	Unknown
688	244	528668	539806	5	HY10509; 19x9x2 meter	No	Unknown
697	257	54237	540358	5	HY10509; 15.8x10.8x3.2 meter	No	Unknown
703	263	561511	540593	5	HY10509; 34.5x7.5x1.9 meter	No	Unknown
14612	3730	524929	539881	5	HY10509; 12.7x3.9x0.3 meter	No	Unknown
14613	3731	559951	539864	5	HY10509; 21.7x9.9x1.1	No	Unknown
20136	-	585499	540596	5	Archis ID: 3289998100; Wooden shipwreck discovered during the construction of the Offshore Wind Farm Gemini	No	Presumably High*

*NOTE: no investigation has been carried out on these wrecks yet; therefore the actual archaeological value of these wrecks has not been determined yet.