



*Geophysical, Geotechnical,  
Environmental, Archaeological and  
Metocean Survey of Dublin Array  
Offshore Wind Farm & Export  
Cable Route Corridors*



*Marine Archaeological  
Assessment*



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**Non-Technical Summary:**

*MDM (McMahon Design and Management Ltd) have commissioned Geomara Ltd. to undertake a maritime archaeological assessment in connection with a foreshore licence application for a marine survey for a proposed offshore windfarm (Dublin Array Offshore Windfarm) located on both the Kish and Bray Banks, approximately 10km from the coast of counties Dublin and Wicklow.*

*The proposed survey, comprising a geophysical survey, associated seabed sampling and metocean equipment deployment, are required to provide data which will facilitate the engineering and foundation design for the wind turbines and export cables. The geophysical survey is non-intrusive in that it uses remote sensing techniques that do not cause any disturbance of the sea-bed and will comply with the requirements of DAHG (2014) "Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters" and Department of Culture, Heritage and the Gaeltacht, Underwater Archaeology Unit "General Requirements for a Geophysical Survey for Archaeological Purposes".*

*This assessment comprises of an introduction to the study area; and to the identification of any potential cultural heritage sites, features and deposits located within the proposed survey area. In order to provide a comprehensive assessment, an extensive desk-based study for the proposed survey area was undertaken. The potential impact of the proposed survey and the associated seabed sampling on the receiving environment is addressed and mitigation measures to ameliorate these impacts are presented.*

*There are 110 known wreck sites (see Tables 3 - 5) within the proposed survey areas or within close proximity to the survey area (Figure 7). Furthermore, the report confirmed the presence of a submerged forest at Bray Harbour which extends northward along the coastline up to Shanganagh Park (Figure 8). None of the wreck sites or the submerged forest will be impacted upon during the proposed bathymetric and geophysical survey. The assessment outlines impact mitigation measures for the associated seabed sampling and metocean equipment deployment.*

*The sea-bed sampling will consist of a series of grab samples for benthic analysis to provide input for environmental assessment, vibrocores to investigate the nature of the upper layers of the seabed and intertidal Cone Penetrometer Tests (CPT's) and boreholes at the proposed landfalls to acquire geotechnical and geological data. The sampling process is a localised activity and will not result in any significant disturbance of the sea-bed or archaeological materials or deposits. The sampling will be taken at various points and locations within the foreshore survey licence area. A diver swim survey may also be undertaken from the low water line to provide overlap with the boat based survey.*

*The deployment of metocean monitoring equipment is a localised activity and will not result in any significant disturbance of the sea-bed or archaeological materials or deposits. The buoys will be moored at various locations*

*within the lease application area. The assessment outlines impact mitigation measures for the deployment of the monitoring buoys.*

*The mitigation strategies outlined here detail the measures to be adopted in order to ameliorate any unforeseen direct, indirect and secondary impacts that the proposed survey may have on features of maritime cultural heritage interest. If these measures are employed it is envisaged that the proposed survey works will have no impact on features of maritime cultural heritage interest.*

*The following mitigation recommendations are presented in connection with the proposed survey:*

1. The Surveys shall be licensed under the National Monuments Act 1930 – 2004.
2. Prior to any sampling taking place the results of the geophysical and bathymetric surveys shall be reviewed by a suitably qualified archaeologist in order to examine the sampling location for any previously unrecorded cultural heritage seabed features.
3. The sample locations will also be cross referenced with all of the cultural heritage sites identified in the Marine Archaeological Assessment Report in order to avoid all such locations. A 100m exclusion zone shall be applied.
4. Archaeological analysis of the whole geophysical and bathymetric survey datasets will be undertaken to both confirm the locations of the wreck sites within the survey corridor and also to identify any potential unrecorded seabed and sub seabed maritime archaeological features.
5. Prior to deployment of the metocean monitoring equipment, the results of the geophysical and bathymetric survey at those locations shall be reviewed by a suitably qualified archaeologist in order to examine the deployment location for any previously unrecorded cultural heritage seabed features. A 100m exclusion zone shall apply.
6. Should the proposed survey and subsequent sampling campaign be subject to further revision, details of these revisions shall be forwarded to the project archaeologist for assessment.
7. On completion of the survey and sampling a report will be produced summarising all archaeological aspects of the project and submitted to DCHG and the National Museum of Ireland.
8. It is recommended that all sites of cultural heritage interest included in that report should be avoided by any future seabed interventions.
9. The video from the ROV survey or diver swim survey, if undertaken, will be assessed by a suitably qualified archaeologist.

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# 1. INTRODUCTION

## 1.1 Introduction

Dublin Array is a proposed offshore wind farm in the Dublin Bay area, approximately 10km offshore. Dublin Array is reviewing the cable routes and lease application areas to connect the offshore windfarm to the electricity transmission grid and have employed MDM as consultants to support the study of the project. The proposed foreshore survey licence area is outlined in Figure 1 below:

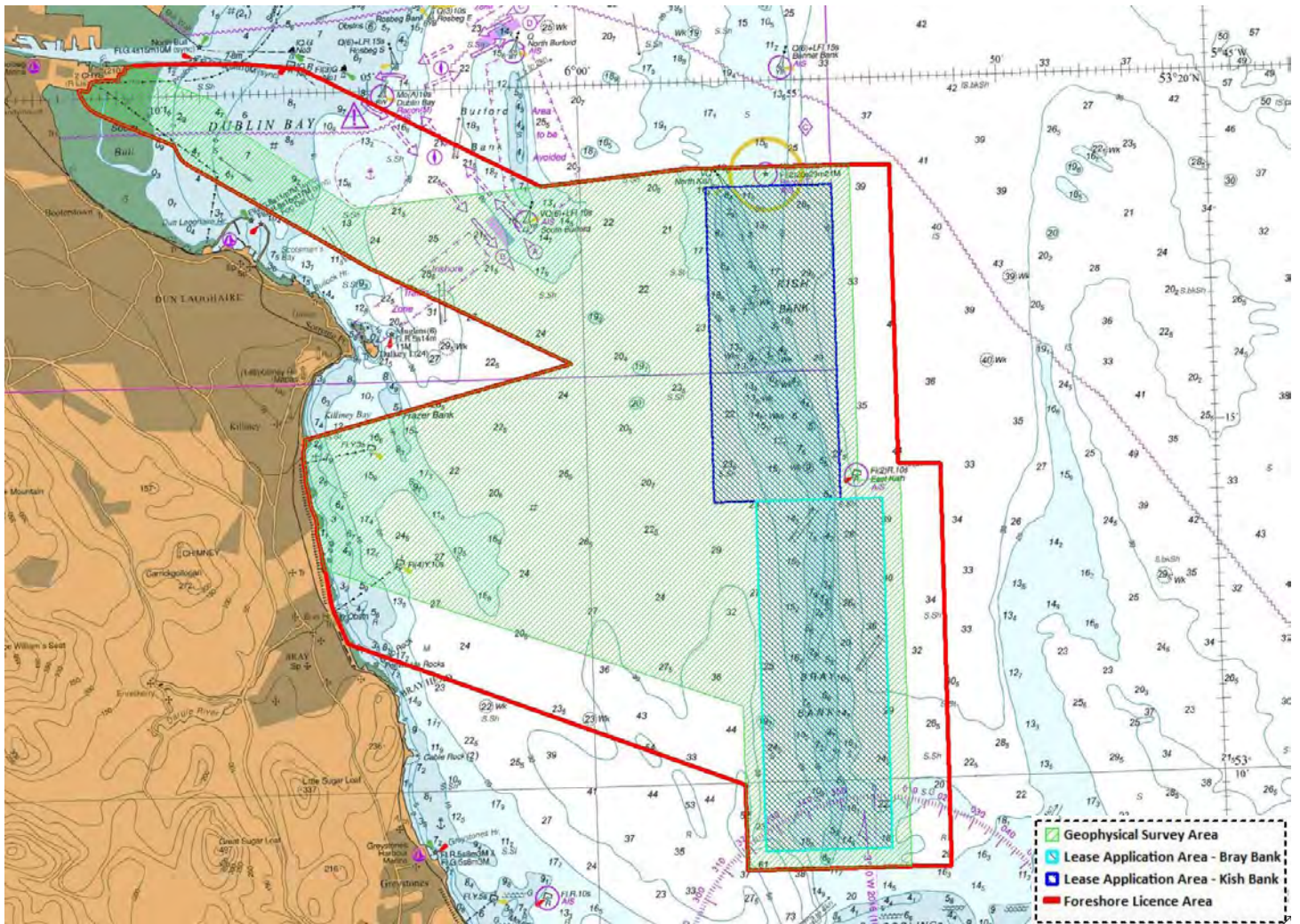


Figure 1. Foreshore survey licence Area

The assessment comprises of an introduction to the survey area and the lease application area (see Figure 1) comprising of the Kish Bank and Bray Bank. In addition, the assessment outlines the identification of cultural heritage sites, features and deposits located along and within the proposed cable route survey area and the lease area. In order to provide a comprehensive assessment, an extensive desk-based study of the survey and the lease application areas was undertaken. The potential impact of the proposed scheme on the receiving environment is addressed and mitigation measures to ameliorate these impacts are presented.

### 1.2 Site Location:

Dublin Array is a proposed offshore wind farm in the Dublin Bay area, located on the Kish and Bray Banks, situated approximately 10km off both the Dublin and Wicklow coast with the Bray Bank being a southerly continuation of the Kish Bank. The relevant overall area on the Banks is referred to as the Lease Application Area (58 km<sup>2</sup>) and this is shown in Figure 1. The coast-parallel north-south trending offshore banks exist in the western Irish Sea at a distance of approximately 10 km offshore. These banks stand in 20 – 30m of water and rise to within a few metres of the water surface. The Kish Lighthouse marks the northern end of the Kish Bank and the Codling Bank lies to the southern end of the Bray Bank. The study area also includes the route of the subsea export cables to Poolbeg and Shanganagh which will connect the wind farm to the shore and the overall survey foreshore licence area covering 196 km<sup>2</sup>.

### 1.3 Legislative Framework and Guidance

This assessment takes into account the following legislative procedures and guidelines:

- The National Monuments Act (1930-2004),
- The Foreshore Act (1933),
- Merchant Shipping Act (1995);
- Valetta Convention;
- ICOMOS; and
- UNESCO

## 2. ASSESSMENT METHODOLOGY

Archaeological assessment has been described as “the overall process of assessing the impact of a development” (DAHGI, 1999, Policy and Guidelines on Archaeological Excavation. Govt. Publications Office, Dublin).

The principle aim of the assessment is to anticipate and avoid impacts on the archaeological resource. Archaeological assessment may be required as part of the planning process in response to developments which may be located in the vicinity of archaeological monuments (The Heritage Council 2000).

This document has been prepared with reference to specific criteria set out in the Guidelines on Information to be contained in Environmental Impact Assessment Reports (Draft EPA 2017) and Advice Notes for Preparing Environmental Impact Statements (Draft EPA 2015).

This report details 3 individual phases, all of which followed in succession and contributed towards the complete assessment of the project.

These phases were:

1. Desktop study
2. Impact Assessment
3. Provision of suggested mitigatory measures

### 2.1 Desk based assessment

The desk-based assessment is a documentary and cartographic search utilising a number of sources in order to locate all known cultural heritage assets within the study area and within the general location of the proposed cable route. An additional purpose of the desktop study is to provide an historical and archaeological background to the subject site.

Geomara consulted the following sources:

- Local and National Libraries
- The National Historic Monuments Register
- Sites and Monuments Record
- Record of Monuments and Places
- Record of Protected Structures
- The National Museum – Topographical Files
- UNESCO World Heritage Sites database
- The Geological Survey of Ireland – Aerial Photographs
- Examination of Historic Ordnance Survey Maps and related sources
- The Architectural Archive of Ireland
- The National Archives of Ireland



- Historic Annals
- Archaeological Excavations Catalogue
- Lewis' Topographical Dictionary
- Genealogical Societies and Local Historical Societies
- The Ports and Harbour Archive
- The National Shipwreck Inventory
- Online and web sources
- Dublin City Development Plan (2016-2022)
- Dun Laoghaire Rathdown County Development Plan (2016-2022)
- Woodbrook-Shanganagh Local Area Plan (2017-2023)
- Poolbeg West SDZ (2019)

A variety of sources have been consulted to provide information on potential impacts and the relationship of the proposed survey within the wider maritime context to include all known maritime and terrestrial cultural heritage assets. Together these provide an overview of the proposed survey route, which can then be used to determine areas of archaeological potential.

### ***2.2 Impact assessment***

Impact assessment is the penultimate stage of the assessment process. It involves dissemination of the results of the desktop assessment and the determination of impact.

### ***2.3 Mitigation measures***

The final aspect of the overall assessment process is the provision of suggested mitigation measures. There are various ways potential impacts of a development can be mitigated. Mitigation measures usually involve avoidance (the implementation of exclusion zones and design alterations), reduction (the introduction of measures to deal with unexpected discoveries during works), or offsetting (excavation and recording of a site before an impact occurs). Ideally, sites and features of cultural heritage interest should be subject to as little disturbance as possible, where policy normally dictates a presumption in favour of preservation in situ in line with current national policy.

### 3. EXISTING ENVIRONMENT

#### 3.1 Introduction

In describing the receiving environment, the context, character, significance and sensitivity of the baseline receiving environment into which the proposed development will fit is assessed. This takes account of any other proposed developments that are likely to proceed.

#### 3.2 Planning Context in Relation to Archaeology and Cultural Heritage

Dublin City Development Plan (2016-2022), Dun Laoghaire Rathdown County Development Plan (2016-2022) and Woodbrook-Shanganagh Local Area Plan (2017-2023) address issues relating to Cultural Heritage and set out a wide range of policies under a number of sub headings. This assessment takes account of all the stated policies and related objectives. The Development Plans implement applicable Ministerial Planning Guidelines to help resolve any issues relating to any cultural and heritage sites onshore or offshore.

The City and County Development Plans and Local Area Plan contain a commitment to the protection and conservation of buildings, areas, structures, sites and features of archaeological, architectural, historical, artistic, cultural, scientific, natural heritage, social or technical interest.

The Planning and Development Act (2000) allows for the listing of important structures in Development Plans in order to provide protection to cultural heritage assets. Details of protected structures are entered by the local authorities in a Record of Protected Structures, which is part of the Development Plan. Balancing development pressures and the protection of this heritage can pose a challenge, however, protective measures can be implemented to ensure no adverse effects occur on Recorded Monuments or Protected Structures.

Dun Laoghaire Rathdown County Council has committed to *'ensure that the protection and conservation of the outstanding architectural and archaeological built heritage of Dún Laoghaire–Rathdown forms an integral and component part in the continuing sustainable development of the County and that this valuable, and in many instances non-renewable, resource continues to be safeguarded through proper management, sensitive enhancement and appropriate development and re-development.'*

The Dublin City Development Plan outlines strategic aims to:

- *Enhance the existing character and distinctiveness of the city and maintain its strong sense of place.*
- *Protect and enhance the built and archaeological heritage of the city.*
- *Promote the use of urban design principles and high standards of architectural design in the redevelopment of regeneration areas.*
- *Promote the use of urban design principles and high standards of architectural design in all new developments. Encourage the development of sustainable neighbourhoods with a distinctive urban character and identity*
- *Support proposals for development and extension of port facilities and an extension of the rail line to the port.*

The *National Monuments Acts 1930-2004* provide for the protection of archaeological sites, monuments, artefacts and shipwrecks that are listed in the Record of Monuments and Places (RMP). Although the archaeological resource is finite (refer Appendix 2), sites continue to be discovered. Where new development is being considered, it is therefore advisable to check the National Monuments Service's Archaeological Survey Database on [www.archaeology.ie](http://www.archaeology.ie) in order to assess the archaeological potential of a site.

- Protect the archaeological heritage of the city.
- Ensure that proposed development within the designated city centre Zone of Archaeological Potential is not detrimental to the character of an archaeological site or its setting.
- Have regard to the archaeological recommendations of the Department of Arts, Heritage, Rural, Regional and Gaeltacht Affairs on any planning applications.
- Endorse the sustainable use of archaeological heritage as an educational and cultural resource and promote public awareness of the archaeological heritage of the city.
- Require the surveying, recording or excavation of archaeological heritage during the development process where appropriate.
- Seek the preservation in-situ or, at a minimum, preservation by record of archaeological sites/monuments included in the Record of Monuments and Places.
- Ensure that any development proposal with potential to impact on archaeological heritage includes for an archaeological assessment. This includes within terrestrial, riverine, inter-tidal and sub-tidal environments.
- Promote the protection of the varied industrial heritage of the city and encourage greater appreciation and public awareness of this heritage.

### **Architectural Heritage**

Dublin has exceptionally strong links with its past. This is evident in the built form, architecture and archaeology of the city. The city centre has a distinct physical character, with narrow streets, contrasting buildings, canals, millraces and a relationship with the river and sea creating a unique urban setting. Most of the significant built heritage and archaeology is located in the city centre which largely follows a Viking and medieval pattern of irregular streets, varying building heights and plot widths. These characteristics, which include the remnants of the city walls, have endured notwithstanding changes over the centuries.

This heritage is a significant element in the definition and experience of the urban environment. It is a valuable cultural and tourism asset and contributes to the economic vitality of the city. Growth and redevelopment can impact on the protection of the historic core. Good urban design and architecture can meet the challenge of a historical context and can, with sensitive design, complement the historic core. Part IV of the *Planning and Development Act, 2000, as amended* provides the legal basis for the conservation and enhancement of the architectural heritage. There are two principal mechanisms within this legislation for the protection of these assets; the Record of Protected Structures (RPS) and Architectural Conservation Areas (ACAs). Specific direction on the implementation and management of these statutory protections is provided in the Department of Arts,

Heritage and the Gaeltacht's publication *Architectural Heritage Protection: Guidelines for Planning Authorities (2011)*. The Department has also issued a range of publications under its *Advice Series* to provide more detailed guidance and advice on historic building materials and issues e.g. maintenance, access, windows, iron, and brickwork.

### **Record of Protected Structures (RPS)**

A protected structure is defined in planning legislation. A significant number of buildings and structures within the city are deemed worthy of protection and thousands are currently on the Record of Protected Structures (RPS). The RPS list is set out in Volume 4, Dublin City Development Plan (2016-2022) and in Appendix 4 of the Dun Laoghaire Rathdown County Development Plan (2016-2022). The RPS is not a static document and additions or deletions, where appropriate, can be made to this record, by invoking the statutory process. It is policy to encourage the protection, enhancement and active use of protected structures.

### **Architectural Conservation Areas (ACA)**

An Architectural Conservation Area (ACA) is a place, area, group of structures or townscape that is of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest or value, or contributes to the appreciation of protected structures. ACAs could encompass, for example, a terrace of houses, a whole streetscape, town centre or a small cluster of structures associated with a specific building such as a mill or country house. Most structures in an ACA are important in the context of their contribution to the streetscape or character of an area and so the protection status generally relates only to the exterior of the buildings or the streetscape, except for Protected Structures within ACAs where the protection extends to the interior and curtilage of these properties. Any works that would have a material effect on the special character of an ACA require planning permission.

Twenty three areas in Dublin City and twenty areas in Dun Laoghaire Rathdown are designated as ACAs. They represent different periods in, and functions of, the development of the city.

### **The Coast**

Dublin Bay is an integral part of the aesthetic landscape and culture of the city. The ties between the city, county and the sea are exhibited in its strong maritime history and the traditions of areas such as the Dublin Docklands, the coastline and villages such as Howth and Bray, traditional seaside villages, which attract visitors throughout the year. The coastline is important in both terms of tourism and recreation attraction stimulating economic activity, providing local amenity and related socio-economic and health benefits.

### **The following policies are considered relevant:**

The planning and development policies of Dublin City Council and Dun Laoghaire Rathdown County Council aim to protect and maintain the integrity of the coastal environment and waterways by avoiding significant impacts and meeting the requirements of statutory bodies, national and European legislation and standards

- Have regard to European and national best practice guidance when assessing development in or near coastal areas which is likely to have significant effects on the integrity, defined by the structure and function, of any designated European Sites, protected coastal and marine fauna and flora.
- Maintain and extend the achievement of the Blue Flag Beach status in co-operation with Irish Water.
- Ensure any development within the aquatic environment shall be carried out in consultation with prescribed bodies and with adherence to their guidelines.

### 3.3 Geology, Bathymetry and seabed typology

The Kish and Bray Banks occur as part of a series of coast-parallel north-south trending offshore banks along the east coast of Ireland. The current seabed landscape is a relict of the underlying bedrock geology and the actions of several glacial periods when large volumes of material were eroded and deposited on the seabed. The morphology and distribution of surficial sediments in the region has resulted largely from glacial deposition/scour processes combined with reworking and re-deposition as a result of riverine input and tidal processes. The Kish Bank and Bray Bank formed as moraines (immobile mounds of glacial debris). These moraines are now overlain by mobile sand and gravel. (*Hanna, J. (2002) Dynamics of coastal and nearshore morphology in southeast Ireland. Ph.D. Thesis. University of Ulster, Coleraine; Wheeler, A.J., et al (2000). Geological appraisal of the Kish, Burford, Bray and Fraser Banks, Outer Dublin Bay Area. Marine Resource Series No. 13*)

Water depths on the Kish and Bray Banks vary between 2 and 26 m. The area of the banks shallower than 20 m is 35 km<sup>2</sup>, of which 33% (10 km<sup>2</sup>) is shallower than 10 m. The largest waves in the area come from the south to southeast direction, with some input from the northeast. The banks experience a southern flow during ebb tides and a northern flow during flood tides, with maximum tidal velocities of 2.2 knots (1.13 m/s) being experienced close to the banks. The Kish & Bray banks contain thicknesses of sand and gravel from 5 m to 35 m, with a stiff clay underlying these. Hydrodynamic modelling assessments have shown that the upper sand layer within the banks is mobile and capable of successive erosion and deposition taking place over spring and neap tidal cycles. (*Cawley, A. (2012) Hydrodynamic Modelling Assessment of the Dublin Array project on the Kish and Bray Banks*)

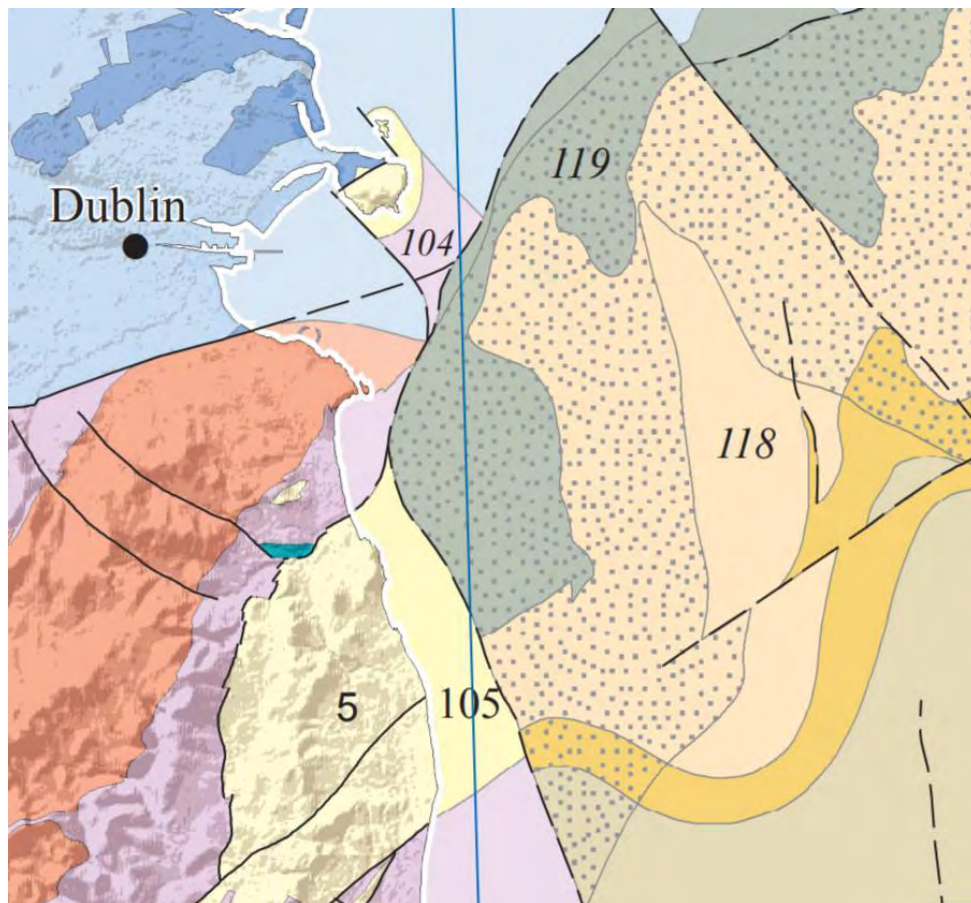


Figure 2. Extract from the Bedrock Geology of Ireland – Ordnance Survey of Ireland 1:1,000,000 scale map

### 3.4 Cartographic evidence

Cartographic sources indicate that there are no known potential cultural heritage assets directly affected onshore at two proposed landfall sites within the proximate location of Hackettsland / Shanganagh or at the landfall centred at Poolbeg. This is explored further in section 4.2.

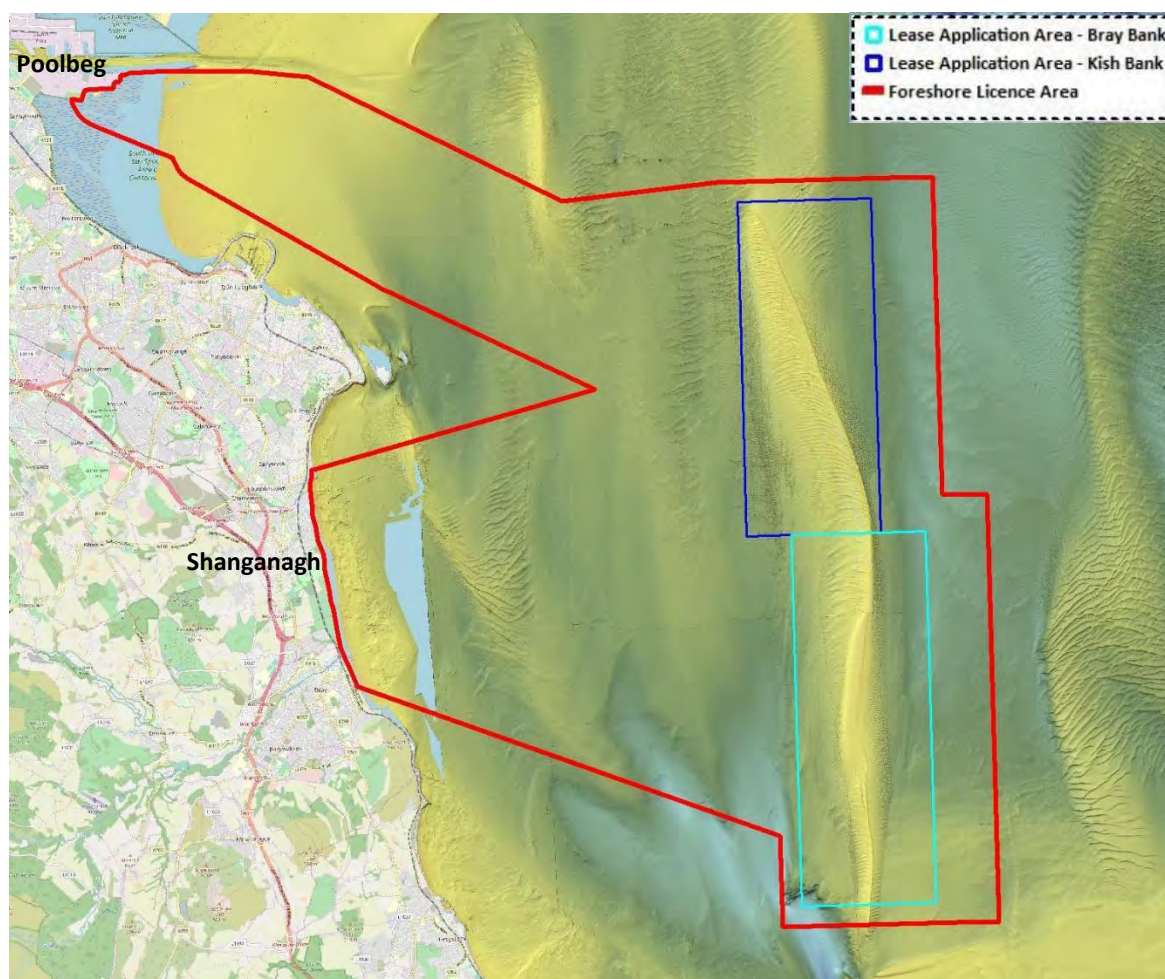


Figure 3: Foreshore survey licence Area & Lease Application Area overlaid on bathymetry data derived from the Infomar national seabed survey.

### 3.5 Foreshore survey licence Area

The Foreshore survey licence Area is shown in Figure 4. The overall project lies wholly within the 12 Mile Limit. The area is quite extensive and the reason for this is that it covers the lease application area, export cable route corridors and seabed sampling at various stations across the survey licence area; the boundary co-ordinates of the Foreshore survey licence Area are presented in Appendix 5.

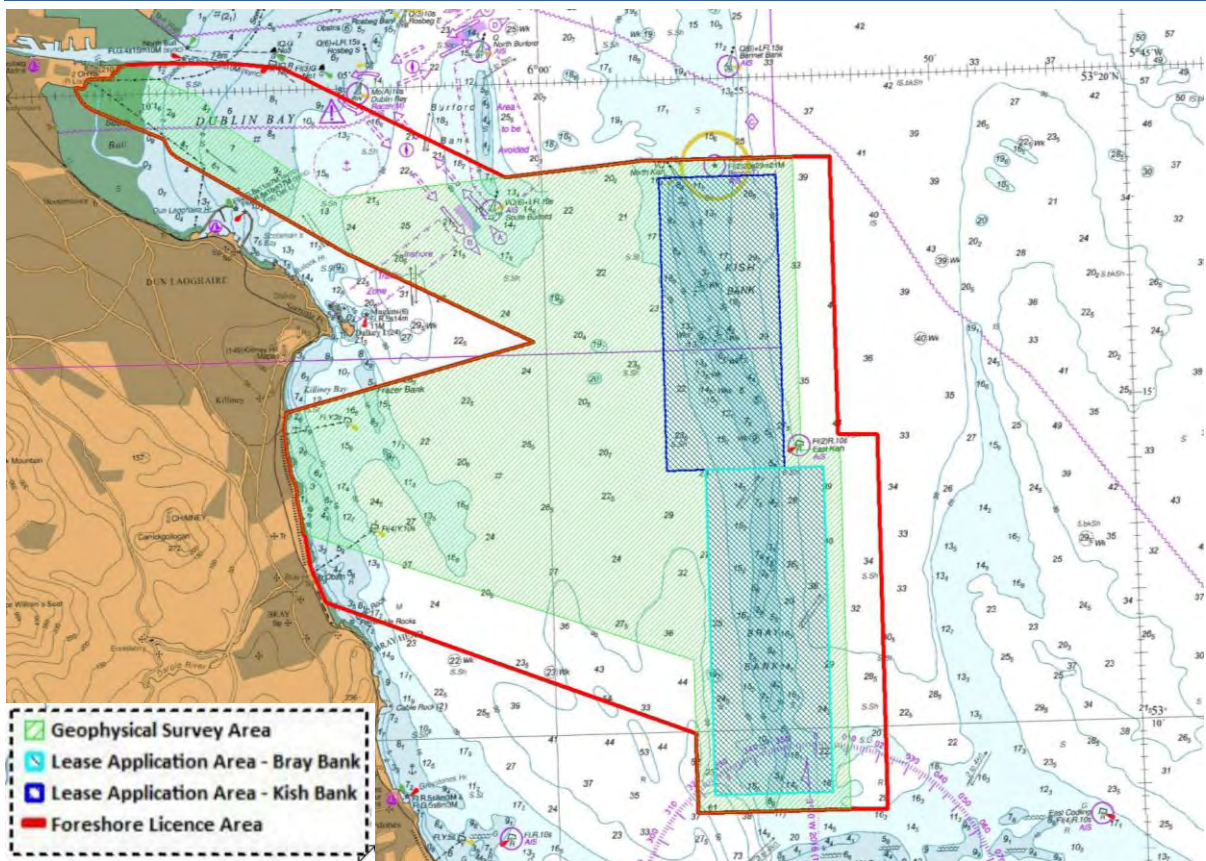


Figure 4. Foreshore survey licence Areas

The specific survey proposed for the Dublin Array Offshore Windfarm comprises of;

1. Geophysical Survey over the proposed Lease Application Area comprising the Kish Bank and the Bray Bank with a nominal 500m buffer.
2. Geophysical Survey of the Export Cable Route Corridors.
3. Seabed sampling at locations across the Foreshore survey licence Area.
4. Metocean data monitoring at locations within Lease Application Area.

The boundaries of the Lease Application Area are defined by ITM co-ordinates for the corner points and these are presented in Table 1 (below):

Kish Bank	
<i>Northing</i>	<i>Easting</i>
740192	722385
736855	722288
736615	730631
739946	730728
Bray Bank	
737967	722320
741305	722417
741579	713147
738235	713049



Table 1. Lease Application Area Co-Ordinates (Kish & Bray Banks)

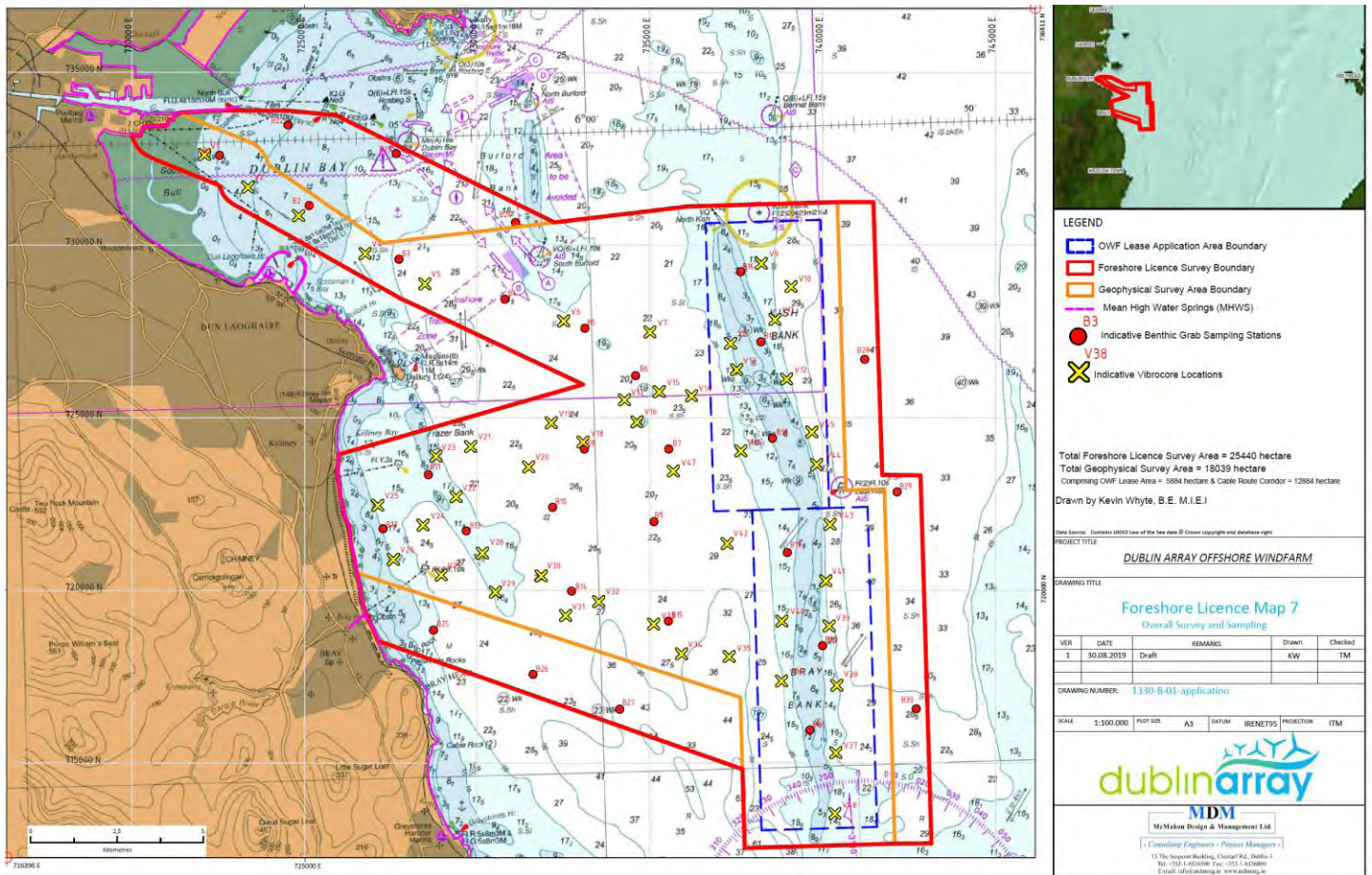


Figure 5. Nominal seabed sampling locations.

### 5. DEVELOPMENT DETAIL

The current surveys are required to provide metocean data which will provide additional information regarding wind, wave and current characteristics, geophysical data which will investigate the nature of the seabed, sub-surface stratigraphy and geotechnical data to facilitate the engineering and foundation design for the array. Survey is also required for subsea export power cables having potential landfalls in the general area of Shanganagh and Poolbeg / Shellybanks. The metocean data to be collected will provide measurement of wind strength and direction to provide greater spatial coverage to supplement the data collected towards the north of the proposed array. In addition a further deployment of wave and current measuring devices will supplement the data collected in 2012. The geophysical survey will provide a broad-scale map of ground types and seabed features. The surveys will also include Grab Sampling to ground-truth the geophysical results and provide benthic samples, vibrocores to investigate the nature of the upper layers of the seabed and intertidal Cone Penetrometer Tests (CPTs) and boreholes at the proposed landfalls to acquire geotechnical and geological data. The nominal locations for the seabed sampling are shown on Figure 5 and these will be qualified following assessment of the geophysical survey data.

The principal objectives of the surveys are to:

- Produce detailed bathymetric mapping.
- Obtain detailed seabed morphology.
- Identify the nature of the seabed.
- Acquire both shallow and deep geological cross-sections of the array site.

In addition, the survey data will determine any marine archaeological features in the area, i.e. identifying wrecks and anomalies of archaeological potential and sediment layers which may be of archaeological interest.

#### *4.1 Sites of cultural heritage interest along the cable corridor.*

The baseline environment has been divided into four categories, each of which is addressed individually. These are as follows:

1. Onshore cultural heritage assets listed by the Department of Culture, Heritage and the Gaeltacht and National Museum of Ireland
2. Known wrecks and obstructions as per NMS Wreck Viewer, Shipwreck Inventory and UKHO
3. Unrecorded maritime archaeological sites, features and deposits identified through assessment of geophysical and hydrographic data
4. Areas of archaeological potential

#### *4.2 Onshore cultural heritage assets listed by DCHG and the National Museum of Ireland*

There are a number of known archaeological sites situated within the vicinity of the proposed cable route survey corridor. However, for the purpose of this report none of these sites listed below will be impacted upon during the Geophysical Survey or Seabed Sampling. However, in order to prevent future impacts on any cultural heritage assets this comprehensive assessment has included all known archaeological sites in the immediate area and these are listed on the Sites and Monuments Record of the DCHG.

There are four recorded monuments near the survey corridor extents in the proximity of Poolbeg, Co. Dublin. These are listed in the RMP as follows: Martello Tower, Sandymount (DU 019-018), a Blockhouse (DU 019-027), the South Bull Seawall (DU 019-029002) and a Battery (DU 019-028). These monuments will not be impacted negatively due to the nature of the surveys and sampling proposed.

Within the southern extents of the cable route survey corridor, the first landfall is located at Shanganagh Cliffs in the townland of Hackettsland, Co. Dublin and the second is located at Shanganagh Park, Shanganagh, Co. Dublin.

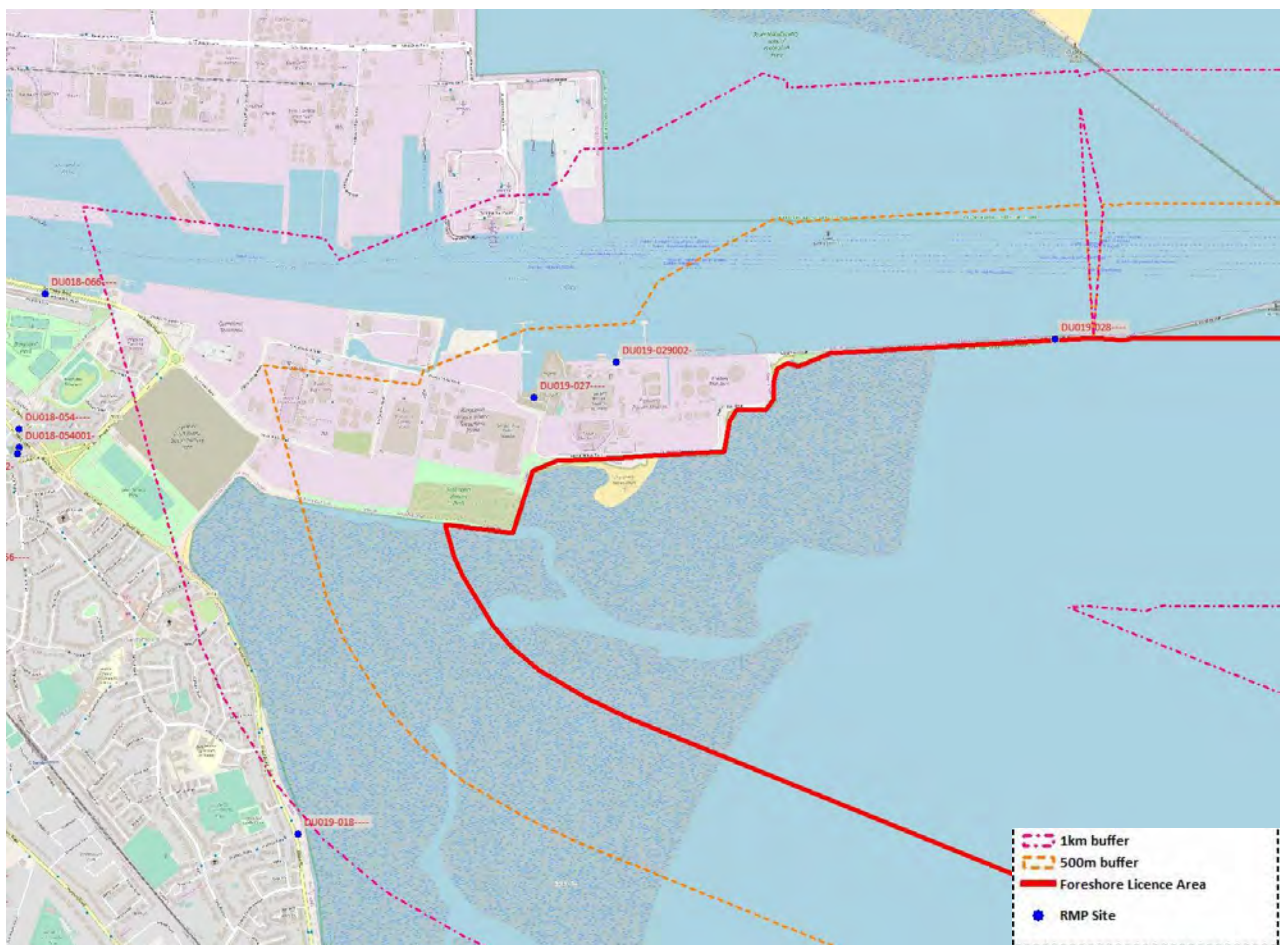


Figure 6. RMP sites at Poolbeg landfall

There are no recorded monuments corresponding with the grid references provided for the proposed landfalls at Shanganagh Cliffs, Hackettsland and Shanganagh Park, Shanganagh. However, there are a number of monuments within 500m of the proposed sampling locations at these landfalls. These are listed in the RMP as follows: Martello Tower (DU 026-05501), Defensive Redoubt Site (DU 026-055002) and Enclosure (DU 026-032). Additional monuments recorded within 1 km of the wider survey boundary are listed in Table 1 overleaf. See Appendix 3 for a comprehensive report on onshore archaeological evidence, including excavations, in the areas surrounding Shanganagh Cliffs and Shanganagh Park.

Previously the Dublin and South East Railway ran along the coast at Shanganagh from Harcourt Street to Bray. It was constructed as an Irish gauge railway in 1859 and operated until 1958. After closure, the rail track was completely removed by the early 1960's. Coastal erosion of the cliffs at Shanganagh has also altered the shoreline over time and there is potential for exposure of unrecorded cultural heritage along the foreshore.



Figure 7. RMP sites at Hackettsland / Shanganagh landfalls

These landfall areas outlined above will not be affected by the proposed Geophysical Survey or by the seabed sampling.

<i>Reference</i>	<i>Class</i>
DU 026 -014001	Martello tower
DU 026 -014002	Earthwork
DU 026 -070	Martello tower
DU 026 -124	Linear earthwork
DU 026 -012	Battery
DU 026 -010	Megalithic Structure
DU 026 -011	Martello tower
DU 026 -013001	Church
DU 026 -013002	Graveyard
DU 026 -013003	Inscribed stone
DU 026 -013004	Ritual tree
DU 026 -013005	Font
DU 026 -013006	Cross
DU 026 -013007	Cross
DU 026 -013008	Ecclesiastical enclosure
DU 026 -030	Megalithic Tomb
DU 026 -031001	Castle tower house
DU 026 -031002	Water mill
DU 026 -033	Enclosure
DU 026 -120	Castle
DU 026 -116	Fulacht fia
DU 026 -068001	Church
DU 026 -069	Ritual well
DU 026 -068002	Graveyard
WI004 -005	Linear earthwork
WI004 -002	Martello tower
WI004 -003	Martello tower
WI004 -004	Burial
WI004 -001001	Cross slab
WI004 -001006	Castle tower house
WI004 -001	Historic town
WI004 -001003	Castle
WI004 -001004	Church

Table 2. RMP sites within 1km of Shanganagh / Hackettsland landfalls.

As outlined in the Non-Technical Summary, this assessment has identified the presence of a submerged Neolithic forest, within the proposed foreshore survey licence area, approx. 2km south of Shanganagh Park. A number of timbers protruding from the seabed, have been identified. This submerged forest and its timbers are located below both the sea and the seabed and is known to stretch northwards along the coast, from the north of Bray Harbour (NGR 326852/219317) to Shanganagh Park (NGR 326520/220721).

All available information for the submerged forest is detailed in full below and within Appendix 2 of the report. No negative impact on the submerged forest is envisaged by the proposed Geophysical Survey or by the seabed sampling. It has been noted and identified within this report in order to highlight its presence for any future planning of works associated with the Dublin Array Project such as development works associated with any export cables making landfall in the area.

### *5.3 Known Shipwreck Sites*

In terms of offshore archaeological evidence however, 110 known wreck sites (see Tables 3 - 5) have been researched and are identified in the immediate proximity to both the survey areas (See Figure 8).

Given the close proximity to these known sites and wrecks, the likelihood of additional unknown archaeological features, wrecks or associated scatter within the surrounding historical landscape needs to be taken into consideration before and during the proposed surveys. Of the 110 wrecks within or adjacent to the cable route survey and lease areas; 24 wrecks were identified in the lease area; 28 wrecks in the cable route survey areas and 58 wrecks outside the cable route survey and lease areas (Tables 3-5 below).

Figure 8 identifies known wrecks in the foreshore survey licence area, including the lease application area. In addition, several wrecks were also found to be outside the areas of the proposed survey area. However, due to tidal conditions, scatter from wrecks can shift and the likelihood of archaeological material drifting to unknown locations is likely. This figure above offers a good indication of the spread of known wrecks in the proposed footprint of the project. Figure 9 shows proposed seabed sampling stations with known wreck sites and Figure 10 shows the indicative locations for deployment of metocean monitoring equipment. See also Appendix 6 Map.

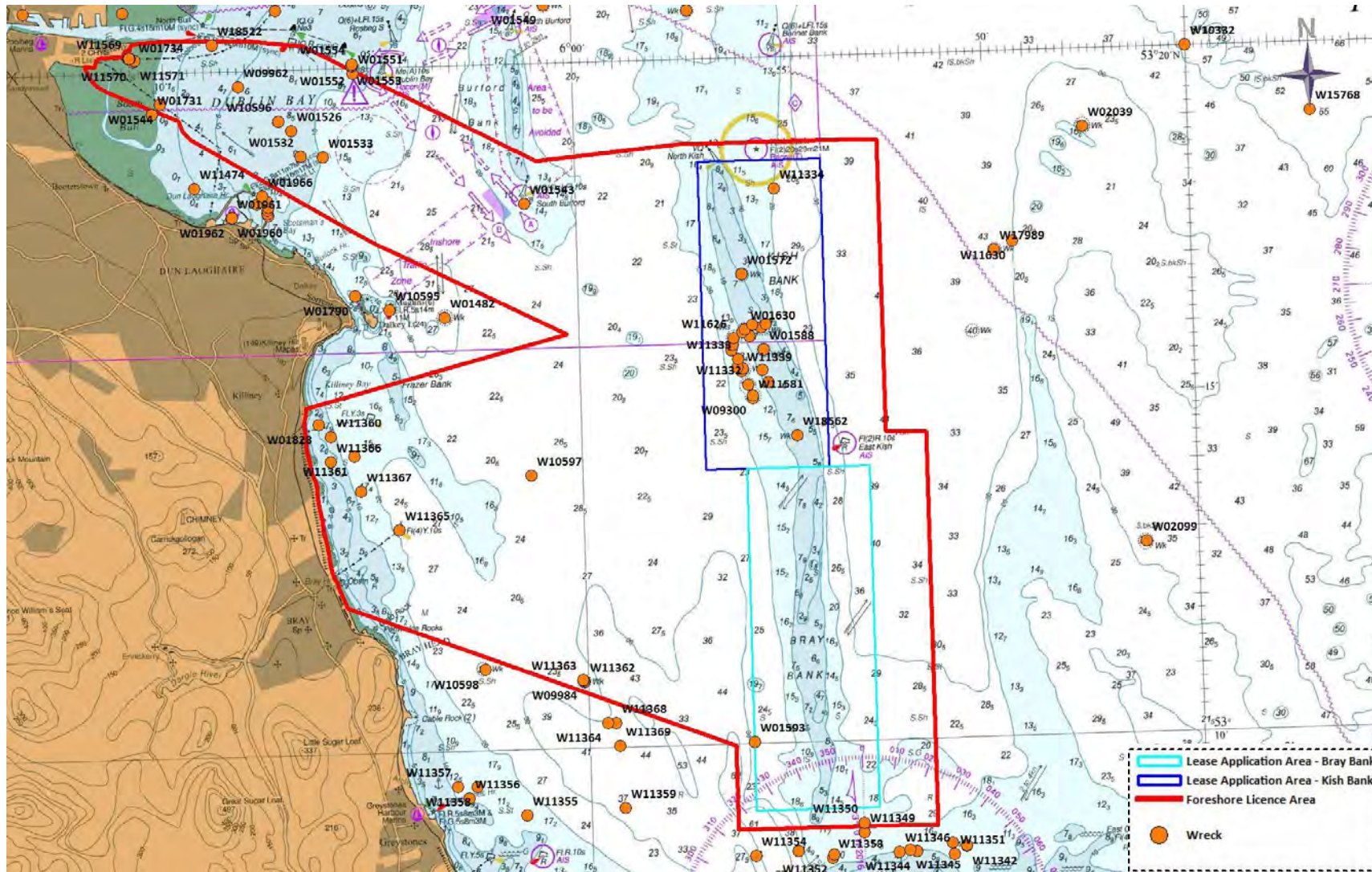


Figure 8. Shipwreck locations (NMS Database) in vicinity of Foreshore survey licence Area.

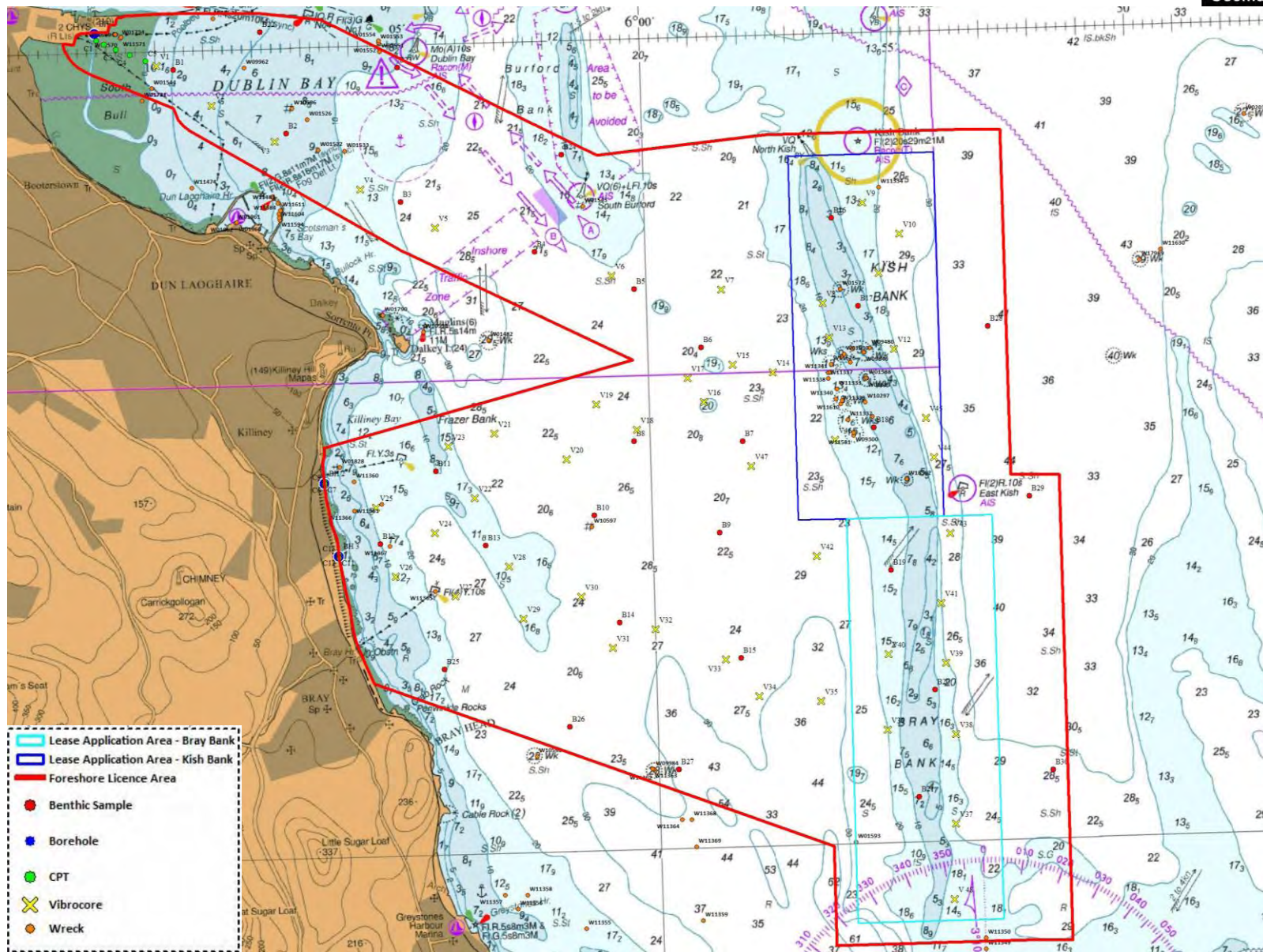


Figure 9. Proposed Seabed Sampling stations with known shipwreck locations.



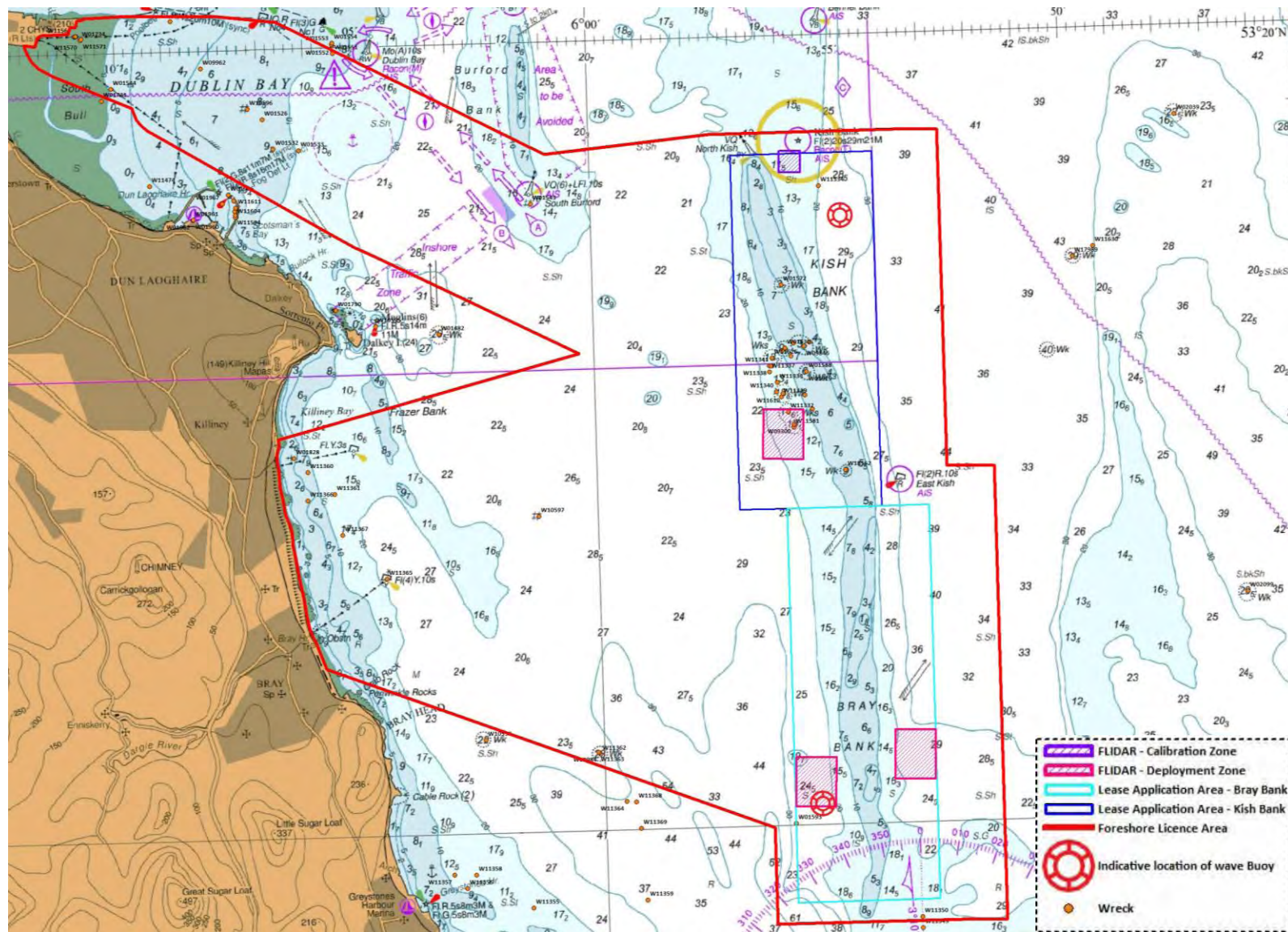


Figure 10 Indicative locations for metocean monitoring equipment deployment.

The tables below (3 – 5) offer further information about both possible and unlikely impacts on wrecks sites within the foreshore survey licence area during the survey. To view all known wreck sites available from the NMS Online Wreck Viewer with co-ordinates/locations along the cable route corridor please refer to Appendix 1. For the purpose of this assessment, the wrecks which have the potential to be affected during survey and sampling works have been grouped together below and for that purpose, outlined whether the survey and sampling works have any possible direct or unlikely impacts. Appropriate mitigation measures are proposed in Section 8.

Below for ease of reference there is a colour-coded reference system for wreck sites for the survey and sampling works:

- **Possible Direct Impacts - 24 Shipwrecks in the Lease Application Areas**
- **Possible Direct Impacts - 28 Shipwrecks in the Foreshore Survey Licence Area**
- **Unlikely Impacts - 58 Shipwrecks outside the cable route corridor and Lease Application Area**

Possible Direct Impacts – Lease Application Areas				
Site Name	Date of Loss	Place of Loss	Description	Reference
W11334	N/A	Kish Bank, Co Dublin 53.30132 N , 5.91910 W	See Appendix 1	NMS Database
W01572 Glenorchy	01/01/1869	Kish Bank, Dublin 53.28058 N, 5.993317 W	See Appendix 1	NMS Database
W09846 MV Bolivar (Stern)	06/03/1947	Kish Bank, Dublin 53.26750 N, 5.92583 W	See Appendix 1	NMS Database
W01594 SS Vesper	13/01/1876	Kish Bank, Dublin 53 165.66N, 5 55 46.24W	See Appendix 1	NMS Database
W01630	N/A	Kish Bank, Dublin 053161.98N, 05 5557W	See Appendix 1	NMS Database
W11331	N/A	Kish Bank, Dublin Located 99m from a Marlin sub-aqua location 53.26660 N, 5.93355 W	See Appendix 1	NMS Database
W08691	N/A	Kish Bank, Dublin 53.26517 N, 5.93708 W	See Appendix 1	NMS Database
W11626	N/A	Kish Bank, Dublin 53.26517N , 5.93708 W	See Appendix 1	NMS Database
W11338	N/A	Kish Bank, Dublin	See Appendix 1	NMS Database

		53.26346 N, 5.93812 W		
W11341	N/A	Kish Bank, Dublin 53.26349 N, 5.93744 W	See Appendix 1	NMS Database
W11337	N/A	Kish Bank, Dublin 53.26226 N, 5.93818 W	See Appendix 1	NMS Database
W01629	Mid 19 <sup>th</sup> C.	Kish Bank, Dublin 53 1543.56N, 05 55 30.31W	See Appendix 1	NMS Database
W01588 Sir Charles Napier	19/11/1857	Kish Bank, Dublin 053 1543.56N, 05 55 30.31W	See Appendix 1	NMS Database
W11340	N/A	Kish Bank, Dublin 53.25800 N, 5.93581 W	See Appendix 1	NMS Database
W11610	N/A	Kish Bank, Dublin 53.257 N, 5.93365 W	See Appendix 1	NMS Database
W11333	N/A	Kish Bank, Dublin 53.26000 N, 5.93542 W	See Appendix 1	NMS Database
W11339	N/A	Kish Bank, Dublin 53.25694 N, 5.93420 W	See Appendix 1	NMS Database
W10297	N/A	Kish Bank 53.25722 N, 5.92583 W	See Appendix 1	NMS Database
W11332	N/A	Kish Bank, Dublin 53.25367 N, 5.93183 W	See Appendix 1	NMS Database
W10276	N/A	Kish Bank, Dublin 53.25417 N, 5.92347 W	See Appendix 1	NMS Database
W09300	N/A	Kish Bank, Dublin 53.25100 N, 5.93000 W	See Appendix 1	NMS Database
W11581	N/A	Kish Bank, Dublin 53.25038 N, 5.93005 W	See Appendix 1	NMS Database
W18562	N/A	Kish Bank 53.24110 N, 5.91233 W	See Appendix 1	NMS Database
W01593 Trustful	29/12/1924	Bray Bank 53.1665 N, 5.9336 W	See Appendix 1	NMS Database

Table 3: List of 24 Wreck sites within the Lease Application Areas

Possible Direct Impacts – Foreshore survey licence Area				
Site Name	Date of Loss	Place of Loss	Description	Reference
W10597		Shankill, approximately 6km East 53.23305 N, 6.02083 W	N/A	NMS Database
W11365	N/A	Codling Bank 53.22067 N, 6.07505 W	See Appendix 1	NMS Database
W11367	N/A	Codling Bank 53.23018 N, 6.09020 W	See Appendix 1	NMS Database
W11361	N/A	Codling Bay 53.23807 N, 6.09263 W	See Appendix 1	NMS Database
W113666	N/A	Codling Bank 53.23766 N, 6.10212 W	See Appendix 1	NMS Database
W11360	N/A	Codling Bay 53.24372 N, 6.10193 W	See Appendix 1	NMS Database
W01828 Loch Fergus	06/02/1899	Killiney Bay, Dublin 150m off-shore	See Appendix 1	NMS Database
W11569	N/A	South Bull, near Ringsend, Dublin 53.33703 N, 6.18041 W	See Appendix 1	NMS Database
W11566	Eachtra - Timber re-deposition, Ringsend 2008	South Bull, near Ringsend, Dublin Bay 53.33704 N, 6.17980 W	See Appendix 1	NMS Database
W11567	N/A	South Bull, near Ringsend, Dublin 53.33705 N, 6.18000 W	See Appendix 1	NMS Database
W11568	N/A	South Bull, near Ringsend, Dublin 53.33704 N, 6.18016 W	See Appendix 1	NMS Database
W01734 (Ringsend Wreck)	Mid - Late 19th Century	Dublin, South Bull, Ringsend, Shellybanks. 53 20 10.5N, 006 10 42.39W	See Appendix 1	NMS Database
W11570	N/A	Dublin, South Bull, Ringsend, 53.33625 N, 6.17844 W	Wooden Wreck	NMS Database
W11571	N/A	South Bull, near Ringsend, Dublin 53.33646 N, 6.17801 W	See Appendix 1	NMS Database
W01544	N/A	Dublin, River Liffey, Poolbeg lighthouse, 2.1km SSW. 53 19 32.7N, 006 10 4.55W	See Appendix 1	NMS Database
W01731	Pre 1803	Dublin, South Bull, at the entrance to the 'Cock Lake'. 53 19 24N, 6 10 16.8W	See Appendix 1	NMS Database
W09962	01/09/1988	Dublin Bay, 1.7km SE of Poolbeg Lighthouse	See Appendix 1	NMS Database

Privet		53.32952 N, 6.13603 W		
W10596	N/A	Dublin Bay 53.32083 N, 6.12000 W	See Appendix 1	NMS Database
W01526	Pre 1803	Dublin Bay, approximately 3km NNE of Sandycove. 53 19 06.45N, 006 06 52.972W PA	See Appendix 1	NMS Database
W01532	Pre 1869	Dublin Bay, 1.5km NE of the E Pier Head of Dun Laoghaire Harbour, 53 18 43.824N, 06 06 40.27W	See Appendix 1	NMS Database
W01533	Pre 1869	Dublin Bay, 1.5km NE of the E Pier Head of Dun Laoghaire Harbour, 53 18 42.47N, 06 06 07.717W PA	See Appendix 1	NMS Database
W11350	N/A	Codling Bank 53.14619 N, 5.88965 W	See Appendix 1	NMS Database
W11363	N/A	Codling Bank 53.18295 N, 06.00218 W	See Appendix 1	NMS Database
W09984 Rose of Lough Gill	01/10/1995	Bray Head, 5km east 53.18279 N, 6.00176 W	See Appendix 1	NMS Database
W11362	N/A	Codling Bank 53.18252 N, 6.00147 W	See Appendix 1	NMS Database
W01543	Pre 1946	Dublin Bay, Burford Bank, near the S Buoy. 53 17 57N, 06 01 15W	See Appendix 1	NMS Database
W18522	N/A	Dublin Bay, 420m SE of Poolbeg Lighthouse 53.33976 N, 6.14630 W	See Appendix 1	NMS Database
W01551	N/A	Dublin Bay / 53 19 55.488N, 006 05 21.48W	See Appendix 1	NMS Database

Table 4: 28 Wreck sites within the Foreshore Survey Licence Area

Unlikely Impacts – Outside the Cable Route Survey and Lease Areas				
Site Name	Date of Loss	Place of Loss	Description	Reference
W11357	N/A	Codling Bank 53.15775 N, 6.05398 W	See Appendix 1	NMS Database
W11356	N/A	Codling Bank 53.15482 N, 6.04957 W	See Appendix 1	NMS Database
W11358	N/A	Codling Bank 53.15765 N, 6.04628 W	See Appendix 1	NMS Database
W11355	N/A	Codling Bank 53.15035 N, 6.02639 W	See Appendix 1	NMS Database
W11359	N/A	Codling Bank 53.15143 N, 5.98631 W	See Appendix 1	NMS Database
W11354	N/A	Codling Bank 53.13902 N, 5.93386 W	See Appendix 1	NMS Database
W11347	N/A	Codling Bank 53.13982 N, 5.91662 W	See Appendix 1	NMS Database
W11353	N/A	Codling Bank 53.13785 N, 5.90297 W	See Appendix 1	NMS Database
W11352	N/A	Codling Bank 53.13880 N, 5.90220 W	See Appendix 1	NMS Database
W11346	N/A	Codling Bank 53.13894 N, 5.87579 W	See Appendix 1	NMS Database
W11345	N/A	Codling Bank 53.13937 N, 5.87141 W	See Appendix 1	NMS Database
W11344	N/A	Codling Bank 53.13899 N, 5.86873 W	See Appendix 1	NMS Database
W11351	N/A	Codling Bank 53.13795 N, 5.85347 W	See Appendix 1	NMS Database
W11348	N/A	Codling Bank 53.14081 N, 5.85421 W	See Appendix 1	NMS Database
W11342	N/A	Codling Bank 53.13993 N, 5.84835 W	See Appendix 1	NMS Database
W11349	N/A	Codling Bank 53.14387 N, 5.88975 W	See Appendix 1	NMS Database
W11364	N/A	Codling Bank 53.17231 N, 5.99255 W	See Appendix 1	NMS Database
W11368	N/A	Codling Bank 53.17222 N, 5.98933 W	See Appendix 1	NMS Database
W11369	N/A	Codling Bank 53.16663 N, 5.98783 W	See Appendix 1	NMS Database
W10598	N/A	2.3km east of Bray Head 53.18612 N, 6.04167 W	See Appendix 1	NMS Database
W110597	N/A	Shankill approx.6km E 53.23305 N, 6.02083 W	See Appendix 1	NMS Database
W01482 HMS Guide Me II	29/08/1918	Muglins, Dublin Bay 1.5km E/SE of 053 1619 52N 006 0315 88W	See Appendix 1	NMS Database
W10595	N/A	Muglins, approx. 130m SW 53.27417 N, 6.07667 W	See Appendix 1	NMS Database
W01790 SS Flying Hawk	27/10/1887	Maiden Rock, Dublin. N of Dalkey Island 53 1640N, 6 0526W	See Appendix 1	NMS Database
W09480 MV Bolivar (Bow)	06/03/1947	Kish Bank, Dublin 53.26830 N, 5.92383 W	See Appendix 1	NMS Database
W17989	N/A	18.3km SE of Howth Head	See Appendix 1	NMS Database

		53.28490 N, 5.83017 W		
W11630	N/A	17km E of Dalkey Island 53.28694 N, 5.82278 W	See Appendix 1	NMS Database
W01960	Pre-1908	Dun Laoghaire Harbour, beside Coastguard Station 53 17 51.282N, 06 08 24.622W	See Appendix 1	NMS Database
W01961	Pre-1908	Dun Laoghaire Harbour, beside Coastguard Station 53 17 51.282N, 06 08 24.622W	See Appendix 1	NMS Database
W01962	Pre-1908	Dun Laoghaire Harbour, beside Coastguard Station 53 17 51.282N, 06 08 24.622W	See Appendix 1	NMS Database
W01967	N/A	Dun Laoghaire Harbour, just inside the entrance. 53 18 3.096N, 006 07 46.596W	See Appendix 1	NMS Database
W01966	N/A	Dublin, Dun Laoghaire Harbour Entrance, end of the E Pier, 53 18 10.51N, 6 7 33.88W	See Appendix 1	NMS Database
W11481	N/A	Dun Laoghaire Harbour, near the north end of the East Pier 53.30143 N, 6.12550 W	See Appendix 1	NMS Database
W11611	N/A	Dun Laoghaire, along the East Pier 53.29997 N , 6.12483 W	See Appendix 1	NMS Database
W11584	N/A	Dun Laoghaire, along the East Pier 53.29927 N, 6.12531 W	See Appendix 1	NMS Database
W11594	N/A	Dun Laoghaire Harbour, along the East Pier 53.29845 N, 6.12515 W	See Appendix 1	NMS Database
W11604	N/A	Dun Laoghaire Harbour, along the East Pier 53.29800 N, 6.12507 W	See Appendix 1	NMS Database
W11474	N/A	53.30500 N, 6.15500 W	See Appendix 1	NMS Database
W01532	Pre 1869	Dublin Bay, 1.5km NE of the E Pier Head of Dun Laoghaire Harbour, 53 18 43.824N, 06 06 40.27W	See Appendix 1	NMS Database
W11566	N/A	South Bull, near Ringsend, Dublin Bay 53.33704 N, 6.17980 W	See Appendix 1	NMS Database
W01552	N/A	Dublin Bay, 53 20 1.572N, 006 05 21.984W	See Appendix 1	NMS Database
W01553	N/A	Dublin Bay, 53 20 2.436N, 006 05 22.524W	See Appendix 1	NMS Database
W01554	N/A	Dublin Bay, 53 20 3.552N, 006 05 22.02W	See Appendix 1	NMS Database
W01465	N/A	Dublin Port, River Liffey, N Bank, 53 20 53.029N, 06 10 56.67W	See Appendix 1	NMS Database

W01466	N/A	Dublin, N Bull, S end, in a creek, 53 21 01.599N, 06 10 38.6W PA	See Appendix 1	NMS Database
W01445	Pre – 1803	Dublin, North Bull, south end, 53 21 9.995N, 06 10 12.385W PA	See Appendix 1	NMS Database
W01138	N/A	Dublin, North Bull, S end, at the low water mark, 53 21 10.571N, 06 09 47.693W	See Appendix 1	NMS Database
W01139	N/A	Dublin, North Bull, S end, adjacent to a small creek, 53 21 17.276N, 06 09 45.693W	See Appendix 1	NMS Database
W01126	Pre-1874	Dublin Bay, off the North Bull, 53 21 15.7N, 06 08 08.232W	See Appendix 1	NMS Database
W01540	N/A	Dublin Bay, off the N Bull, 53 21 15N, 006 08 03W.	See Appendix 1	NMS Database
W09785 Kilkenny (Cargo Debris)	21/11/1991	Dublin Bay 53.34770 N, 6.12005 W	See Appendix 1	NMS Database
W00883 SS Flying Dart	12/08/1890	Dublin Bay, Baily Lighthouse, 1 mile off, Dublin Bay 53.34743 N, 6.01086 W	See Appendix 1	NMS Database
W10332	N/A	Dublin Bay 53.33333 N, 5.75000 W	See Appendix 1	NMS Database
W10400	N/A	Dublin Bay 53.3484 N, 6.22285 W	See Appendix 1	NMS Database
W01561 HMD Deliverer	03/11/1917	Wicklow, Bennet Bank, E side, 53 20 42.468N, 005 57 8.988W	See Appendix 1	See Appendix 1
W10400	N/A	Dublin Bay 53.3484 N, 6.22285 W	See Appendix 1	See Appendix 1
W10332	N/A	Dublin Bay 53.33333 N, 5.75000 W	See Appendix 1	See Appendix 1
W02039 RMS Leinster	10/10/1918	Dublin, Kish Light Vessel, 5 miles E of / 53 18 51.48N, 005 47 34.224W	See Appendix 1	See Appendix 1

Table 5: List of 58 Wreck Sites adjacent to Foreshore survey licence Area

#### 5.4 Unrecorded sites

Unrecorded maritime archaeological sites, features and deposits may be identified through a number of methods, including the assessment of geophysical survey and bathymetric data.

This assessment has identified there is an increased potential for unrecorded archaeological features associated with a submerged forest corresponding with the proposed site location of Landfall B at Shanganagh. The submerged forest stretches along the coast, from the north of Bray Harbour (NGR 326852/219317) to Shanganagh Park (NGR 326520/220721).





Figure 11 - Overview map of the area identifying the location of the submerged Neolithic forest, just north of Bray Harbour and South of Landfall B (Shanganagh).

The presence of a submerged forest near Bray was first noted at the close of the 19<sup>th</sup> C. In 1896, natural scientist Robert Lloyd Praeger found the remains of a ‘collapsed forest of Scots Pine trees’ set in peat, below a layer of marine clay. Re-examination of Praeger’s record of the site was undertaken by Dr Jason Bolton in 1999, as part of his postgraduate research (assisted by the Heritage Council) into coastal erosion and its impact upon archaeological sites. Unlike Praeger’s report 100 years previous, only three trees were identified during the ten-month survey – with one example exposed during low-tide, and the remaining two found at a depth of four metres. The three surviving trees exposed during this 1999 survey were identified as Scots pine, *or pinus sylvestris*, and samples returned a radiocarbon date of 6,180 (+/- 80) years before present.

In 2001 further coastal erosion took place on the north strand of Bray beach, and as a result, a total of 35 trees in addition to a layer of peat, embedded with organic material was exposed. The remains of the submerged forest were visible at low-tide and was found in two locations, located a couple of hundred metres from each other (J.Bolton, pers.comm)



Figure 12 – Exposed timbers from the submerged Prehistoric forest on the north strand, Bray, exposed in 2001. (J. Bolton)



Figure 13 - Exposed Scots Pine timbers, some up to 7m in length – north strand, Bray 2001 (J. Bolton)

The site is currently the subject of a submerged landscape study being undertaken by an international research team from the Irish Marine Institute, University College Cork, the University of Bradford and I.T Sligo. The ‘Lost Frontiers Programme’ aims to explore the extensive landscapes that exist between Ireland and Great Britain. The 6000 year old submerged forest near Bray is believed to form part of a Prehistoric landscape that lies beneath the Irish Sea – in which evidence of some of the first human activity in Ireland is expected to be preserved. Research on the submerged forest, in addition to the 19 other sites that make up the study, began in February 2018 and will be published as part of the Europe’s ‘Lost Frontiers’ Programme.

There are a large number of unknown locations for shipwrecks in the immediate vicinity of the proposed cable route survey area and lease area. Furthermore, it’s very difficult to ascertain how many unknown wrecks or scatter from nearby wrecks could potentially be located by the proposed survey. The Shipwreck Inventory of Ireland and its Ports and Harbours Archive housed at the NMS in Dublin has numerous shipwrecks with unknown Co-ordinates off Dublin Bay, off Wicklow, off South Bull and near or adjacent to the Kish and Bray Banks.

### *5.5 Areas of archaeological potential*

The foreshore survey licence area covers a substantial portion of Dublin Bay and the Kish & Bray Banks including potential landfall sites near Shanganagh and Poolbeg. The potential for areas of archaeological activity are possible at the landfall sites mentioned above but due to the non-invasive nature of the Geophysical Survey it is highly unlikely any onshore or offshore cultural heritage sites will be impacted.

#### **Archaeological Excavations**

Examination of the online excavations database [www.excavations.ie](http://www.excavations.ie) revealed no archaeological sites in the immediate survey area. Excavations in the vicinity of the landfall sites at Poolbeg and the area close to Hackettsland / Shanganagh have been carried out in various locations and are detailed in Appendix 3. However, since the desktop assessment is focusing on the offshore geophysical survey and seabed sampling of the cable route and its lease areas - it is not envisaged any impact on archaeological materials in the study area will arise.

#### **Topographical Files**

No corresponding finds were identified or noted during the research undertaken for this report. (Appendix 4).

## 6. PROPOSED MARINE SURVEY

The survey operations may be broken down into separate but overlapping zones, with boundaries generally defined by water depth as specified in the technical requirements outlined below. The surveys will ensure that there are no gaps or un-surveyed areas between the different survey operations. For the marine route survey, the sidescan ranges will be limited to those providing the greatest resolution possible (able to resolve a 0.5m object or better). Bathymetry data collection will, at minimum, comply with the requirements in this document or with International Hydrographic Office standards (S44).

The survey zones can generally be described as follows;

Intertidal Zone	High Water Mark to Low Water Mark
Marine Zone Survey	From Low Water Mark extending seaward including the Lease Application Area and 'Buffer Zone'.

Survey line spacing will be designed to ensure adequate coverage and overlap of geophysical data capture. A line plan showing number of survey lines as a function of depth will be provided prior to start of survey operations. Tie-lines will be performed to verify primary survey data.

For swathe bathymetry, "20% overlap" signifies that adjacent acquisition swathes within the survey corridor overlap by 20%. For side scan sonar (SSS), 100% overlap requires two passes of complete coverage over a given area of sea-floor, with the two passes each ensonifying the sea-floor from opposite directions to ensure targets are adequately imaged. Features such as shallow reefs, surge channels, debris fields, archaeological features, ferrous obstructions or anything that could be a hazard to the cable or installation work will be noted.

In order to ensure data continuity, overlaps between survey zones will be as follows;

Intertidal Survey / Marine Survey	50 m overlap
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### **Intertidal Zone Survey**

The intertidal zone will comprise a topographic survey which will be undertaken with conventional terrestrial survey techniques and bar probes or terrestrial geophysical techniques such as Ground Penetrating Radar may be used to determine the minimum depth of sand along the survey corridor. Walk-over surveys will also be undertaken to check for marine archaeology feature. A series of shallow cores will be taken to be analysed for infauna, sediment granulometry and organic carbon content. Activities in the intertidal zone will be co-ordinated to take advantage of the tidal cycle and the safety of survey personnel and equipment will be paramount.

In the event that the Intertidal Survey does not achieve the requisite overlap with the Marine Survey, a Diver Swim / ROV Survey may be undertaken along export cable route corridors once these are confirmed. In that case, the Diver Swim / ROV Survey will extend seaward from the boundary of the Intertidal Survey to 50

metres beyond the boundary of the Marine Survey. A diver swim rope with 25m gradations will be positioned along the route. Dive lines will be configured to provide representative coverage across each cable route corridor (nominally spaced at 125m).

Bathymetry will be measured by diver depth gauge at each 25m gradation. Geomorphology will be determined by underwater video along the length of the diver swim rope. The diver video will be undertaken along each line in the survey swathe; divers will use a dive slate or other clearly written method to indicate Kilometre Point (KP) and water depth at the specified gradations along the rope.

Tie-lines will be nominally spaced at 125m parallel to shore and will verify primary survey data within the Diver Swim area. Bathymetry and seabed composition are to be noted along tie-lines. The Diver Swim Survey will comply with the requirements of the Underwater Archaeology Unit of the Department of Culture, Heritage & the Gaeltacht.

Site investigations in the intertidal zone will also include a borehole at each general landfall location, close to the High Water Mark (3 in total), with a diameter of approximately 10 cm to a depth of approximately 20 m. In the inter tidal area at both the Shanganagh landfalls and at Shellybanks, 5 CPTS are proposed to approximately 4cm in diameter to 15m depth, dependent upon rock depth. The indicative locations are within a 10m corridor along the centre line of the cable route avoiding existing infrastructure.

Access to the foreshore and in particular to the intertidal zone will be required for a tracked vehicle and ancillary equipment to carry out the boreholes and CPTs. Existing access routes will be utilised to access the coring locations along route previously agreed with the relevant local authority/landowner and with due consideration for any environmental or other relevant constraints. A landing craft may be required for the CPT / borehole rig to access the foreshore adjacent to Shanganagh Park.

The ground will be reinstated to previous condition as the investigations at each location are completed. Pre and post investigation site photographs will be taken.

### **Marine Zone Survey**

The area extending seaward from the Low Water Line will be surveyed using Multibeam Echosounder (MBES), sidescan sonar, marine magnetometer and shallow reflection seismic (sub-bottom profiler) equipment. Sub-bottom profile equipment will be used on a non-interfering basis with other sounding systems. Different sub-bottom profiling equipment is likely to be required in different areas of the survey area. The sub-bottom profiler equipment used will be able to discern the nature and density of the seabed and will provide both shallow and deep geological cross sections of the Dublin Array Lease Application Area and shallow geological cross sections along the cable route corridors.

Survey line separation will be sufficient to provide full multibeam data coverage. Spacing will be approximately three times water depth, for example in 20m of water the line spacing would be 60m; the anticipated minimum line separation is 30m; typically line spacing is in region of 75 – 100m. Final line planning will be dependent upon equipment selection.

Seabed sampling will also be undertaken including grab samples and vibrocores. Vibrocores to a depth of 6m and 80mm in diameter will be collected at 47 locations within the cable route corridors and across the

lease application area. On recovery, vibrocore samples will be cut into 1 m lengths, labelled, capped and stored vertically prior to processing. The vibrocorer shall be deployed from the geophysical vessel. Benthic survey is also proposed which will include grab sampling across the Foreshore survey licence Area using a Hamon or Van Veen grab (0.1 – 0.2 m<sup>2</sup>) with a stainless steel bucket. Sample depth may be up to 20 cm depending on seabed type. The grab will be deployed and retrieved by winch. In deep or fast-moving water additional weights may be required to ensure the grab operates successfully.

General requirements for a geophysical survey for archaeological purposes:

**Side Scan Sonar:**

- For archaeological purposes, the Side Scan Sonar will have an operational frequency of 410/500 kHz.
- Side scan will be set at typically 3 x water depth for survey line spacing.
- This will not be slant-range corrected.
- There will be 100% coverage of sites and therefore overlap of areas may be required.

**Magnetometer:**

- A magnetometer will always be used in tandem with side scan sonar.
- Proton or caesium type magnetometer will be used.
- This will be used with DGPS positioning.

**Sub-bottom profiler:**

Sub bottom profile data shall be acquired on all lines of the proposed line plan so that an accurate interpretation of the geology can be obtained. Sub bottom profiling equipment that typically resolves to twenty centimetres (0.2m) within the top three metres (3m) of the seabed should be used. The equipment shall be capable of penetrating to a minimum of six metres (6m) in suitable seabed conditions. Vessel mounted sensors shall be fully compensated for heave. In water sensors shall be dynamically positioned and steered along the predefined survey lines using industry standard techniques. The positioning of the “fish” may be determined using fixed layback to counteract poor acoustic positioning in shallow water.

**General**

- Track plots are to be recorded and superimposed onto a locational chart
- All geophysical survey is to be carried out by suitably qualified personnel. The results must be viewed and assessed by the project archaeologist.
- A copy of the original data/traces, as well as the interpreted results of the geophysics, are to be sent to the Underwater Archaeological Unit of DCHG.

**Buoy mounted metocean equipment**

Up to two FLiDAR units will be deployed on site. The exact details of the FLiDAR buoy and mooring arrangement will be confirmed following a competitive tender process. The FLiDAR units may include additional meteorological and oceanographic sensors along with control and data systems, water intrusion sensors and

camera. The physical attributes of the LiDAR will depend upon the option that is selected. The diameter will be in the region of 1 – 3 m and will weigh approximately 1,700kg. The keel will be between 2 – 3 m.

The exact details of two Waverider buoys will also be determined after contract award. The Waverider buoys are smaller than the FLiDAR units, typically with diameter less than 1m and weighing approximately 200 kg.

The metocean units will be mounted on buoy which will be moored to the seabed with a u-mooring or single point mooring. The exact specification of the mooring arrangement is equipment specific and will be determined once a contractor has been appointed and has reviewed the seabed characteristics, water depth, wave, tide and current profile. A typical mooring will comprise between 1 and 4 mooring lines which will be approximately three times the water depth. Lines are connected to a clump weight designed specifically for the conditions of the site. The clump weight is anticipated to have a dry weight of approximately 3 tonnes, and a footprint of approximately 2m diameter.

## 7. IMPACT ASSESSMENT

The survey has limited potential to cause direct and indirect impacts on cultural heritage assets within the area of the proposed cable route and lease areas.

Due to the nature (non-intrusive) of the proposed Geophysical Survey it is unlikely that it will impact upon any archaeological materials. Seabed sampling such as grab samples or vibrocores on the other hand can have minor impacts on the sea bed and sub-surface archaeological features. The bathymetric and geophysical survey will identify any seabed features and the results can be assessed by a qualified archaeologist in order to avoid any impacts. Direct impacts may be caused by the deployment of moorings in the vicinity of cultural heritage assets.

### 6.1 Impacts on maritime cultural heritage

The types of impact that the proposed survey will have on the baseline environment is addressed under the following categories:

Type of Impact	Description
Direct Impact	Direct impacts on marine archaeological sites, features, deposits and artefacts as a result of the Seabed Sampling and metocean equipment deployment.
Indirect Impact	Potential damage to marine archaeological sites and features within the proposed development may be caused by activity associated with the surveys and sampling
Secondary Impact	Secondary impacts on marine archaeological sites, features and artefacts.
Cumulative Impact	The assessment will consider the potential for the effects of cumulative impacts on sites, features and artefacts of cultural heritage interest associated with the proposed survey.

### 6.2 Direct Impacts

The assessment has identified 24 wreck sites within the lease application area and a further 28 wrecks have been identified within the foreshore survey licence area. 58 wrecks have been identified in close proximity to the foreshore survey licence area.

It is not always easy to establish the precise locations of these known wrecks and the sheer numbers also suggest that there will be many unknown wrecks and other cultural heritage features within the study area.

The bathymetric and geophysical surveys will not have a direct impact on any known or unrecorded seabed or sub seabed features. The sampling campaign and metocean equipment deployment, without mitigation measures, has the potential to have a limited direct impact on both seabed and subsurface features of cultural heritage importance.

The bathymetric and geophysical surveys have the potential to have a direct positive impact on the cultural heritage landscape as precise locations of known wreck sites and their condition may be established. The survey results may also reveal other unrecorded wreck sites and other possible cultural heritage features. The surveys may also be able to shed more light on the extent of the submerged forest noted at Shanganagh and Bray.



The recorded RMPs within close proximity of landfalls at Poolbeg and Hackettsland / Shanganagh offer a good indication of possible unrecorded archaeological features/finds and deposits which may appear during the survey but none of these unrecorded features are envisaged to be impacted upon negatively.

### 6.3 Indirect Impacts

There will be no indirect impacts as a result of the survey and sampling campaign.

### 6.4 Secondary Impact

There will be no secondary impacts as a result of the survey and sampling campaign.

### 6.5 Cumulative impacts

If the overall project goes ahead then there will be possible cumulative impacts as a result of the original bathymetric survey and sampling. The recorded cultural heritage sites on the coast at Shanganagh and Bray highlight the intense human activity in the general area from earliest times up to the present day (Appendices 1 - 4). This activity has the potential to yield associated features finds or deposits. The presence of a Submerged Neolithic Forest also confirms the possibility of human activity and cultural assets in the assessment area which stretches along the coast, from north of Bray Harbour (NGR 26769/19331) to Shanganagh Park ((26492/20891). The baseline data gathered for this desktop assessment will be supplemented by the data obtained during the proposed survey works to enable a robust mitigation strategy to be developed for the proposed wind farm.

## **8 MITIGATION MEASURES**

There are various ways that potential impacts of a development can be mitigated. Mitigation measures usually involve avoidance (the implementation of exclusion zones and design alterations), reduction (the introduction of measures to deal with unexpected discoveries during works), or offsetting (excavation and recording of a site before an impact occurs). Ideally, sites and features of cultural heritage interest should be subject to as little disturbance as possible, where policy normally dictates a presumption in favour of preservation in situ in line with current national policy.

Overall, the aim is to minimise the impact on cultural heritage assets through the appropriate siting of infrastructure and works. As such, the preferred mitigation for the disturbance of a site of cultural heritage interest would be avoidance, so that the sampling and associated operations are micro-sited to avoid wrecks or identified sites and features of cultural heritage interest.

This can be achieved through the use of 'exclusion zones'. These should be marked on project charts to avoid potential sites and features of maritime cultural heritage interest. The size of the exclusion zone is normally dependent on the certainty the target represents a wreck or site and the potential importance or sensitivity of that asset (historically significant or not). An exclusion zone for seabed sampling and metocean equipment deployment of 100 metres around recorded sites of maritime cultural heritage and sites of unrecorded maritime cultural heritage detected during the geophysical survey is proposed.

Adherence to the implementation of the exclusion zones during scheme operations can be checked through procedures and protocols set out in a works method statement. Protocols should be established before the start of scheme operations detailing instructions to follow in the event of unexpected discoveries, with contact details of the relevant stakeholders.

Given the results of the impact assessment above, the mitigation strategies outlined here detail the measures to be adopted in order to ameliorate the direct, indirect and secondary impacts that the survey may have on features of maritime cultural heritage interest within the proposed scheme. If these measures are employed it is envisaged that the proposed survey will have no impact on features of maritime cultural heritage interest.

The following mitigation recommendations are presented in connection with the proposed survey:

1. The Surveys shall be licensed under the National Monuments Act 1930 – 2004.
2. Prior to any sampling taking place the results of the geophysical and bathymetric surveys shall be reviewed by a suitably qualified archaeologist in order to examine the sampling location for any previously unrecorded cultural heritage seabed features.
3. The sample locations will also be cross referenced with all of the cultural heritage sites identified in the Marine Archaeological Assessment Report in order to avoid all such locations. A 100m exclusion zone shall be applied.

4. Archaeological analysis of the whole geophysical and bathymetric survey datasets will be undertaken to both confirm the locations of the wreck sites within the survey corridor and also to identify any potential unrecorded seabed and sub seabed maritime archaeological features.
5. Prior to deployment of the metocean monitoring equipment, the results of the geophysical and bathymetric survey at those locations shall be reviewed by a suitably qualified archaeologist in order to examine the deployment location for any previously unrecorded cultural heritage seabed features. A 100m exclusion zone shall apply.
6. Should the proposed survey and subsequent sampling campaign be subject to further revision, details of these revisions shall be forwarded to the project archaeologist for assessment.
7. On completion of the survey and sampling a report will be produced summarising all archaeological aspects of the project and submitted to DCHG and the National Museum of Ireland.
8. It is recommended that all sites of cultural heritage interest included in that report should be avoided by any future seabed interventions.
9. The video from the ROV survey or diver swim survey, if undertaken, will be assessed by a suitably qualified archaeologist.

## APPENDIX 1 SHIPWRECK INVENTORY

The Shipwreck Inventory of Ireland includes all known wrecks for the years up to and including 1945. The Shipwreck Inventory is principally a desktop survey with information gathered from a broad range of cartographic, archaeological and historical sources, both documentary and pictorial. Approximately 10,000 records have been compiled and integrated into the shipwreck database thus far. Wrecks over 100 years old and archaeological objects found underwater are protected under the National Monuments (Amendment) Acts 1987 and 1994. Significant wrecks less than 100 years old can be designated by Underwater Heritage Order on account of their historical, archaeological or artistic importance as is the case with the wreck of the RMS Lusitania located off Kinsale Head. Underwater Heritage Orders can also be used to designate areas of seabed or land covered by water to more clearly define and protect wreck sites and archaeological objects. Under the legislation all diving on known protected wreck sites or with the intention of searching for archaeological underwater material is subject to licensing requirements. There were a large number of shipwrecks recorded in the area which were either with co-ords or some without. The tables below are broken down into known wrecks sites with co-ords, wrecks sites with unknown co-ords and wrecks found online at [irishwrecks.net](http://irishwrecks.net) which were in the immediate vicinity.

All known co-ordinate sites were recorded in the vicinity and are listed below including additional known wreck sites which were provided by DCHG on a plotted map and these are plotted in the text of the above report and associated tables (tables 3 – 5).

KNOWN SHIPWRECK SITES IN THE LICENCE APPLICATION AREA					
Wreck Name / Number	Date of Loss	Place of Loss	Classification	Description	Reference
W11357	N/A	Codling Bank 53.15775 -6.05398	N/A	N/A	NMS Database
W11356	N/A	Codling Bank 53.15482 -6.04957	N/A	N/A	NMS Database
W11358	N/A	Codling Bank 53.15765 -6.04628	N/A	N/A	NMS Database
W11355	N/A	Codling Bank 53.15035 -6.02639	N/A	N/A	NMS Database
W11359	N/A	Codling Bank 53.15143 -5.98631	N/A	N/A	NMS Database
W11354	N/A	Codling Bank 53.13902 -5.93386	N/A	N/A	NMS Database

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W11347	N/A	Codling Bank 53.13982 -5.91662	N/A	N/A	NMS Database
W11353	N/A	Codling Bank 53.13785 -5.90297	N/A	N/A	NMS Database
W11352	N/A	Codling Bank 53.13880 -5.90220	N/A	N/A	NMS Database
W11346	N/A	Codling Bank 53.13894 -5.87579	N/A	N/A	NMS Database
W11345	N/A	Codling Bank 53.13937 -5.87141	N/A	N/A	NMS Database
W11344	N/A	Codling Bank 53.13899 -5.86873	N/A	N/A	NMS Database
W11351	N/A	Codling Bank 53.13795 -5.85347	N/A	N/A	NMS Database
W11348	N/A	Codling Bank 53.14081 -5.85421	N/A	N/A	NMS Database
W11342	N/A	Codling Bank 53.13993 -5.84835	N/A	N/A	NMS Database
W11349	N/A	Codling Bank 53.14387 -5.88975	N/A	N/A	NMS Database
W11350	N/A	Codling Bank 53.14619 -5.88965	N/A	N/A	NMS Database
W11364	N/A	Codling Bank 53.17231 -5.99255	N/A	N/A	NMS Database
W11368	N/A	Codling Bank	N/A	N/A	NMS Database

		53.17222 -5.98933			
W11369	N/A	Codling Bank 53.16663 -5.98783	N/A	N/A	NMS Database
W01593 Trustful	29/12/19 24	Bray Bank, Wicklow 5310N 056W	Fishing Drifter	Sprang a leak during a SW gale while fishing off Bray Head. Crew took to the life boat and were picked up by the Dun Laoghaire Pilot boat a few hours later.	NMS Database
W11566	Eachtra - Timber re- depositio n, Ringsend 2008	South Bull, near Ringsend, Dublin Bay 53.33704 6.17980	N/A	Re-deposited Ship Timbers	NMS Database
W10598	N/A	2.3km east of Bray Head 53.18612 -6.04167	N/A	N/A	NMS Database
W11363	N/A	Codling Bank 53.18295 -06.00218	N/A	N/A	NMS Database
W09984 Rose of Lough Gill	01/10/19 95	Bray Head, 5km east 53.18279 -6.00176	Fishing Boat	Fishing boat sank.	NMS Database
W11362	N/A	Codling Bank 53.18252 -6.00147	N/A	N/A	NMS Database
W11365	N/A	Codling Bank 53.22067 -6.07505	N/A	N/A	NMS Database
W11367	N/A	Codling Bank 53.23018 -6.09020	N/A	N/A	NMS Database
W110597	N/A	Shankill approx.6km E 53.23305 -6.02083	N/A	N/A	NMS Database
W18562	N/A	Kish Bank	N/A	Wreck surveyed by the Celtic Voyager in 2010 as part of the INFOMAR seabed mapping programme. Wreck measures	NMS Database

		53.24110 -5.91233		13.5m long, 3.5m in maximum width and lies in 10m of water. GSI Wreck No_289.	
W113666	N/A	Codling Bank  53.23766 -6.10212	N/A	N/A	NMS Database
W11361	N/A	Codling Bay  53.23807 -6.09263	N/A	N/A	NMS Database
W10597		Shankill, approximately 6km East 53.23305 -6.02083	N/A	N/A	NMS Database
W11360	N/A	Codling Bay  53.24372 -6.10193	N/A	N/A	NMS Database
W01828 Loch Fergus	06/02/18 99	Killiney Bay, Dublin  150m off-shore	Barque	UKHO wreck no. 009000318. 818/ 874 ton, 23/24 year old Iron barque of Liverpool / Glasgow. Classed as 100 A1 by Lloyd's. Owned by J. Sproat & Co., Liverpool, master was T. Williams. En route from Glasgow to Brisbane, seventeen crew, three passengers, general cargo. Went ashore during SSE force 7 gale. Three crew took to the lifeboat, but capsized. Locals helped the 3 ashore. Remaining 17 aboard rescued by the Dun Laoghaire lifeboat. Surveyed in April 1991. Lies orientated E/W (bow to the west) in general depth of 4-5m spread over an area of 65 x 10m. Small portions of bottom sheeting, rib structure stand 1.2m above seabed. Mast also visible. Wreck had been dismantled by salvors.	NMS Database
W01482 HMS Guide Me II	29/08/19 18	Muglins, Dublin Bay  1.5km E/SE of 053 1619 52N  006 0315 88W	Anti- Submarine Drifter	UKHO wreck no. 009000033. Chart symbol 30wk. 100-ton, 10-year-old British anti-submarine drifter sank following a collision. Owned by J. Mitchell & J. Cow. Hired by the Admiralty in 1915 and converted into a British anti-submarine drifter. Sank following a collision with the SS Glengariff. Lies with a slight list to the port side in a general sea depth of 32-35m. Relatively intact, the wreck is oriented WNW-ESE on the seafloor measuring 28.5m in length and 5.5m in width, with a maximum height of 3m above the seabed. Part of the wheelhouse roof remains. Forward gun and bell have been recovered by divers.	NMS Database
W10595	N/A	Muglins, approx. 130m SW  53.27417 -6.07667	Sailing Ship	N/A	NMS Database

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W01790 SS Flying Hawk	27/10/18 87	Maiden Rock, Dublin. N of Dalkey Island  53 1640N  006 0526W	Iron Steam Tug	UKHO wreck no. 009000288. 61 ton, 11 year old twin-screw iron steam tug of Glasgow. Owned by the Clyde Shipping Co. /G.J. Kidston, Glasgow, master was J. Hayes. En route in ballast from Kingstown to tow a vessel. Struck a rock in SSW force 8 gale, sank on 27 October 1887. Crew saved. The hull had disappeared in deep water by 8 November 1887. The lighter 42 B was sunk trying to lighten the wreck on 6 December 1887. The wreck lies at base of Maiden Rock broken up and scattered in a depth of 5-10m. Metal sheeting's, a steam engine, a boiler and a propeller lie on the seabed.	NMS Database
W11581	N/A	Kish Bank, Dublin  53.25038  -5.93005	N/A	Wooden wreck known as the '9.5 fathom wreck'.	NMS Database
W09300	N/A	Kish Bank, Dublin  53.25100  -5.93000	N/A	Wreck surveyed by the RV Keary in 2010 as part of the INFOMAR seabed mapping programme. Wreck measures 21m long, 3.7m in maximum width and lies in 15m of water. GSI Wreck No_288.	NMS Database
W11332	N/A	Kish Bank, Dublin  53.25367  -5.93183	N/A	Wooden wreck identified by Browne & Stokes during a geophysical survey in 2008. The wreck was surveyed by the RV Keary in 2010 as part of the INFOMAR seabed mapping programme. Wreck measures 26.5m long, 4.3m in maximum width and lies in 15m of water. GSI Wreck No_287.	NMS Database
W10276	N/A	Kish Bank, Dublin  53.25417  -5.92347	N/A	N/A	NMS Database
W11339	N/A	Kish Bank, Dublin  53.25694  -5.93420	N/A	N/A	NMS Database
W10297	N/A	Kish Bank  53.25722  -5.92583	N/A	N/A	NMS Database
W11340	N/A	Kish Bank, Dublin  53.25800  -5.93581	N/A	N/A	NMS Database
W11610	N/A	Kish Bank, Dublin  53.257  -5.93365	N/A	N/A	NMS Database



WW11333	N/A	Kish Bank, Dublin  53.26000  -5.93542	N/A	N/A	NMS Database
W11337	N/A	Kish Bank, Dublin  53.26226  -5.93818	N/A	N/A	NMS Database
W01629	Mid 19 <sup>th</sup> C.	Kish Bank, Dublin  053 1543.56N, 05 55 30.31W	N/A	Remains of a 300-400 ton vessel (approx.) wooden wreck. Discovered by Marlin Sub Aqua Club in 2003. The vessel is partially exposed on the seabed in 8-10m of water. Pottery, clay pipes, iron pots, a number of anchors, a capstan and a winch were recorded on the wreck site. Most likely to be the wreck of the Sir Charles Napier. See W01588.	NMS Database
W01588  Sir Charles Napier	19/11/18 57	Kish Bank, Dublin  053 1543.56N, 05 55 30.31W	Ship	The Sir Charles Napier was a 638-ton merchant vessel built in Miramichi, New Brunswick, Canada, and owned by Locketts of London. The sailing ship was en route from Liverpool to Sierra Leone, carrying a cargo that included 6,000 iron pots and iron hoops, when it was stranded and wrecked on the Kish Bank during a force 6 wind. The Kish Bank is but one of a series of underwater sandbanks that run parallel to the east coast of Ireland, stretching from Wexford in the south to Dublin Bay in the north. One of the most treacherous of these sandbanks is the Kish Bank. Master Samuel Bissett and 18 of his crew survived; one crew member was drowned. The vessel was clearly off-course when lost and a subsequent inquiry in Dublin found that the ship's compass had been affected by the large cargo of iron carried on board, a problem compounded by carelessness on the master's part in navigating the vessel. It was estimated that the value of the loss of the vessel was £3,000, with another £4,000 lost on the cargo. The Sir Charles Napier measures 33m in length, 7m in width and 1.7m in maximum height and lies orientated NW-SE on a sandy seabed in a general sea depth of 8m. A survey by Roy Stokes of Marlin Sub Aqua Club in 2003 identified the wreck as that of the Sir Charles Napier. Even though the wreck was partially salvaged at the time, part of the cargo still remains on board, including crockery, iron skillets and faggots of iron. See also W01629. GSI_280.	NMS Database
W11338	N/A	Kish Bank, Dublin  53.26346  -5.93812	N/A	N/A	NMS Database
W11341	N/A	Kish Bank, Dublin	N/A	N/A	NMS Database

		53.26349 -5.93744			
W11626	N/A	Kish Bank, Dublin  53.26517 -5.93708	N/A	Wooden wreck known as the 'Iron Pipe Wreck' located by Browne and Stokes in 2008. The wreck was surveyed by the RV Keary in 2010 as part of the INFOMAR seabed mapping programme. Wreck measures 19m long, 5m in maximum width and lies in 14m of water. GSI Wreck No_282.	NMS Database
W08691	N/A	Kish Bank, Dublin  53.26517 -5.93708	N/A	Wreck surveyed by the RV Keary in 2010 as part of the INFOMAR seabed mapping programme. Wreck measures 4m long, 1.8m in maximum width and lies in 10m of water. GSI Wreck No_285.	NMS Database
W11331	N/A	Kish Bank, Dublin  Located 99m from a Marlin sub-aqua location  53.26660 -5.93355	N/A	N/A	NMS Database
W01630	N/A	Kish Bank, Dublin  053161.98N  05 5557W	N/A	Wooden wreck discovered by Marlin Sub Aqua Club in 2003. The wreck is partially exposed on the seabed in 8–10m of water and is upside-down. Hull is copper-sheeted. The wreck rises approximately 1m in height off the seabed and measure 17m long. Pottery is strewn around it.	NMS Database
W01594 SS Vesper	13/01/18 76	Kish Bank, Dublin  53 165.66N  5 55 46.24W	Screw Steamer	The Vesper was a 478-ton (gross tonnage) iron merchant steamer of Hartlepool, built in Dundee by Barclay Curle & Company, with a nominal horse-power of 60. Benjamin R. Huntley of Hartlepool was one of the vessel's owners. The ship's master was Jacob Tolsen and under his command the Vesper left Glasgow on 11 January 1876, en route to Dunkirk in France, carrying 600 tonnes of coal and sugar. All was going well until the early hours of the morning of 13 January, when the vessel struck the Kish Bank and became stranded. Signals of distress fired by the stricken vessel were not responded to and after a number of unsuccessful attempts to get the steamer off the sandbank, the vessel began to break in two. After three failed attempts to launch the lifeboats, the ship's captain and crew of 16 eventually managed to launch a lifeboat and landed safely at Killiney, Co. Dublin. The captain blamed the sinking on a defective compass. A subsequent inquiry held that Master Tolsen had failed to take the necessary precautions when approaching waters well known to be dangerous. Both Tolsen and his chief officer were severely reprimanded for altering the logbook in an effort to mislead the inquiry as to the ship's correct position in relation	NMS Database

				to land. Master Tolsen was required to pay £5 towards the cost of the inquiry. The wreck of the Vesper lies in a general sea depth of 8m and measures 54m in length, 9m in width and 2.27m in maximum height. The vessel lies on a sandy seabed, orientated N-S, with its stern to the N. The southern end of the wreck is mostly buried, but the outlines of the stern and of the boiler area are visible. The bow and focs'le area are the most prominent parts of the wreck and stand largely intact and proud of the seabed, with anchors and winches visible. UKHO wreck no. 009101809 GSI_284	
W09846 MV Bolivar (Stern)	06/03/19 47	Kish Bank, Dublin  53.26750  -5.92583	Cargo Ship	<p>The MV Bolivar was a 5,320-ton cargo vessel and at the time of its loss was owned by the Norwegian shipping company, Fred Olsen. The cargo ship was laid down in the yard of Akers Mekaniske Verksted of Oslo in 1939 and was launched, ready for fitting out, in 1940. However, following the German invasion of Norway in April of 1940, the ship lay alongside the quay wall at the Akers yard for the duration of the war. The Bolivar was finally completed in 1946, setting out on her maiden voyage, to South America, in December of that year.</p> <p>It was upon her return from Buenos Aires to Dublin via Liverpool in early March 1947, with a cargo of grain and bales of leather, that the diesel-powered vessel ran aground on the Kish Bank during a snow storm. Several attempts were made to take the vessel off the bank, but the wind direction and the falling tide both conspired to keep her stuck fast. As the tide continued to drop, the ship broke in two amidships, with the fore part of the vessel drifting clear and settling 100m away from the stern section. A Dublin-based tug, the Coliemore, and a Dún Laoghaire lifeboat, the Dun Leary 2, came to the Bolivar's aid and successfully rescued the 39 crew and 12 passengers. Despite hopes of salvaging the stern section, both the ship and cargo became a total loss. The bow section remained largely intact and sank, while the after section was cut down to about the main deck line and was partially salvaged by the Hammond Lane Scrap Company in 1948. On the seafloor At the time of its loss the wreck was largely dispersed because she was an obstruction to navigation, but nonetheless a substantial amount of the ship's hull and machinery remain to be seen. The bow section initially remained largely intact and sank beneath the surface, while the after section was cut down to about the main deck line.</p> <p>Today the wreck lies in two main parts, with the stern measuring 83m in length, 16m in width and 5.34m in maximum height. The stern is orientated E-W on the seabed, in a general sea depth of 10m. The remains of the fore section of the vessel lie over 100m to the NE and are largely buried. See W09480 regarding details on the stern co-ordinates of the wreck.</p>	NMS Database

W09480 MV Bolivar (Bow)	06/03/19 47	Kish Bank, Dublin  53.26830  -5.92383	Cargo Ship	See Above	NMS Database
W01572 Glenorchy	01/01/18 69	Kish Bank, Dublin  53.28058  -5.993317	Sailing Ship	1,285-ton vessel of Glasgow, official no. 60,391. Master was Thomas Meiklejohn. En route from Greenock to Bombay (maiden voyage), cargo of coal, railway sleepers. Struck the Kish Bank, became a wreck. Crew saved. Four tugs saved materials off the wreck. The wreck of the Glenorchy is buried to its gunnels on the starboard side, with much of the port side visible, along with some plating lying on the seabed. The wreck measures 70m in length, 13m in width and 3.3m in maximum height and lies orientated N-S on a sandy seabed in a general sea depth of 7m, with its bow lying to the N. GSI Wreck No. GSI_277.	NMS Database
W17989	N/A	18.3km SE of Howth Head  53.28490  -5.83017	N/A	Wreck surveyed by the Geological Survey of Ireland in 2008 as part of the Irish National Seabed Survey. Wreck measures 26m long, 8m in maximum width and lies in 42m of water. GSI Wreck No_304.	NMS Database
W11630	N/A	17km E of Dalkey Island  53.28694  -5.82278	N/A	Known by divers as the North Wreck and appears to be the remains of a barge or hopper. The wreck was surveyed by the Geological Survey of Ireland in 2008 as part of the Irish National Seabed Survey. It measured 25m long, 7.3m in maximum width and lies in 42m of water. GSI Wreck No_303.	NMS Database
W01960	Pre-1908	Dun Laoghaire Harbour, beside Coastguard Station  53 17 51.282N  06 08 24.622W	N/A	One of three wrecks marked on a chart (Admiralty Chart 1471) of Dun Laoghaire Harbour as surveyed in 1902 (updated in 1908).	NMS Database
W01961	Pre-1908	Dun Laoghaire Harbour, beside Coastguard Station 53 17 51.282N 06 08 24.622W	N/A	One of three wrecks marked on a chart (Admiralty Chart 1471) of Dun Laoghaire Harbour as surveyed in 1902 (updated in 1908).	NMS Database
W01962	Pre-1908	Dun Laoghaire Harbour, beside Coastguard Station 53 17 51.282N 06 08 24.622W	N/A	One of three wrecks marked on a chart (Admiralty Chart 1471) of Dun Laoghaire Harbour as surveyed in 1902 (updated in 1908).	NMS Database
W01967	N/A	Dublin, Dun Laoghaire Harbour, just inside the entrance. 53 18 3.096N, 006 07 46.596W	N/A	Possible wreck (INSS No. G145) identified during the National Seabed Survey. Wreck measures L. 27m, W. 5m with a height of 1m off the seabed. It lies in a general sea depth of 8m.	NMS Database

W01966	N/A	Dublin, Dun Laoghaire Harbour Entrance, end of the E Pier, 53 18 10.51N, 6 7 33.88W	N/A	Wreck discovered by Marlin Sub Aqua Club during training dive. Wreck lies exposed on a sandy seabed beside the rocky slope of the East Pier foundation in 10–12m of water. Wreck appears to extend into the seabed, with only 3m of wreck visible. Remains consist 'of a few transverse ribs and part of a keel or keelson'. Pieces of iron, including an anchor, lie scattered on the lower slope of the pier.	NMS Database
W11481	N/A	Dun Laoghaire Harbour, near the north end of the East Pier  53.30143  -6.12550	N/A	Wreck recorded by the UKHO in 1932 as being in two different sections.	NMS Database
W11611	N/A	Dun Laoghaire, along the East Pier  53.29997  -6.12483	N/A	Possible section of wreck surveyed by the Geological Survey of Ireland in 2004 as part of the Irish National Seabed Survey. Wreck measures 0.75m long and lies in 4.3m of water. GSI Wreck No_163d.	NMS Database
W11584	N/A	Dun Laoghaire, along the East Pier  53.29927  -6.12531	N/A	Possible section of a wreck surveyed by the Geological Survey of Ireland in 2004 as part of the Irish National Seabed Survey. Wreck measures 2m long and lies in 4.6m of water. GSI Wreck No_163a.	NMS Database
W11594	N/A	Dun Laoighaire Harbour, along the East Pier  53.29845  -6.12515	N/A	Section of a possible wreck surveyed by the Geological Survey of Ireland in 2004 as part of the Irish National Seabed Survey. Wreck measures 4.5m long and lies in 4.5m of water. GSI Wreck No_GSI_163b.	NMS Database
W11604	N/A	Dun Laoighaire Harbour, along the East Pier  53.29800  -6.12507	N/A	Section of a possible wreck surveyed by the Geological Survey of Ireland in 2004 as part of the Irish National Seabed Survey. Wreck measures 4.5m long and lies in 4.3m of water. GSI Wreck No_GSI_163c.	NMS Database
W01543	Pre 1946	Dublin Bay, Burford Bank, near the S Buoy. 53 17 57N, 06 01 15W	Yacht	UKHO wreck no. 009000045. Chart symbol NDW. Sunken yacht reported in September 1946 as being dangerous to navigation. In October 1946 Irish Lights Commissioners reported mast of wreck visible at low water. In November 1946 wreck was dispersed, no longer considered dangerous to navigation.	NMS Database
W11334	N/A	Kish Bank, Co Dublin  53.30132  -5.91910	N/A	N/A	NMS Database

W11474	N/A	53.30500 -6.15500	N/A	N/A	NMS Database
W01532	Pre 1869	Dublin Bay, 1.5km NE of the E Pier Head of Dun Laoghaire Harbour, 53 18 43.824N, 06 06 40.27W	N/A	One of 4 wrecks marked on a chart (Admiralty Chart 1415) of Dublin. It is described as “remains of wrecks” and is located in about 10m of water.	NMS Database
W01533	Pre 1869	Dublin Bay, 1.5km NE of the E Pier Head of Dun Laoghaire Harbour, 53 18 42.47N, 06 06 07.717W PA	N/A	One of four wrecks marked on a chart (Admiralty Chart 1415) of Dublin. It is described as “remains of wrecks” and is located in about 10m of water.	NMS Database
W01526	Pre 1803	Dublin Bay, approximately 3km NNE of Sandycove. 53 19 06.45N, 006 06 52.972W PA	N/A	One of five wrecks plotted on William Bligh’s 1803 map of Dublin Bay. It is located in shallow water just off the South Bull	NMS Database
W10596	N/A	Dublin Bay 53.32083 -6.12000	N/A	Anchor and cable	NMS Database
W01731	Pre 1803	Dublin, South Bull, at the entrance to the 'Cock Lake'. 53 19 24N, 6 10 16.8W	N/A	One of five wrecks plotted on William Bligh’s 1803 map of Dublin Bay. It is located in shallow water, just off the South Bull, at the entrance to the 'Cock Lake'. It also appears to feature on John Taylor’s 1816 map of Dublin.	NMS Database
W01544	N/A	Dublin, River Liffey, Poolbeg lighthouse, 2.1km SSW. 53 19 32.7N, 006 10 4.55W	N/A	Dutch dredging company discovered a wreck in June 1989 while excavating route for new sewerage pipe. Wreck lay exposed in the southern bank of the trench, measuring c. 15ft across and consisting of a ‘wooden framework’. Cargo of tightly packed, uncut slates was also evident. Vessel lies in 3–5m of water, buried 0.5m beneath the sandy seabed. Wreck was reburied once sewerage pipe was laid.	NMS Database
W09962 Privet	01/09/19 88	Dublin Bay, 1.7km SE of Poolbeg Lighthouse 53.32952 -6.13603	Fishing boat	Fishing vessel sank. Mapped by INSS in 2003.	NMS Database

W18522	N/A	Dublin Bay, 420m SE of Poolbeg Lighthouse  53.33976  -6.14630	N/A	Wooden wreck measuring 16.4m long, 5.5m wide, standing 20cm proud of the seabed. The wreck was identified during a geophysical survey for the Dublin Bay Pipeline Project.	NMS Database
W01734 (Ringsend Wreck)	Mid - Late 19th Century	Dublin, South Bull, Ringsend, Shellybanks. 53 20 10.5N, 006 10 42.39W	N/A	Wooden wreck, known as the 'Ringsend Wreck', became exposed during dredging operations for the Dublin Bay pipeline in April 2001. A test excavation carried out on the wreck by Lar Dunne and Emer Dennehy (01E0402) revealed the wreck is orientated E-W and is a composite structure built of timber and metal. Several structural pieces were revealed during the excavation: four iron and three wood.  The three timbers could form part of a keelson. Carvel planking was also visible, with evidence for iron and wooden fastenings in the form of treenails and dowels. An iron knee had bronze fastenings. A number of iron concretions, musket balls and bullets were also retrieved in the area of the wreck during the excavation.	NMS Database
W11571	N/A	South Bull, near Ringsend, Dublin Bay  53.33646  -6.17801	N/A	Wooden wreck.	NMS Database
W11569	N/A	South Bull, near Ringsend, Dublin Bay  53.33703  -6.18041	N/A	Re-deposited ship timbers	NMS Database
W11566	N/A	South Bull, near Ringsend, Dublin Bay  53.33704  -6.17980	N/A	Re-deposited ship timbers	NMS Database
W11568	N/A	South Bull, near Ringsend, Dublin Bay  53.33704  -6.18016	N/A	Re-deposited ship timbers	NMS Database
W11567	N/A	South Bull, near Ringsend, Dublin Bay  53.33705  -6.18000	N/A	Re-deposited ship timbers	NMS Database

W01551	N/A	Dublin Bay / 53 19 55.488N, 006 05 21.48W	N/A	Possible wreck (INSS No. G160) identified during the National Seabed Survey. Wreck measures L. 3m, W. 3m with a height of 3m off the seabed. It lies in a general sea depth of 9m.	NMS Database
W01552	N/A	Dublin Bay, 53 20 1.572N, 006 05 21.984W	N/A	One of three anomalies indicating a possible wreck (INSS No. G161a), identified by the National Seabed Survey. Anomaly measures L. 3m, W. 3m with a height of 2m off the seabed. It lies in a general sea depth of 8m.	NMS Database
W01553	N/A	Dublin Bay, 53 20 2.436N, 006 05 22.524W	N/A	One of three anomalies indicating a possible wreck (INSS No. G161c), identified by the National Seabed Survey. Anomaly measures L. 2m, W. 2m with a height of 1m off the seabed. It lies in a general sea depth of 8m.	NMS Database
W01554	N/A	Dublin Bay, 53 20 3.552N, 006 05 22.02W	N/A	One of three anomalies indicating a possible wreck (INSS No. G161c), identified by the National Seabed Survey. Anomaly measures L. 2m, W. 2m with a height of 1m off the seabed. It lies in a general sea depth of 8m.	NMS Database
W01465	N/A	Dublin Port, River Liffey, N Bank, 53 20 53.029N, 06 10 56.67W	N/A	Remains of a wooden wreck protrude through the mud.	NMS Database
W01466	N/A	Dublin, N Bull, S end, in a creek, 53 21 01.599N, 06 10 38.6W PA	N/A	One of 10 wrecks marked on John Vernon's estate map of the North Bull. It is located towards the southern end of the North Bull, close to a small creek.	NMS Database
W01445	Pre – 1803	Dublin, North Bull, south end, 53 21 9.995N, 06 10 12.385W PA	N/A	N/A	NMS Database
W01138	N/A	Dublin, North Bull, S end, at the low water mark, 53 21 10.571N, 06 09 47.693W	N/A	One of 10 wrecks marked on John Vernon's estate map of the North Bull. It is located towards the southern end of the Bull at the low water mark.	NMS Database
W01139	N/A	Dublin, North Bull, S end, adjacent to a small creek, 53 21 17.276N, 06 09 45.693W	N/A	One of 10 wrecks marked on John Vernon's estate map of the North Bull. It is located towards the southern end of the Bull, adjacent to a small creek.	NMS Database
W01126	Pre-1874	Dublin Bay, off the North Bull, 53 21 15.7N, 06 08 08.232W	N/A	One of 3 wrecks marked on an admiralty chart of Dublin Bay compiled by J.H. Kerr in 1874. The wreck was located approximately 700m from the low spring water mark in approx. 1.5m of water	NMS Database
W11570	N/A	Dublin, South Bull, Ringsend, 53.33625	Ringsend Wreck	Wooden Wreck	NMS Database



		-6.17844			
W01540	N/A	Dublin Bay, off the N Bull, 53 21 15N, 006 08 03W.	Admiralty/De coy Ship	UKHO wreck no. 009000069. Surveyed in 1931, in a depth of 2m, listed as a 'dangerous wreck'.	NMS Database
W09785 Kilkenny (Cargo Debris)	21/11/19 91	Dublin Bay 53.34770 -6.12005	N/A	N/A	NMS Database
W00883 SS Flying Dart	12/08/18 90	Dublin Bay, Baily Lighthouse, 1 mile off, Dublin Bay 53.34743 -6.01086	Paddler Steamer	The Flying Dart was a 111-ton iron paddle steam tug, built by J.T. Eltringham, South Shields in 1882, with 70 horse-power engines. It was owned by the Clyde Company (G. Kidston of Glasgow) and the ship's master was J. Altrum. The vessel was en route, in ballast, from Dún Laoghaire to Dublin Bay in adverse weather conditions when it collided with a cattle steamship, the North Wall of Dublin, belonging to the London and North-Western Railway Company. The Flying Dart sank about 20 minutes after the accident, though the North Wall apparently sustained no damage. The six crew on board the tug were rescued by lifeboats despatched by the North Wall. The wreck of the Flying Dart measures 27.7m in length, 4m in width and is orientated E-W in a general depth of 28m. It is almost completely buried in the muddy, sandy seabed, the gunwale aft protruding only a few centimetres. However, amidships the boiler is clearly visible, with its central hole for the funnel, as are the remains of the paddle wheels to either side. As you move forward the hull is more exposed, leading to a small scour around the bow, which stands 1m high. The wreck lies directly under the route taken by the fast ferry, Jonathan Swift, on its way into and out of Dublin Port. It is therefore essential to check the ferry timetable as well as the tide tables before diving it.	NMS Database
W01561 HMD Deliverer	03/11/19 17	Wicklow, Bennet Bank, E side, 53 20 42.468N, 005 57 8.988W	Steam Drifter	UKHO wreck no. 009101858. Chart symbol wk16. 79-ton, 7-year-old British steam tug/drifter sunk by a submarine whilst on Admiralty service. No survivors. Surveyed in October 1996. Lies in a general sea depth of 23m (least depth 22m), orientated NW/SE, with bows to NW. Vertical height of 4-5m. An explosion at the bridge severed the vessel as the forward hold and bow lie approximately 10m away from the main wreck.	NMS Database
W10332	N/A	Dublin Bay 53.33333 -5.75000	N/A	N/A	NMS Database
W10400	N/A	Dublin Bay 53.3484 -6.22285	N/A	N/A	NMS Database

W18539	N/A	Co. Dublin) Royal Canal, 70m SE of the Belfast-Dublin railway line. It lies adjacent to the north bank of the canal alongside Ossory Road.	N/A	The remains of a barge is visible on Google Earth imagery (7 December 2013) submerged beneath the water on the north side of the Royal Canal near the Dublin-Belfast railway bridge.  The upper structure of the barge is gone but at least six bulkheads are visible. It measures approximately 20.6m long and 4.22m wide. It is orientated NW/SE on the canal bed. Its date is unknown.	
W10400	N/A	Dublin Bay  53.3484  -6.22285	N/A	N/A	NMS Database
W10332	N/A	Dublin Bay  53.33333  -5.75000	N/A	N/A	NMS Database
W02039 RMS Leinster	10/10/19 18	Dublin, Kish Light Vessel, 5 miles E of / 53 18 51.48N, 005 47 34.224W	Screw Steamer	2,646-ton, 22-year-old steel twin screw steamer built in Birkenhead, Liverpool, by Lairds. Owned by the City of Dublin Steam Packet Company, captain was William Birch. Measured L. 360ft x B. 42ft x D. 27ft. En route from Dun Laoghaire to Holyhead with a general cargo including 250 sacks of mail and 680 passengers. Over 400 of the passengers were soldiers. Torpedoed by German submarine UB-123, sank bow-first in fifteen minutes. The destroyer, HMS Lively, Destroyer Mallard and the Motor Launch 154 saved some of the survivors. 501 of the 771 on board lost their lives. Many of the recovered bodies were buried in the military cemetery at Blackhorse Avenue in Dublin. The wreck lies well buried in sand at a general depth of 25–28m and is orientated N–S. The bow is separated from the main vessel and the stern section is badly damaged, with the wreck site measuring 112m in length, 15.5m in width and 3.5m in maximum height, with an average height of 2.4m. A sediment scour has developed on its east side and the main body of the ship has settled deep into the sand. While the bow has been separated from the rest of the ship by the torpedo damage, about 53m of the wreck still remains relatively intact. The stern is now badly broken up and the rudder and steering quadrant sits 5m clear of the main body of the wreck. Due to its moderate depth and the usually reasonable visibility at the site, the Leinster remains one of the most popular wreck dives in Dublin Bay. An Anchor raised in 1996, now displayed on Dun Laoghaire promenade as a memorial to the victims of the tragic event.	NMS Database

## **APPENDIX 2. RECORDED SITES AND MONUMENTS**

The following townlands/locations were researched for archaeological sites and monuments:

*Shanganagh, Hackettsland, Ravenswell, Bray, Little Bray, Bray Commons, Cork Little, Cork Great, Aske, Lehaunstown, Shankill, Corke Abbey and Poolbeg/Ringsend.*

### **Existing Archaeological Environment (On-Shore)**

The proposed cable route from the Dublin Array Offshore Wind Farm wind will reach landfall at the Eirgrid Substation at Poolbeg and one of two potential locations north of Bray, Co. Wicklow. The first is located at Shanganagh Cliffs in the townland of Hackettsland, Co. Dublin and the second is located at Shanganagh Park, Shanganagh Co. Dublin.

There are four recorded monuments near the Landfall at Poolbeg, Co. Dublin. However, it is very unlikely these monuments will be impacted on negatively. These are listed in the RMP as follows: Martello Tower, Sandymount (DU 019-018), a Blockhouse (DU 019-027), the South Bull Seawall (DU 019-029002) and a Battery (DU 019-028).

There are no recorded monuments corresponding with the grid references provided for the landfalls at Hackettsland / Shanganagh, Co. Dublin. However, there are a number of monuments within 500m of the proposed sampling locations at these landfalls. These are listed in the RMP as follows: Martello Tower (DU 026-05501), Defensive Redoubt Site (DU 026-055002) and Enclosure (DU 026-032). Additional monuments within 1km of the proposed landfall sites are listed in the RMP as follows:

Reference	Class
DU 026 -014001	Martello tower
DU 026 -014002	Earthwork
DU 026 -070	Martello tower
DU 026 -124	Linear earthwork
DU 026 -012	Battery
DU 026 -010	Megalithic Structure
DU 026 -011	Martello tower
DU 026 -013001	Church
DU 026 -013002	Graveyard
DU 026 -013003	Inscribed stone
DU 026 -013004	Ritual tree
DU 026 -013005	Font
DU 026 -013006	Cross
DU 026 -013007	Cross
DU 026 -013008	Ecclesiastical enclosure
DU 026 -030	Megalithic Tomb
DU 026 -031001	Castle tower house
DU 026 -031002	Water mill
DU 026 -033	Enclosure
DU 026 -120	Castle
DU 026 -116	Fulacht fia
DU 026 -068001	Church
DU 026 -069	Ritual well
DU 026 -068002	Graveyard
WI004 -005	Linear earthwork
WI004 -002	Martello tower
WI004 -003	Martello tower
WI004 -004	Burial
WI004 -001001	Cross slab
WI004 -001006	Castle tower house
WI004 -001	Historic town
WI004 -001003	Castle
WI004 -001004	Church

**APPENDIX 3. ARCHAEOLOGICAL EXCAVATIONS**

*www.excavations.ie* was consulted and the following townlands/locations were studied for archaeological excavations:

*Shanganagh, Ravenswell, Bray, Little Bray, Bray Commons, Cork Little, Cork Great, Aske, Lehaunstown, Shankill, Corke Abbey, Poolbeg (Dublin South City)*

**Excavations**

Excavations within the vicinity of the Poolbeg and the two additional proposed landfall areas at Shanganagh, comprise the following:

**POOLBEG**

<b>County</b>	Dublin	<b>Site Name</b>	Great South Wall
<b>SMR No.</b>	DU019-029002	<b>Licence No.</b>	15E0454
<b>Site Type</b>	18 <sup>th</sup> Century Marine Structure	<b>Description</b>	<a href="https://excavations.ie/report/2015/Dublin/0024542/">https://excavations.ie/report/2015/Dublin/0024542/</a>
<b>ITM</b>	E 722302m N 733900m	<b>Latitude/Longitude</b>	53.341179, -6.163400

<b>County</b>	Dublin	<b>Site Name</b>	Poolbeg Yacht and Boat Club
<b>SMR No.</b>	N/A	<b>Licence No.</b>	04E0740
<b>Site Type</b>	Marine	<b>Description</b>	<a href="https://excavations.ie/report/2004/Dublin/0011704/">https://excavations.ie/report/2004/Dublin/0011704/</a>
<b>ITM</b>	E 718777m N 732937m	<b>Latitude/Longitude</b>	53.333327 -6.216663

<b>County</b>	Dublin	<b>Site Name</b>	Pigeon House Road, Poolbeg
<b>SMR No.</b>	DU 019-029	<b>Licence No.</b>	09E0022
<b>Site Type</b>	Post-Medieval	<b>Description</b>	<a href="https://excavations.ie/report/2009/Dublin/0020689/">https://excavations.ie/report/2009/Dublin/0020689/</a>
<b>ITM</b>	E 721267m N738318m	<b>Latitude/Longitude</b>	53.381104 -6.177244

<b>County</b>	Dublin	<b>Site Name</b>	Pigeon House Fort, Ringsend
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<b>SMR No.</b>	DU019-027	<b>Licence No.</b>	09E0259
<b>Site Type</b>	18 <sup>TH</sup> /19 <sup>TH</sup> c. Artillery Fort	<b>Description</b>	<a href="https://excavations.ie/report/2009/Dublin/0020692/">https://excavations.ie/report/2009/Dublin/0020692/</a>
<b>ITM</b>	E 720213M N 733671M	<b>Latitude/Longitude</b>	53.339604 -6.194840

<b>County</b>	Dublin	<b>Site Name</b>	Pigeon House Road, Poolbeg
<b>SMR No.</b>	DU019-029	<b>Licence No.</b>	09E022 EXT.
<b>Site Type</b>	No archaeologic al significance	<b>Description</b>	<a href="https://excavations.ie/report/2010/Dublin/0021497/">https://excavations.ie/report/2010/Dublin/0021497/</a>
<b>ITM</b>	E 19835M N 733596M	<b>Latitude/Longitude</b>	53.339016 -6.200540

<b>County</b>	Dublin	<b>Site Name</b>	Dublin Waste to Energy Project, Poolbeg
<b>SMR No.</b>	N/A	<b>Licence No.</b>	13E0066
<b>Site Type</b>	19 <sup>TH</sup> c. Fortifications	<b>Description</b>	<a href="https://excavations.ie/report/2013/Dublin/0023776/">https://excavations.ie/report/2013/Dublin/0023776/</a>
<b>ITM</b>	E 719782m 733380m	<b>Latitude/Longitude</b>	53.3370809 -6.201420

<b>County</b>	Dublin	<b>Site Name</b>	Dublin Port, Docks and Shipping
<b>SMR No.</b>	N/A	<b>Licence No.</b>	01E1004
<b>Site Type</b>	Monitoring Marine Dredging	<b>Description</b>	<a href="https://excavations.ie/report/2001/Dublin/0006296/">https://excavations.ie/report/2001/Dublin/0006296/</a>
<b>ITM</b>	E 721072 m N 734145 m	<b>Latitude/Longitude</b>	53.343665 -6.181770

<b>County</b>	Dublin	<b>Site Name</b>	Poolbeg
<b>SMR No.</b>	N/A	<b>Licence No.</b>	02E1132

<b>Site Type</b>	No archaeological significance	<b>Description</b>	<a href="https://excavations.ie/report/2002/Dublin/0007962/">https://excavations.ie/report/2002/Dublin/0007962/</a>
<b>ITM</b>	E 720620 M N 733697 M	<b>Latitude/Longitude</b>	53. 339745 -6. 188723

**HACKETTSLAND & SHANGANAGH**

<b>County</b>	Dublin	<b>Site Name</b>	Shanganagh/Cork Little/Aske/Cork Great/Little Bray/Bray Commons
<b>SMR No.</b>	SMR 26:124	<b>Licence No.</b>	05E0392
<b>Site Type</b>	No archaeological significance	<b>Description</b>	<a href="https://excavations.ie/report/2005/Dublin/0013534/">https://excavations.ie/report/2005/Dublin/0013534/</a>
<b>ITM</b>	E 724877m N718050m	<b>Latitude/Longitude</b>	53.198209 -6.130975

<b>County</b>	Wicklow	<b>Site Name</b>	Corke Great/Ravenswell
<b>SMR No.</b>	SMR 26:124	<b>Licence No.</b>	O2E1717EVT
<b>Site Type</b>	Medieval	<b>Description</b>	<a href="https://excavations.ie/report/2005/Wicklow/0014726/">https://excavations.ie/report/2005/Wicklow/0014726/</a>
<b>ITM</b>	E726228m N719287m	<b>Latitude/Longitude</b>	53.198209 -6.130975

<b>County</b>	Dublin	<b>Site Name</b>	Mill Lane, Shanganagh
<b>SMR No.</b>	DU022-010	<b>Licence No.</b>	06E0794
<b>Site Type</b>	Testing	<b>Description</b>	<a href="https://excavations.ie/report/2006/Dublin/0015445/">https://excavations.ie/report/2006/Dublin/0015445/</a>
<b>ITM</b>	E725448m N722020m	<b>Latitude/Longitude</b>	53.233733 -6.120877

<b>County</b>	Dublin	<b>Site Name</b>	Lehaunstown
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<b>SMR No.</b>	N/A	<b>Licence No.</b>	94E0201
<b>Site Type</b>	18 <sup>th</sup> C military camp	<b>Description</b>	<a href="https://excavations.ie/report/1995/Dublin/0001943/">https://excavations.ie/report/1995/Dublin/0001943/</a>
<b>ITM</b>	E723724m N723529m	<b>Latitude/Longitude</b>	53.247689 -6.140095

<b>County</b>	Dublin	<b>Site Name</b>	Shanganagh
<b>SMR No.</b>	N/A	<b>Licence No.</b>	05E0392
<b>Site Type</b>	Urban	<b>Description</b>	<a href="https://excavations.ie/report/2008/Dublin/0019505/">https://excavations.ie/report/2008/Dublin/0019505/</a>
<b>ITM</b>	E725384M N721967M	<b>Latitude/Longitude</b>	53.233275 -6.121853

<b>County</b>	Wicklow	<b>Site Name</b>	Bray
<b>SMR No.</b>	N/A	<b>Licence No.</b>	05E0392
<b>Site Type</b>	No archaeological significance	<b>Description</b>	<a href="https://excavations.ie/report/2010/Wicklow/0022043/">https://excavations.ie/report/2010/Wicklow/0022043/</a>
<b>ITM</b>	E 726658m N 719 295M	<b>Latitude/Longitude</b>	53.208957 -6.013849

<b>County</b>	Dublin	<b>Site Name</b>	Ravenswell/Shanganagh
<b>SMR No.</b>	N/A	<b>Licence No.</b>	11E0304
<b>Site Type</b>	No archaeological significance	<b>Description</b>	<a href="https://excavations.ie/report/2011/Dublin/0022343/">https://excavations.ie/report/2011/Dublin/0022343/</a>
<b>ITM</b>	E 725924m N 722579m	<b>Latitude/Longitude</b>	53.238641 -6.113532

<b>County</b>	Dublin	<b>Site Name</b>	Shanganagh Castle (Grounds)
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<b>SMR No.</b>	DU 026-120	<b>Licence No.</b>	13E114
<b>Site Type</b>	19 <sup>th</sup> C. Demesne	<b>Description</b>	<a href="https://excavations.ie/report/2013/Dublin/0023004/">https://excavations.ie/report/2013/Dublin/0023004/</a>
<b>ITM</b>	E 725476M N 721183M	<b>Latitude/Longitude</b>	53.226210 -6.120784

<b>County</b>	Dublin	<b>Site Name</b>	Shanganagh Castle
<b>SMR No.</b>	DU026-03101	<b>Licence No.</b>	14E0341
<b>Site Type</b>	Medieval	<b>Description</b>	<a href="https://excavations.ie/report/2014/Dublin/0025186/">https://excavations.ie/report/2014/Dublin/0025186/</a>
<b>ITM</b>	E 725226m N 722846m	<b>Latitude/Longitude</b>	53.241206 -6.123873

<b>County</b>	Wicklow	<b>Site Name</b>	Corke Abbey, Bray
<b>SMR No.</b>	N/A	<b>Licence No.</b>	02E1717
<b>Site Type</b>	Urban	<b>Description</b>	<a href="https://excavations.ie/report/2002/Wicklow/0009278/">https://excavations.ie/report/2002/Wicklow/0009278/</a>
<b>ITM</b>	E 726117m N 719434m	<b>Latitude/Longitude</b>	53.210348 -6.111884

#### **APPENDIX 4. TOPOGRAPHICAL FILES**

The following locations at Shanganagh and Poolbeg were examined and no associated topographical finds were listed within the survey or landfall areas:

<b>Townland</b>	<b>Finds Description</b>
Dublin City South	N/A
Shanganagh	N/A

We envisage no impacts during the Geophysical Survey or through the Geotechnical Survey due to prior preventative measures put in place for the grab sampling which have specific locations chosen in order to avoid any known wrecks. Therefore, prior to these seabed samples being taken the Geophysical survey will be assessed to avoid any impacts.

## APPENDIX 5. FORESHORE SURVEY LICENCE AREA BOUNDARY

ID	ITM Coordinates		Geographic Coordinates	
	Eastings	Northing	Longitude	Latitude
1	722418.435	733898.571	6° 9.69920' W	53° 20.46834' N
2	722534.026	733889.962	6° 9.59530' W	53° 20.46210' N
3	722553.471	733894.766	6° 9.57768' W	53° 20.46442' N
4	722575.293	733898.788	6° 9.55794' W	53° 20.46628' N
5	724554.061	733891.221	6° 7.77625' W	53° 20.43449' N
6	725917.983	733756.328	6° 6.55130' W	53° 20.34243' N
7	732240.567	730654.718	6° 0.93608' W	53° 18.57849' N
8	736101.22	731117.27	5° 57.45060' W	53° 18.76910' N
9	740431.909	731243.327	5° 53.55062' W	53° 18.76923' N
10	741474.551	731244.816	5° 52.61246' W	53° 18.75339' N
11	741730.488	723339.562	5° 52.59356' W	53° 14.48954' N
12	742839.965	723331.187	5° 51.59720' W	53° 14.46719' N
13	743155.488	712668.819	5° 51.60033' W	53° 8.71666' N
14	742093.965	712662.445	5° 52.55188' W	53° 8.73026' N
15	737749.595	712535.197	5° 56.44896' W	53° 8.73011' N
16	737683.896	714817.892	5° 56.44897' W	53° 9.96123' N
17	727138.155	718532.864	6° 5.81765' W	53° 12.12064' N
18	726904.94	719069.472	6° 6.01419' W	53° 12.41318' N
19	726881.995	719142.357	6° 6.03304' W	53° 12.45279' N
20	726796.002	719320.041	6° 6.10600' W	53° 12.54978' N
21	726724.06	719497.375	6° 6.16636' W	53° 12.64638' N
22	726665.037	719755.674	6° 6.21320' W	53° 12.78643' N
23	726596.356	720178.788	6° 6.26479' W	53° 13.01544' N
24	726525.288	720482.28	6° 6.32138' W	53° 13.18001' N
25	726483.006	720666.769	6° 6.35496' W	53° 13.28004' N
26	726441.112	720923.656	6° 6.38647' W	53° 13.41909' N
27	726389.617	721162.164	6° 6.42705' W	53° 13.54836' N
28	726332.944	721424.678	6° 6.47170' W	53° 13.69065' N
29	726323.168	721601.924	6° 6.47627' W	53° 13.78631' N
30	726320.488	721650.518	6° 6.47752' W	53° 13.81254' N
31	726293.041	721857.202	6° 6.49726' W	53° 13.92432' N
32	726162.768	722168.434	6° 6.60688' W	53° 14.09391' N
33	726097.479	722505.498	6° 6.65753' W	53° 14.27649' N
34	726032.61	722795.854	6° 6.70891' W	53° 14.43390' N
35	726007.228	723084.361	6° 6.72487' W	53° 14.58974' N
36	725990.211	723228.922	6° 6.73673' W	53° 14.66789' N
37	725964.373	723409.825	6° 6.75565' W	53° 14.76576' N
38	725965.43	723610.027	6° 6.74995' W	53° 14.87364' N
39	725971.179	723660.389	6° 6.74359' W	53° 14.90070' N
40	726002.229	723752.668	6° 6.71350' W	53° 14.94999' N
41	726002.008	723800.092	6° 6.71258' W	53° 14.97555' N
42	726000.047	723865.868	6° 6.71278' W	53° 15.01102' N
43	725992.148	723934.407	6° 6.71825' W	53° 15.04807' N
44	733068.418	725961.003	6° 0.30914' W	53° 16.03665' N
45	728264.033	728230.826	6° 4.57288' W	53° 17.33086' N

46	727985.289	728359.043	6° 4.82047' W	53° 17.40400' N
47	727772.278	728457.881	6° 5.00967' W	53° 17.46035' N
48	727304.506	728721.896	6° 5.42404' W	53° 17.60938' N
49	722905.755	731207.082	6° 9.32297' W	53° 19.01102' N
50	722752.123	731328.427	6° 9.45842' W	53° 19.07856' N
51	722647.446	731464.181	6° 9.54948' W	53° 19.15317' N
52	722547.402	731698.306	6° 9.63410' W	53° 19.28074' N
53	722538.327	731724.888	6° 9.64165' W	53° 19.29519' N
54	720678.45	732480.983	6° 11.29847' W	53° 19.72831' N
55	720523.965	732555.64	6° 11.43585' W	53° 19.77066' N
56	720350.731	732655.918	6° 11.58952' W	53° 19.82707' N
57	720245.744	732743.461	6° 11.68205' W	53° 19.87568' N
58	720174.748	732825.429	6° 11.74410' W	53° 19.92082' N
59	720063.877	733008.944	6° 11.83975' W	53° 20.02124' N
60	720030.85	733086.34	6° 11.86773' W	53° 20.06340' N
61	719999.473	733202.346	6° 11.89334' W	53° 20.12635' N
62	720250.137	733169.747	6° 11.66839' W	53° 20.10536' N
63	720324.757	733403.033	6° 11.59588' W	53° 20.23008' N
64	720412.82	733438.326	6° 11.51578' W	53° 20.24790' N
65	720664.461	733451.996	6° 11.28888' W	53° 20.25183' N
66	720771.554	733457.817	6° 11.19232' W	53° 20.25350' N
67	721039.146	733472.374	6° 10.95103' W	53° 20.25768' N
68	721060.452	733584.301	6° 10.92928' W	53° 20.31771' N
69	721086.381	733627.099	6° 10.90495' W	53° 20.34042' N
70	721197.106	733631.701	6° 10.80514' W	53° 20.34138' N
71	721226.652	733671.085	6° 10.77763' W	53° 20.36220' N
72	721222.299	733728.142	6° 10.78024' W	53° 20.39301' N
73	721237.895	733782.868	6° 10.76494' W	53° 20.42229' N
74	721278.65	733804.614	6° 10.72774' W	53° 20.43345' N
75	721317.142	733792.348	6° 10.69336' W	53° 20.42631' N
76	721435.402	733840.901	6° 10.58575' W	53° 20.45085' N
77	722418.435	733898.571	6° 9.69920' W	53° 20.46834' N

## **APPENDIX 6. OVERALL MAPPING SURVEY EXTENTS**

Appendix 6 Overall Mapping - Survey Extents

