SAORGUS | ENERGY LTD

Dublin Array

An Offshore Wind Farm on the Kish and Bray Banks

Natura Impact Statement to inform Appropriate Assessment

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EXECUTIVE SUMMARY

The proposed Dublin Array offshore wind farm will be located on the Kish and Bray Banks, approximately 10 km off the Dublin and Wicklow coasts in the western Irish Sea. The electricity generated by Dublin Array will be exported to the national grid via a cable that will run from an offshore substation on the banks to a proposed connection point at the existing Eirgrid Substation in Carrickmines, Co. Dublin via a cable landfall site at Shanganagh, south of Shankill, Co. Dublin and north of Bray, Co. Wicklow. This project is one of two offshore wind farms off the east coast to have received a grid connection offer from Eirgrid under the 'Gate 3' round of offers designed to meet Ireland's 2020 renewable energy targets. The total area of the proposed lease area is approximately 54km², although the footprint of the actual turbine foundations will be 0.03% of this area. The proposed development will comprise up to 145 three-bladed wind turbines with a maximum blade tip height of 160 m (maximum rotor diameter of 130 m and maximum hub height of 100 m) above mean high water springs together with associated infrastructure including the turbine foundations, inter-turbine cabling and offshore substation. The wind turbines will be arranged in rows four to five deep, running north-south along the banks. Turbines within a row will be placed approximately 500 m apart, with rows also being separated by 500m. For the purposes of the current impact assessment, construction of the proposed development will involve driving 145 monopile foundations, up to 6.5m in diameter, into the seabed at the Kish and Bray banks using a jack-up rig with pile-driving equipment. Wind turbines will be erected on the monopile foundations. Trenching will be required for the transmission cables between the turbines running to the offshore substation and ultimately ashore at Shanganagh, Co. Dublin. A construction period of 3 years (seasons) is proposed for the completion of the Dublin Array which will include the installation of monopoles, transition pieces and turbine towers concurrently. This construction period is indicative only and will be subject to weather conditions and any conditions imposed in the foreshore lease. Construction activities will be carried out continuously throughout the construction period, with approximately 5% of the site under construction at any one time.

This NIS report is set out in two parts, the first of which is a Screening Assessment which aims to inform the Appropriate Assessment process in determining whether the proposed project, alone or in combination with other plans and projects, is likely to have significant effects on the Natura 2000 sites within the study area. The Screening Assessment identifies designated sites within the potential impact zone of the proposed development, following the guidance published by the NPWS (DoEHLG, 2009). The Screening considers the potential for adverse effects upon the conservation objectives and qualifying interests (including habitats and species) within the affected designated Natura 2000 sites. If the effects are deemed to be significant, potentially significant, or uncertain, or where the Screening process becomes overly complicated, then the preparation of the NIS to inform the Appropriate Assessment process is required under the requirements of Article 6(3) of the EU Habitats Directive (92/43/EEC).

The EU *'Habitats Directive'* was transposed into Irish law by the '*European Community (Natural Habitats) Regulations 1997*' (S.I. No. 94/1997). The most recent transposition of this legislation in Ireland is the '*European Communities (Birds and Natural Habitats) Regulations 2011*' (S.I. No. 477 of 2011). The Birds Directive (2009/147/EC) which is now included in these previous Regulations seeks to protect birds of special importance by the designation of Special Protection Areas (SPAs) whereas the Habitats Directive does the same for habitats and other species groups within Special Areas of Conservation (SACs), which are designated or proposed as candidate Special Areas of Conservation (cSACs). Both SAC and SPA sites

are identified as Natura 2000 sites and collectively form the Natura 2000 network within the EU. Specific guidance for the preparation of Natura Impact Statement reporting and the evaluation of effects on Natura 2000 sites has been utilised in the current report, including:

- DoEHLG (2009) Appropriate Assessment of Plans and Projects in Ireland, Guidance for Planning Authorities;
- NPWS (2012). Marine Natura Impact Statements in Irish Special Areas of Conservation: A Working Document. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht;
- EC (2010) Wind energy developments and Natura 2000. EU Guidance on wind energy development in accordance with the EU nature legislation;
- EC (2002). Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC. European Commission;
- English Nature (2001) Habitats Regulations Guidance Note (No.4): Alone or in combination.

In addition to existing baseline studies and impact assessment reporting set out in the previously prepared Environmental Impact Statement for the proposed development (MRG, 2012) the NIS has been informed by specialist reporting commissioned for this study, which sets out the potential for significant effects on the qualifying interests of the Natura 2000 sites identified within the study area. These reports are included as appendices to the current NIS:

- '*Hydrodynamic Modelling Assessment of the Dublin Array project on the Kish and Bray Banks*' (Hydro Environmental Ltd., 2013);
- *Report on Marine Mammals in relation to the Dublin Array* (BEC Consultants Ltd., 2013);
- *The Proposed Dublin Array Wind Farm – Assessment of Potential Impacts on Seabirds'* (Ecology Ireland, 2013).

From the evaluation of the Screening assessment the sites potentially affected by the proposed development and which are subject to further assessment in the NIS are:

- Lambay Island cSAC
- Rockabill to Dalkey SAC (proposed)
- North Bull Island SPA
- Rogerstown Estuary SPA
- Baldoyle Bay SPA
- Rockabill SPA
- South Dublin Bay and River Tolka Estuary SPA
- Malahide Estuary SPA
- Lambay Island SPA
- Howth Head Coast SPA
- Ireland's Eye SPA
- Skerries Islands SPA
- Dalkey Island SPA
- The Murrough SPA
- Wicklow Head SPA

The key qualifying interests of these sites assessed in the NIS reporting include Annex I listed habitats (geogenic reefs) and Annex II listed marine mammals (Grey seal and Harbour porpoise) within the cSAC sites and a diversity of wintering and breeding seabirds, waders and waterbirds within the SPA sites. Specific mitigation measures have been prescribed in order to reduce and avoid significant direct, indirect and cumulative effects on these qualifying interests.

The conclusions of the NIS have been reached taking account of the impact predictions set out in the specialist reporting, with cognisance of monitoring of other offshore wind energy sites, the findings of a wider literature review and the character of the current study area. The NIS therefore concludes that there is sufficient evidence to determine that the proposed development will not have an adverse effect on the integrity of the Natura 2000 sites identified above, alone or in combination with other projects or proposals in respect of the requirements of Article 6(3) of the Habitats Regulations (2011).

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1 INTRODUCTION

Ecofact Environmental Consultants Ltd. have been commissioned by Saorgus Energy to prepare a Natura Impact Statement (NIS) to inform the Appropriate Assessment process for a proposed offshore wind farm development on the Kish and Bray Banks in the Irish Sea, due east of Co. Dublin. This wind farm development is referred to as the Dublin Array Wind Farm.

The preparation this NIS to inform the Appropriate Assessment process is required under the Habitats Directive (92/43/EEC) in instances where a plan or project may give rise to significant effects upon a Natura 2000 site. Natura 2000 sites are of European Importance and have been designated in accordance with the requirements of the EC Habitats Directive (1992) and EC Birds Directive (2009/147/EC); transposed into Irish legislation as the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2011). The Habitats Directive, in combination with the Birds Directive (2009), establishes a network of internationally important sites designated for their ecological status; identified as Special Areas of Conservation (SACs) designated under the Habitats Directive for the protection of flora, fauna and habitats and as Special Protection Areas (SPAs) designated under the Birds Directive to protect rare, vulnerable and migratory birds. These sites together form a Europe-wide 'Natura 2000' network of designated sites, referred to in this report as Natura 2000 sites.

This NIS provides a focused and detailed impact assessment of the implications of the proposed wind farm development, alone and in combination with other plans and projects on the integrity of the Natura 2000 site network in view of the conservation objectives of these sites; taking account of the best scientific evidence and methods available. It is the obligation of the appropriate Competent Authority to make a determination for the Appropriate Assessment on the basis of information provided, taking account of the findings of the NIS. The assessment follows the requirements of the Habitats Directive 92/43/EEC, Article 6(3) and the guidance published by the National Parks and Wildlife Service (DoEHLG, 2009) '*Appropriate Assessment of Plans and Projects in Ireland, Guidance for Planning Authorities*'. This assessment takes account of the recommendations set out in the '*Best Practice Guidelines for the Irish Wind Energy Industry*' (IWEA, 2012). Mitigation measures are set out in detail to avoid / reduce any potential impacts.

1.1 Project description

The proposed Dublin Array offshore wind farm will be located on the Kish and Bray Banks, approximately 10 km off the Dublin and Wicklow coasts, as shown in Figure 1. The summary of the proposed development is taken from the Environmental Impact Statement prepared for the proposed development (MRG, 2013). Electricity generated by Dublin Array will be exported to the national grid via a cable that will run from an offshore substation on the banks to a proposed connection point at the existing Eirgrid Substation in Carrickmines, Co. Dublin via a cable landfall site at Shanganagh, south of Shankill, Co. Dublin and north of Bray, Co. Wicklow. This project is one of two offshore wind farms off the east coast to have received a grid connection offer from Eirgrid under the 'Gate 3' round of offers designed to meet Ireland's 2020 renewable energy targets.

The total area of the proposed lease area is approximately 54km² (5,400 hectares); although the footprint of the actual turbine foundations will be 0.03% of this area. A meteorological monitoring mast with a height of up to 100 m above high water springs sea will be located within this area to record meteorological data from the offshore wind farm site. The proposed

development will comprise up to 145 three-bladed wind turbines with a maximum blade tip height of 160 m (maximum rotor diameter of 130 m and maximum hub height of 100 m) above mean high water springs level and associated infrastructure including the turbine foundations, inter-turbine cabling and offshore substation.

The resulting minimum distance from mean high water springs level to the blade tips will be 30 m. The turbines will be finished in a mid grey colour with a semi-matt finish. The base of each turbine will be painted with yellow markings to aid sea navigation, as recommended by the Commissioners of Irish Lights. In addition, some turbines will be fitted with marine navigation lights and aviation lights, as specified by the Commissioners of Irish Lights and the Irish Aviation Authority. The wind turbines will be arranged in a row pattern, four to five deep, running north-south along the banks. Turbines within a row will be placed approximately 500 m apart, with rows also being separated by approximately 500m. This layout arrangement will result in a uniform appearance when viewed from land in that, from most viewpoints, avenues of turbines will be seen along the horizon.

Figure 1 Site location and proposed layout of the Dublin Array Offshore Wind Farm on the Kish and Bray Banks; proposed turbine array layout depicted as individual dots.

For the purposes of the current impact assessment, construction of the proposed development will involve driving 145 monopile foundations, up to 6.5m in diameter, into the seabed at the Kish and Bray banks using a jack-up rig with pile-driving equipment. Wind

turbines will be erected on the monopile foundations. Trenching will be required for the transmission cables between the turbines running to the offshore substation and ultimately ashore at Shanganagh, Co. Dublin. Appropriate mitigation measures will be employed during the construction activities. A construction period of 3 years (seasons) is proposed for the completion of the Dublin Array which will include the installation of monopoles, transition pieces and turbine towers concurrently. This construction period is indicative only and will be subject to weather conditions and any conditions imposed in the foreshore lease. Construction will be carried out using jack-up ships capable of carrying several complete wind turbines, with one movement into or out of Dublin Port per day estimated. Construction activities will be carried out continuously throughout the construction period, with approximately 5% of the site under construction at any one time. Construction will either commence at the southern end of the site and progress northwards, or start in the middle of the site and progress north and south. The time of operation will depend on the wind resource available at any given time. On-going maintenance of the Dublin Array is likely to consist of visits by two small boats per day.

1.2 Legislative context

The current assessment takes account of Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora - '*The Habitats Directive'* which was transposed into Irish law by the '*European Community (Natural Habitats) Regulations 1997*' (S.I. No. 94/1997). The most recent transposition of this legislation in Ireland is the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011). The Birds Directive (2009/147/EC) which is now included in the former Regulations seeks to protect birds of special importance by the designation of Special Protection Areas (SPAs) whereas the Habitats Directive does the same for habitats and other species groups within Special Areas of Conservation (SACs), which are designated or proposed as candidate Special Areas of Conservation (cSACs). It is the responsibility of each member state to designate SPAs and SACs, both of which will form part of Natura 2000, a network of protected areas throughout the European Community. Article 6, paragraphs 3 and 4 of the EC 'Habitats' Directive (1992) state that:

6(3) 'Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.'

6(4) 'If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted. Where the site concerned hosts a priority natural habitat type and / or a priority species, the only considerations which may be raised are those relating to human health or public safety, to beneficial consequences of primary importance

for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest.'
In addition, the European Court of Justice in Case C-127/02 (the "Waddenzee Ruling") has made a relevant ruling in relation to Appropriate Assessment and this is reflected in the current assessment:

'Any plan or project not directly connected with or necessary to the management of the site is to be subject to an appropriate assessment of its implications for the site in view of the site's conservation objectives if it cannot be excluded, on the basis of objective information, that it will have a significant effect on that site, either individually or in combination with other plans or projects" and that the plan or project may only be authorised "where no reasonable scientific doubt remains as to the absence of such effects.'

1.3 Appropriate Assessment guidance documents

- DoEHLG (2009) Appropriate Assessment of Plans and Projects in Ireland, Guidance for Planning Authorities;
- NPWS (2012a). Marine Natura Impact Statements in Irish Special Areas of Conservation: A Working Document. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht;
- European Commission (2010) Wind energy developments and Natura 2000. EU Guidance on wind energy development in accordance with the EU nature legislation;
- European Commission (2001). Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC. European Commission;
- English Nature (2001) Habitats Regulations Guidance Note (No.4): Alone or in combination.

1.4 Consultation

During preparation of this document consultation was undertaken, both directly and indirectly (via publically available information / websites) with relevant statutory bodies and stakeholders. Additional and prior consultation undertaken for the preparation of the EIS (MRG, 2013) and associated baseline ecological surveys to inform the EIS process were also referred to. Consultees included:

- National Parks and Service (NPWS), including direct consultation with the NPWS Site Designations Unit
- Irish Whale and Dolphin Group (IWDG)
- Water Framework Directive (WFD) Ireland
- BirdWatch Ireland
- Dún Laoghaire / Rathdown County Council
- Bord Iascaigh Mhara

2 METHODOLOGY

2.1 Desk study

A desktop study was undertaken to identify the extent and scope of the potentially affected designated Natura 2000 sites within the current study area in relation to the proposed Dublin Array Wind Farm. The desktop study identified the designated Natura 2000 sites within the impact zone of the proposed development and identified this as the study area for consideration in the current NIS. Following the DoEHLG (2009) guidance publication a distance of 15km is presented as a suitable radius for sites potentially affected; however, in the current scenario, taking account of highly mobile qualifying interests within the marine environment and the foraging range and migratory lifecycle of a number of bird species, a wider impact zone was utilised.

2.1.1 Reporting to inform the Environmental Impact Statement

The desk study undertaken for the current NIS included a comprehensive review of the baseline field survey data undertaken to inform the Environmental Impact Statement (EIS) reporting (MRG, 2013), prepared for the Environmental Impact Assessment of the proposed development and included a review of the impact assessment conclusions set out in the EIS. This included the following elements of the EIS of specific relevance to the scope of the NIS:

- *Kish Bank Proposed Offshore Wind Farm Progress Report No. 2 on Seabird Surveys Sept 2001- Sept 2002* (Percival *et al*., 2002);
- *Assessment of the potential effects on seabirds of a proposed windfarm on the Kish Bank: 2004, minor updates 2009* (Coveney Wildlife Consulting Ltd., 2009);
- *Kish Bank Seabird Survey: Final Report on surveys conducted between June 2010 and June 2011* (Newton & Trewby, 2011);
- *A marine ecological study of the Kish and Bray banks for a proposed offshore wind farm development: Re-characterisation survey* (Ecological Consultancy Services Ltd (EcoServe) 2008);
- *A marine ecological study of the Kish and Bray banks for a proposed off-shore wind farm development: Commercial fisheries* (Ecological Consultancy Services Ltd (EcoServe, 2011);
- *Kish and Bray Banks Proposed Turbine Location Feasibility Study Hydrographic and Geophysical Report of Survey Volume 1 June – September 2008* (Hydrographic Surveys Ltd., 2008);
- *Geological Report on the Environmental Impact of the Proposed Kish & Bray Banks Wind Farm Development*. (Graham, 2009).

2.1.2 Dedicated surveys and reporting to inform the NIS

In addition to the EIS baseline surveys and reporting, specialist assessments were also undertaken to inform the NIS with regard to the qualifying interests and conservation features of the Natura 2000 sites within the study area of the proposed development. These reports are presented as appendices to the current NIS and included:

- '*Hydrodynamic Modelling Assessment of the Dublin Array project on the Kish and Bray Banks*' (Hydro Environmental Ltd., 2013);

- *Report on Marine Mammals in relation to the Dublin Array* (BEC Consultants Ltd., 2013);
- *The Proposed Dublin Array Wind Farm – Assessment of Potential Impacts on Seabirds'* (Ecology Ireland, 2013).

2.2 Appropriate Assessment Methodology

The preparation of this NIS to inform the Appropriate Assessment process follows the guidance published by the National Parks and Wildlife Service (DoEHLG, 2009) '*Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities'*. According to these guidelines, the Appropriate Assessment process is a four staged approach, as described below:

- *Stage One: Screening / Test of Significance* - The process which identifies the likely impacts upon a Natura 2000 site of a project or plan, either alone or in combination with other projects or plans, and considers whether these impacts are likely to be significant;
- *Stage Two: Natura Impact Statement* - The consideration of the impact of the project or plan on the integrity of the Natura 2000 site, either alone or in combination with other projects or plans, with respect to the site's structure and function and its conservation objectives. Additionally, where there are adverse impacts, an assessment of the potential mitigation of those impacts;
- *Stage Three: Assessment of Alternative Solutions* - The process which examines alternative ways of achieving the objectives of the project or plan that avoid adverse impacts on the integrity of the Natura 2000 site; and
- *Stage Four: Assessment Where Adverse Impacts Remain* - An assessment of compensatory measures where, in the light of an assessment of Imperative Reasons of Overriding Public Interest (IROPI), it is deemed that the project or plan should proceed.

The safeguards set out in Article 6(3) and (4) of the Habitats Directive are triggered not by certainty but by the possibility of significant effects. Thus, in line with the precautionary principle, it is unacceptable to fail to undertake an appropriate assessment on the basis that it is not certain that there are significant effects.

2.2.1 Screening to Inform Appropriate Assessment

Following the guidelines set out by DoEHLG (2009) Screening is the process that addresses and records the reasoning and conclusions in relation to the first two tests of Article 6(3); i.e. whether a plan or project can be excluded from Appropriate Assessment requirements because it is directly connected with or necessary to the management of the site; and the potential effects of a project or plan, either alone or in combination with other projects or plans, on a Natura 2000 site in view of its conservation objectives, and considering whether these effects will be significant. According to the DoEHLG (2009) guidance, screening is the process that addresses and records the reasoning and conclusions in relation to the first two tests of Article 6(3) of the EU Habitats Directive, that is: whether a plan or project is directly connected to or necessary for the management of the site; and whether a plan or project, alone or in combination with other plans and projects, is likely to have significant effects on a Natura 2000 site or sites in view of its conservation objectives.

The proposed offshore wind farm development does not comply with the first screening test (i.e. the proposed works are not directly connected to or necessary for the management of any Natura 2000 site). The Screening assessment therefore aims to inform the Appropriate Assessment process in determining whether the proposed project, alone or in combination with other plans and projects, is likely to have significant effects on the Natura 2000 sites within the study area. If the effects are deemed to be significant, potentially significant, or uncertain, or it the screening process becomes overly complicated, then the Appropriate Assessment process must proceed to the preparation of a Natura Impact Statement (NIS). The required elements of a Screening Report included in the current report are as follows:

- Description of plan or project - Identification of relevant Natura 2000 sites and compilation of information on their qualifying interests and conservation objectives. Include the potential for a plan or project, whether it is within or outside a Natura 2000 site, to have direct, indirect or cumulative effects. Desk study information for the conservation interests is available from the NPWS.
- Assessment of likely effects – direct, indirect and cumulative – undertaken on the basis of available information as a desk study or field survey or primary research as necessary. A precautionary approach is fundamental and, in cases of uncertainty, it should be assumed the effects could be significant. As a guide, any element of a plan or project that has the potential to affect the conservation objectives of a Natura 2000 site, including its structure and function, should be considered significant.

2.2.2 Natura Impact Assessment

A Natura Impact Statement (NIS) considers whether the plan or project, alone or in combination with other projects or plans, will have adverse effects on the integrity of a Natura 2000 site, and includes any mitigation measures necessary to avoid, reduce or offset negative effects. The current report is set out in the format of a NIS and comprises a scientific examination of the plan / project and the relevant Natura 2000 sites; to identify and characterise any possible implications for the site in view of the site's conservation objectives, structure and function, taking account of in combination effects. The requirements for Appropriate Assessment derive directly from Article 6(3) of the EU Habitats Directive (1992).

Direct and indirect impacts in isolation or in combination with other plans and projects on the identified Natura 2000 sites in view of the sites' conservation objectives have been examined. Case law of the European Court of Justice (ECJ) has established that Appropriate Assessment must be based on best scientific knowledge in the field. These are the qualifying interests i.e. Annex I habitats, Annex I bird species (EU Birds Directive, incorporated into the EU Habitats Directive) and Annex II species hosted by a site and for which that site has been selected. The conservation objectives for Natura sites (SACs and SPAs) are determined under Article 4 of the Habitats Directive and are intended to ensure that the relevant qualifying interests i.e. Annex I habitats, Annex I bird species and Annex II species present within the designated sites are maintained in a favourable condition. The current assessment of the proposed development provides a description of the project and the receiving environment. The conservation objectives of Natura 2000 sites potentially affected by the proposed development are listed and potential impacts outlined with respect to the integrity of the Natura 2000 site. Mitigation measures have been proposed for the protection of the conservation interests and the avoidance of impacts to Natura 2000 sites occurring within the study area.

3 SCREENING FOR APPROPRIATE ASSESSMENT

3.1 Description of the proposed project

The proposed project on the Kish Bank and the Bray Bank will be located on the Kish and Bray banks, approximately 10 km off the Dublin and Wicklow coasts, see Figure 1. The electricity generated by Dublin Array will be exported to the national grid via a cable that will run from an offshore substation on the banks to a proposed connection point at the existing Eirgrid Substation in Carrickmines, Co. Dublin via a cable landfall site at Shanganagh, south of Shankill, Co. Dublin and north of Bray, Co. Wicklow. This project is one of two offshore wind farms off the east coast to have received a grid connection offer from Eirgrid under the 'Gate 3' round of offers designed to meet Ireland's 2020 renewable energy targets. The total area of the proposed lease area is approximately 54km² (5,400 hectares); although the footprint of the actual turbine foundations will be 0.03% of this area. A meteorological monitoring mast with a height of up to 100 m above high water springs will be located within this area to record meteorological data from the offshore wind farm site.

The proposed development will comprise up to 145 three-bladed wind turbines with a maximum blade tip height of 160m (maximum rotor diameter of 130m and maximum hub height of 100m) above mean sea level and associated infrastructure including the turbine foundations, inter-turbine cabling and offshore substation. The resulting minimum distance from mean high water springs level to the blade tips will be 30m. The turbines will be finished in a mid grey colour with a semi-matt finish. The base of each turbine will be painted with yellow markings to aid sea navigation, as recommended by the Commissioners of Irish Lights. In addition, turbines will be fitted with marine navigation lights and aviation lights, as specified by the Commissioners of Irish Lights and the Irish Aviation Authority. The wind turbines will be arranged in a row pattern, four to five deep, running north-south along the banks. Turbines within a row will be placed approximately 500m apart, with rows also being separated by approximately 500m. This layout arrangement will result in a uniform appearance when viewed from land in that, from most viewpoints, avenues of turbines will be seen along the horizon.

The proposed development is evaluated on the basis of information provided and for the purposes of this assessment the proposed turbines will be set on 145 monopile foundations, of up to 6.5m diameter, which will be driven into the seabed at the Kish and Bray banks using a jack-up rig with pile-driving equipment. Wind turbines will be erected on the monopile foundations. Trenching will be required for the transmission cables between the turbines running to the offshore substation and ultimately ashore at Shanganagh. Appropriate mitigation measures will be employed during the construction activities. A construction period of 3 years (seasons) is proposed for the completion of the Dublin Array which will include the installation of monopoles, transition pieces and turbine towers concurrently. This construction period is indicative only and will be subject to detailed design, project planning, weather conditions and any conditions imposed in the foreshore lease. Construction will be carried out using jack-up ships capable of carrying several complete wind turbines, with one movement into or out of Dublin Port per day estimated. Construction activities will be carried out continuously throughout the construction period, with approximately 5% of the site under construction at any one time. The time of operation will depend on the wind resource available at any given time. On-going maintenance of the Dublin Array is likely to consist of visits by two small boats per day.

3.2 Description of the receiving environment

The Dublin Array is proposed to be constructed on the Kish and Bray banks, approximately 10 km off the Dublin and Wicklow coasts. The study area for the Dublin Array Wind Farm along the Kish and Bray Sand Banks extends 18km north-south and 3km east-west giving an overall study area in the order of 54 km^2. The site is located in relatively shallow waters ranging from 4.5m to 31.5m below mean sea level, with the surrounding area under a depth of 20-45 m, with the area west of the banks shallower than the area east of the banks. These banks are described as submarine banks trending north-south parallel to the coastline with NNE-SSW trending bedforms consisting primarily of sand and some gravel.

The description of the physical environment as set out in the EIS and relevant appendices (MRG, 2013) provides information on the geology and existing hydrodynamic environment of the study area. The bed sediment to the north is generally classified as a fine to medium sand with sand content varying from 90% to 95%. Other surveys from grab sampling indicate a coarser bed to the south of the Bray Bank associated with higher tidal flow activity. The surface sand layers on the Kish and Bray Banks were found to be active, being constantly mobilised and deposited during tidal cycles. The residual tidal circulation is important for retaining sediment along the sand bank (Hydro Environmental, 2013).

Specific seabird surveys have been undertaken at the proposed Dublin Array Wind Farm site an annual survey was undertaken by Ecology Consulting between September 2001 and September 2002 (Percival *et al*., 2002), with a desk study utilising this information carried out in 2004 (Coveney Wildlife, 2004; updated 2009). A second annual survey was carried out by BirdWatch Ireland between June 2010 and June 2011 (Newton & Trewby, 2011); this information was collated as a desk assessment prepared by Ecological Consultancy Services Ltd. in 2011 (Ecoserve, 2011) as Chapter 9: Birds of the EIS for the proposed development. The impact assessment prepared by Ecoserve was edited and incorporated into the current EIS by MRG Consulting Engineers (MRG, 2013), on behalf of the developers.

From the results of the baseline surveys undertaken it is clear that the proposed development site is used by high numbers of the following species: Fulmar, Razorbill, Manx Shearwater, Northern gannet, Cormorant, Little gull, Herring gull, Kittiwake and Guillimot (further analysis of this species is required according to the EIS). All of these species are listed as special conservation interests of the numerous Special Protection Area (SPA) sites identified within the study area.

The development site and the surrounding area support a number of Annex II marine mammal species with varying frequency, including harbour porpoise (*Phocoena phocoena*), grey seal (*Halichoerus grypus*) and bottlenose dolphin (*Tursiops truncatus*). Harbour porpoises and grey seals are resident along the east coast and are listed as qualifying interests for two separate Special Areas of Conservation (SAC).

The Kish and Bray banks and the surrounding area of the South Dublin coast are utilised for numerous marine activities including commercial shipping, commercial fishing and leisure boating / recreational fishing.

3.3 Identification of relevant Natura 2000 sites

3.3.1 Screening of Natura 2000 sites within the study area

The screening assessment to inform the Appropriate Assessment has identified Natura 2000 sites within a 15km radius of the proposed development, following the guidance published by DoEHLG (2009). However, taking account of the size and scale of the proposed development and the potential for impacts affecting wide-ranging conservation interests of Natura 2000 sites within the study area, the potential impact radius of the proposed development has been extended to include designated Natura 2000 sites within a wider study area. Designated candidate Special Areas of Conservation (cSAC) sites and Special Protection Area (SPA) sites within the study area are presented in Table 1 and Table 2 respectively. The conservation interests of these sites and the potential for interactions leading to adverse effects arising from the proposed development are identified for each site.

A number of terrestrial Natura 2000 designations occur within the appointed radial area of the Dublin Array Wind Farm study area. These sites are identified as having qualifying interests and associated conservation objectives restricted to terrestrial ecological features that do not extend into or interact in a cumulative fashion with the offshore / marine element of the proposed development. Having regard to the location of the proposed development, in addition to the minor scale of the landfall and cable laying requirements in the terrestrial environment it is considered that there are no direct or indirect connections identified between these sites and the current proposal.

No pathways for potential impacts which would have the potential for significant adverse effects (direct, indirect or cumulative) are identified at this Screening stage with regard to these sites listed below and for the above reasons they are excluded from further assessment in the current report:

- Ballyman Glen cSAC
- Knocksink Wood cSAC
- Glenasmole Valley cSAC
- Vale of Clara cSAC
- Deputy's Pass Nature Reserve cSAC
- Glen of the Downs cSAC
- Carriggower Bog cSAC
- Wicklow Mountains cSAC
- Rye Water Valley/Carton cSAC
- Red Bog Kildare cSAC
- Slaney River Valley cSAC
- Poulaphouca Reservoir SPA
- Wicklow Mountains SPA

Table 1 Designated cSAC sites within the coastal and marine environment which are located within the study area of the proposed Dublin Array Wind Farm. The qualifying interests and the potential for impacts affecting these individual features are identified.

SAC	Distance	Qualifying Interests	Potential for impacts identified	Further assessment required
Ireland's Eye cSAC	Approximately 11.5 km due northwest	Perennial vegetation of stony banks [1220] Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]	Taking account of distance and the character of this qualifying feature there will be no interactions or pathways for impacts arising from the proposed development which may affect this habitat.	No further assessment required with regard to the Annex I habitats of this site.
Lambay Island cSAC	Approximately 20km due north	Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] Grey seal (*Halichoerus grypus*) [1364]	There will be no interactions or pathways for impacts arising from the proposed development which may affect this terrestrial habitat. The Grey seal has been recorded from within the development area and SAC populations are known to be mobile.	Further assessment is required to determine the significance of potential impacts affecting the cSAC populations of grey seal with regard to disturbance, habitat displacement and loss of feeding grounds. No further assessment required with regard to the Annex I habitats of this site.
Howth Head cSAC	Approximately 6.5km due north	Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] European dry heaths [4030]	There will be no interactions or pathways for impacts arising from the proposed development which may affect these terrestrial habitats listed as qualifying interests of this site.	No further assessment required with regard to the Annex I habitats of this site.
Baldoyle Bay cSAC	Approximately 11km northwest	Mudflats and sandflats not covered by seawater at low tide [1140] Salicornia and other annuals colonizing mud and sand [1310] Spartina swards (*Spartinion maritimae*) [1320] Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] Mediterranean salt meadows (*Juncetalia maritimi*) [1410]	Taking account of distance and the character of these qualifying features, there will be no interactions or pathways for impacts arising from the proposed development which may affect the habitats for which this site is designated.	No further assessment required with regard to the Annex I habitats of this site.
Rogerstown Estuary cSAC	Approximately 22km northwest	Estuaries [1130] Mudflats and sandflats not covered by seawater at low tide [1140]	Taking account of distance and the character of these qualifying features there will be no	No further assessment required with regard to the Annex I habitats of this site.

SAC	Distance	Qualifying Interests	Potential for impacts identified	Further assessment required
		Salicornia and other annuals colonizing mud and sand [1310] Spartina swards (*Spartinion maritimae*) [1320] Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] Mediterranean salt meadows (*Juncetalia maritimi*) [1410] Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120] Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]	interactions or pathways for impacts arising from the proposed development which may affect the habitats for which this site is designated.	
Malahide Estuary cSAC	Approximately 17km northwest	Mudflats and sandflats not covered by seawater at low tide [1140] Salicornia and other annuals colonizing mud and sand [1310] Spartina swards (*Spartinion maritimae*) [1320] Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] Mediterranean salt meadows (*Juncetalia maritimi*) [1410] Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120] Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]	Taking account of distance and the character of these qualifying features there will be no interactions or pathways for impacts arising from the proposed development which may affect the habitats for which this site is designated.	No further assessment required with regard to the Annex I habitats of this site.
South Dublin Bay cSAC	Approximately 11.5km due west	Mudflats and sandflats not covered by seawater at low tide [1140]	Taking account of distance and the character of this qualifying feature there will be no interactions or pathways for impacts arising from the proposed development which may affect the habitats for which this site is designated.	No further assessment required with regard to the Annex I habitats of this site.
North Dublin Bay cSAC	Approximately 11km northwest	Petalwort (*Petalophyllum ralfsii*) [1395] Mudflats and sandflats not covered by seawater at low tide [1140] Annual vegetation of drift lines [1210] Salicornia and other annuals colonizing mud and sand [1310] Spartina swards (*Spartinion maritimae*) [1320] Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] Mediterranean salt meadows (*Juncetalia maritimi*) [1410] Embryonic shifting dunes [2110]	Taking account of distance and the character of these qualifying features there will be no interactions or pathways for impacts arising from the proposed development which may affect the habitats or species for which this site is designated.	No further assessment required with regard to the Annex I habitats and Annex II species of this site.

SAC	Distance	Qualifying Interests	Potential for impacts identified	Further assessment required
		Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120] Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] Humid dune slacks [2190]		
Bray Head cSAC	Approximately 9km due west	Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] European dry heaths [4030] Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (*important orchid sites) [6210]	Taking account of distance and the character of these qualifying features there will be no interactions or pathways for impacts arising from the proposed development which may affect the terrestrial habitats for which this site is designated.	No further assessment required with regard to the Annex I habitats of this site.
Rockabill to Dalkey SAC (*proposed*)	Approximately 1.6km due west	Reefs [1170] Harbour porpoise (*Phocoena phocoena*) [1351]	The extent of reef habitat designated within the site is unknown; however, it is considered to be associated with the rocky shoreline and subtidal reefs along the shore. Biogenic reefs are not recorded from this site. Harbour porpoises have been recorded from within the development site and are associated with the population designated within this proposed cSAC, located in close proximity to the proposed development.	Reef habitat within this site is non-biogenic; however, due to proximity to the proposed development, smothering / disturbance impacts are possible. The proposed development gives rise to the potential for human disturbance; habitat displacement and loss of feeding grounds potentially affecting this species within and without the proposed cSAC boundary. Acoustic disturbance during construction and operation requires particular assessment.
Murrough Wetlands cSAC	Approximately 9.5km southwest	Annual vegetation of drift lines [1210] Perennial vegetation of stony banks [1220] Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] Mediterranean salt meadows (*Juncetalia maritimi*) [1410] Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* [7210] Alkaline fens [7230]	Taking account of distance and the character of these qualifying features there will be no interactions or pathways for impacts arising from the proposed development which may affect the habitats for which this site is designated.	No further assessment required with regard to the Annex I habitats of this site.

SAC	Distance	Qualifying Interests	Potential for impacts identified	Further assessment required
Wicklow Reef cSAC	Approximately 17km due south	Reefs [1170]	Taking account of distance and the character of these qualifying features there will be no interactions or pathways for impacts arising from the proposed development which may affect the habitats for which this site is designated.	No further assessment required with regard to the Annex I habitats of this site. The biological communities of this biogenic reef habitat are unlikely to be affected.
Magherabeg Dunes cSAC	Approximately 25km due south	Annual vegetation of drift lines [1210] Embryonic shifting dunes [2110] Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120] Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] Atlantic decalcified fixed dunes (*Calluno-Ulicetea*) [2150] Petrifying springs with tufa formation (*Cratoneurion*) [7220]	Taking account of distance and the character of these qualifying features there will be no interactions or pathways for impacts arising from the proposed development which may affect the habitats for which this site is designated.	No further assessment required with regard to the Annex I habitats of this site.
Buckroney-Brittas Dunes cSAC	Approximately 30km due south	Annual vegetation of drift lines [1210] Perennial vegetation of stony banks [1220] Mediterranean salt meadows (*Juncetalia maritimi*) [1410] Embryonic shifting dunes [2110] Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120] Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] Atlantic decalcified fixed dunes (*Calluno-Ulicetea*) [2150] Dunes with *Salix repens ssp.argentea* (*Salix arenariae*) [2170] Humid dune slacks [2190] Alkaline fens [7230]	Taking account of distance and the character of these qualifying features there will be no interactions or pathways for impacts arising from the proposed development which may affect the habitats for which this site is designated.	No further assessment required with regard to the Annex I habitats of this site.

Table 2 Designated SPA sites within the study area of the proposed Dublin Array Wind Farm with potential for impacts on special conservation interests identified.

SPA	Distance	Qualifying Features	Potential for impacts identified	Further assessment required
North Bull Island SPA	Approximately 9.5km northwest	Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Shelduck (*Tadorna tadorna*) [A048] Teal (*Anas crecca*) [A052] Pintail (*Anas acuta*) [A054] Shoveler (*Anas clypeata*) [A056] Oystercatcher (*Haematopus ostralegus*) [A130] Golden Plover (*Pluvialis apricaria*) [A140] Grey Plover (*Pluvialis squatarola*) [A141] Sanderling (*Calidris alba*) [A144] Knot (*Calidris canutus*) [A143] Dunlin (*Calidris alpina*) [A149] Black-tailed Godwit (*Limosa limosa*) [A156] Bar-tailed Godwit (*Limosa lapponica*) [A157] Curlew (*Numenius arquata*) [A160] Redshank (*Tringa totanus*) [A162] Turnstone (*Arenaria interpres*) [A169] Black-headed Gull (*Larus ridibundus*) [A179] Wetlands & Waterbirds [A999]	Migration flight paths may potentially bring wading and waterbird species through the turbine array; this gives rise to the potential for collision impacts. Daily movements of these species between resting and feeding grounds need to be identified. There are no direct or indirect impacts potentially affecting the habitats of this SPA	Migratory wading and waterbird species listed as conservation features of this SPA are unlikely to be affected; however further, detailed assessment is required at NIS stage particularly with regard to black-headed gull.
Rogerstown Estuary SPA	Approximately 23km northwest	Greylag Goose (*Anser anser*) [A043] Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Shelduck (*Tadorna tadorna*) [A048] Shoveler (*Anas clypeata*) [A056] Oystercatcher (*Haematopus ostralegus*) [A130] Ringed Plover (*Charadrius hiaticula*) [A137] Grey Plover (*Pluvialis squatarola*) [A141] Knot (*Calidris canutus*) [A143] Dunlin (*Calidris alpina*) [A149] Black-tailed Godwit (*Limosa limosa*) [A156] Redshank (*Tringa totanus*) [A162] Wetlands & Waterbirds [A999]	Migration flight paths may potentially bring wading and waterbird species through the turbine array; this gives rise to the potential for collision impacts. Daily movements of these species between resting and feeding grounds need to be identified. There are no direct or indirect impacts potentially affecting the habitats of this SPA	Migratory wading and waterbird species listed as conservation features of this SPA are unlikely to be affected; however further, detailed assessment is required at NIS stage.
Baldoyle Bay SPA	Approximately 11.5km northwest	Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Shelduck (*Tadorna tadorna*) [A048]	Migration flight paths may potentially bring wading and waterbird species through the turbine array; this gives rise to the potential for collision impacts. Daily	Migratory wading and waterbird species listed as conservation features of this SPA are unlikely to

SPA	Distance	Qualifying Features	Potential for impacts identified	Further assessment required
		Ringed Plover (*Charadrius hiaticula*) [A137] Golden Plover (*Pluvialis apricaria*) [A140] Grey Plover (*Pluvialis squatarola*) [A141] Bar-tailed Godwit (*Limosa lapponica*) [A157] Wetlands & Waterbirds [A999]	movements of these species between resting and feeding grounds need to be identified. There are no direct or indirect impacts potentially affecting the habitats of this SPA	be affected; however further, detailed assessment is required at NIS stage.
Rockabill SPA	Approximately 30km north	Arctic Tern (*Sterna paradisaea*) [A194] Roseate Tern (*Sterna dougallii*) [A192] Common Tern (*Sterna hirundo*) [A193] Purple Sandpiper (*Calidris maritima*) [A148]	Migration flight paths may potentially bring these species through the turbine array. Daily movements between resting and feeding grounds need to be identified. The proposal gives rise to the potential for human disturbance during breeding season and migration; collision risk; habitat loss by way of reduced feeding ground area; cumulative loss of sandbank habitat affecting feeding range.	Potential disturbance to feeding sites, cumulative impacts affecting sandbank feeding grounds, disturbance impacts during migration. Requires assessment at NIS stage.
South Dublin Bay and River Tolka Estuary SPA	Approximately 10km west	Black-headed Gull (*Larus ridibundus*) [A179] Roseate Tern (*Sterna dougallii*) [A192] Common Tern (St*erna hirundo*) [A193] Arctic Tern (*Sterna paradisaea*) [A194] Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Oystercatcher (*Haematopus ostralegus*) [A130] Ringed Plover (*Charadrius hiaticula*) [A137] Grey Plover (*Pluvialis squatarola*) [A140] Knot (*Calidris canutus*) [A143] Sanderling (*Calidris alba*) [A144] Dunlin (*Calidris alpina*) [A149] Bar-tailed Godwit (*Limosa lapponica*) [A157] Redshank (*Tringa totanus*) [A162] Wetlands & Waterbirds [A999]	Migration flight paths may potentially bring these species through the turbine array. Daily movements between resting and feeding grounds need to be identified. The proposal gives rise to the potential for human disturbance during breeding season and migration; collision risk; habitat loss by way of reduced feeding ground area; cumulative loss of sandbank habitat affecting feeding range. There are no direct or indirect impacts potentially affecting the habitats of this SPA	Potential disturbance to feeding sites, collision risk, cumulative impacts affecting sandbank feeding grounds, disturbance impacts during migration. Requires assessment at NIS stage.
Malahide Estuary SPA	Approximately 17km northwest	Great Crested Grebe (*Podiceps cristatus*) [A005] Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Shelduck (*Tadorna tadorna*) [A048] Pintail (*Anas acuta*) [A054] Goldeneye (*Bucephala clangula*) [A067] Red-breasted Merganser (*Mergus serrator*) [A069]	Migration flight paths may potentially bring these species through the turbine array. Daily movements between resting and feeding grounds need to be identified. The proposal gives rise to the potential for human disturbance during breeding season and migration in addition to collision risks. These wading species were not recorded in significant numbers within the proposed development site.	Migratory wading and waterbird species listed as conservation features of this SPA are unlikely to be affected; however further, detailed assessment is required at NIS stage.

SPA	Distance	Qualifying Features	Potential for impacts identified	Further assessment required
		Oystercatcher (*Haematopus ostralegus*) [A130] Golden Plover (*Pluvialis apricaria*) [A140] Grey Plover (*Pluvialis squatarola*) [A141] Knot (Calidris canutus) [A143] Dunlin (*Calidris alpina*) [A149] Black-tailed Godwit (*Limosa limosa*) [A156] Bar-tailed Godwit (*Limosa lapponica*) [A157] Redshank (*Tringa totanus*) [A162] Wetlands & Waterbirds [A999]	There are no direct or indirect impacts potentially affecting the habitats of this SPA	
Lambay Island SPA	Approximately 19.5km north	Fulmar (*Fulmarus glacialis*) [A009] Cormorant (*Phalacrocorax carbo*) [A017] Shag (*Phalacrocorax aristotelis*) [A018] Lesser Black-backed Gull (*Larus fuscus*) [A183] Herring Gull (*Larus argentatus*) [A 184] Kittiwake (*Rissa tridactyla*) [A188] Guillemot (*Uria aalge*) [A199] Razorbill (*Alca torda*) [A200] Puffin (Fratercula arctica) [A204] Greylag Goose (*Anser anser*) [A043]	Migration flight paths may potentially bring these species through the turbine array. Daily movements between resting and feeding grounds need to be identified. The proposal gives rise to the potential for human disturbance during breeding season and migration; collision risk; habitat loss by way of reduced feeding ground area; cumulative loss of sandbank habitat affecting feeding range.	Potential disturbance to feeding sites, collision risk, cumulative impacts affecting sandbank feeding grounds, disturbance impacts during migration. Requires assessment at NIS stage.
Howth Head Coast SPA	Approximately 7km northwest	Kittiwake (*Rissa tridactyla*) [A188]	The proposal gives rise to the potential for human disturbance during breeding season and migration; collision risk; habitat loss by way of reduced feeding ground area; cumulative loss of sandbank habitat affecting feeding range.	Potential disturbance to feeding sites, collision risk, cumulative impacts affecting sandbank feeding grounds, disturbance impacts during migration. Requires assessment at NIS stage.
Ireland's Eye SPA	Approximately 11km northwest	Razorbill (*Alca torda*) [A200] Guillemot (*Uria aalge*) [A199] Kittiwake (*Rissa tridactyla*) [A188] Herring Gull (*Larus argentatus*) [A184] Cormorant (*Phalacrocorax carbo*) [A017]	The proposal gives rise to the potential for human disturbance during breeding season and migration; collision risk; habitat loss by way of reduced feeding ground area; cumulative loss of sandbank habitat affecting feeding range.	Potential disturbance to feeding sites, collision risk, cumulative impacts affecting sandbank feeding grounds, disturbance impacts during migration. Requires assessment at NIS stage.
Skerries Islands SPA	Approximately 30km northwest	Cormorant (*Phalacrocorax carbo*) [A017] Shag (*Phalacrocorax aristotelis*) [A018] Herring Gull (*Larus argentatus*) [A184] Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Purple Sandpiper (*Calidris maritima*) [A148] Turnstone (*Arenaria interpres*) [A169]	The proposal gives rise to the potential for human disturbance during breeding season and migration; collision risk; habitat loss by way of reduced feeding ground area; cumulative loss of sandbank habitat affecting feeding range. The wading species were not recorded in significant numbers within the proposed development site.	Potential disturbance to feeding sites, collision risk, cumulative impacts affecting sandbank feeding grounds, disturbance impacts during migration. Requires assessment at NIS stage.

SPA	Distance	Qualifying Features	Potential for impacts identified	Further assessment required
Dalkey Island SPA	Approximately 8.5km west	Arctic Tern (*Sterna paradisaea*) [A194] Roseate Tern (*Sterna dougallii*) [A192] Common Tern (*Sterna hirundo*) [A193]	The proposal gives rise to the potential for human disturbance during breeding season and migration; collision risk; habitat loss by way of reduced feeding ground area; cumulative loss of sandbank habitat affecting feeding range. The wading species were not recorded in significant numbers within the proposed development site.	Potential disturbance to feeding sites, collision risk, cumulative impacts affecting sandbank feeding grounds, disturbance impacts during migration. Requires assessment at NIS stage.
The Murrough SPA	Approximately 10km southwest	Red-throated Diver (*Gavia stellata*) [A001] Greylag Goose (*Anser anser*) [A043] Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Wigeon (*Anas penelope*) [A050] Teal (*Anas crecca*) [A052] Black-headed Gull (*Larus ridibundus*) [A179] Herring Gull (*Larus argentatus*) [A184] Little Tern (*Sterna albifrons*) [A195] Wetlands & Waterbirds [A999]	The proposal gives rise to the potential for human disturbance during breeding season and migration; collision risk; habitat loss by way of reduced feeding ground area; cumulative loss of sandbank habitat affecting feeding range. The wading species were not recorded in significant numbers within the proposed development site. There are no direct or indirect impacts potentially affecting the habitats of this SPA.	Potential disturbance to feeding sites, collision risk, cumulative impacts affecting sandbank feeding grounds, disturbance impacts during migration. Requires assessment at NIS stage.
Wicklow Head SPA	Approximately 20km southwest	Kittiwake (*Rissa tridactyla*) [A188]	The proposal gives rise to the potential for human disturbance during breeding season and migration; collision risk; habitat loss by way of reduced feeding ground area; cumulative loss of sandbank habitat affecting feeding range. The wading species were not recorded in significant numbers within the proposed development site.	Potential disturbance to feeding sites, collision risk, cumulative impacts affecting sandbank feeding grounds, disturbance impacts during migration. Requires assessment at NIS stage.

Designated Special Areas of Conservation (SACs) within the Study Area of the Proposed Dublin Array Offshore Wind Farm

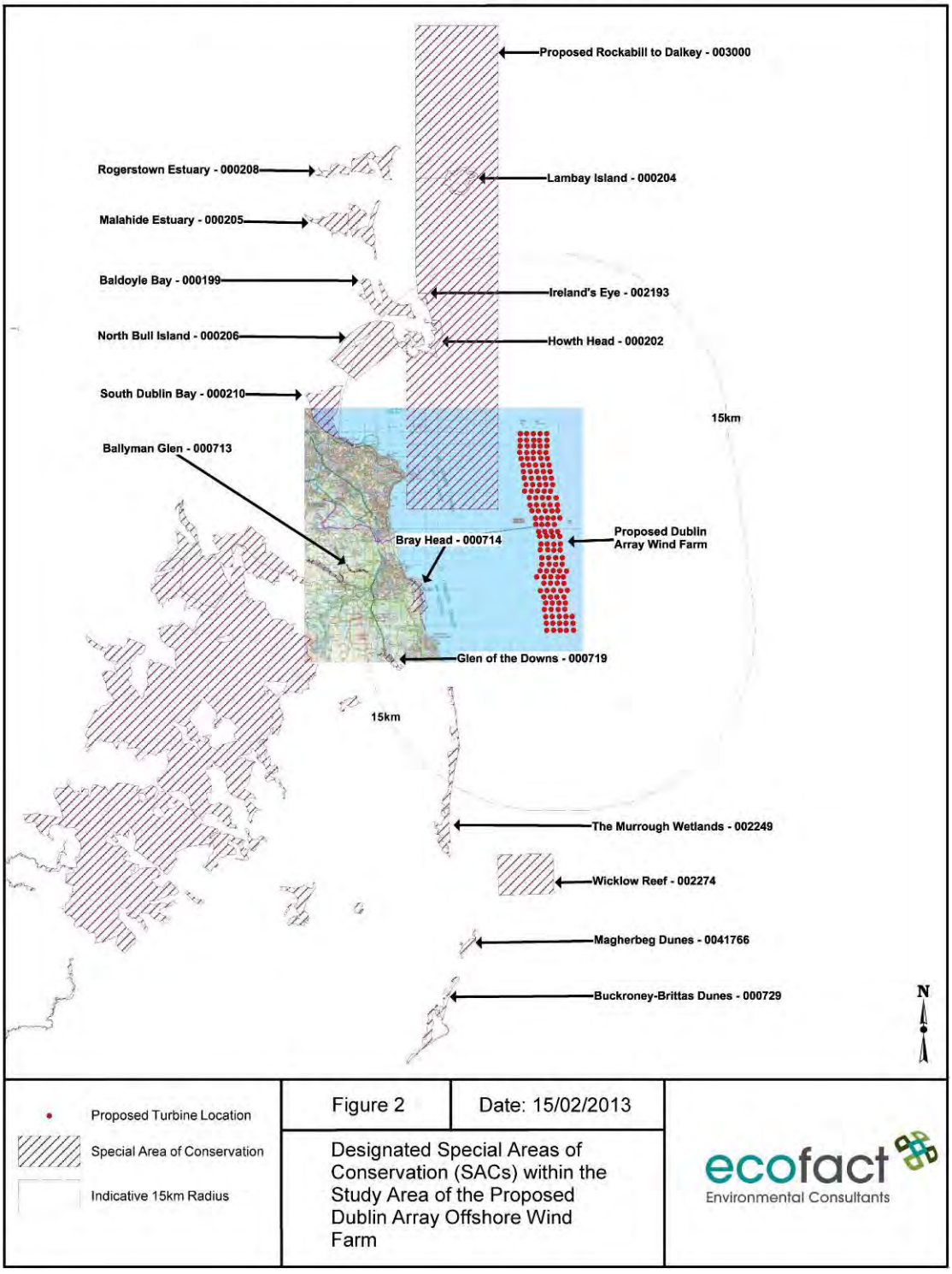

Figure 2 Map showing the locations of designated candidate SAC sites within the study area, relative to the proposed Dublin Array Wind Farm development.

Designated Special Protection Areas (SPAs) within the Study Area of the Proposed Dublin Array Offshore Wind Farm

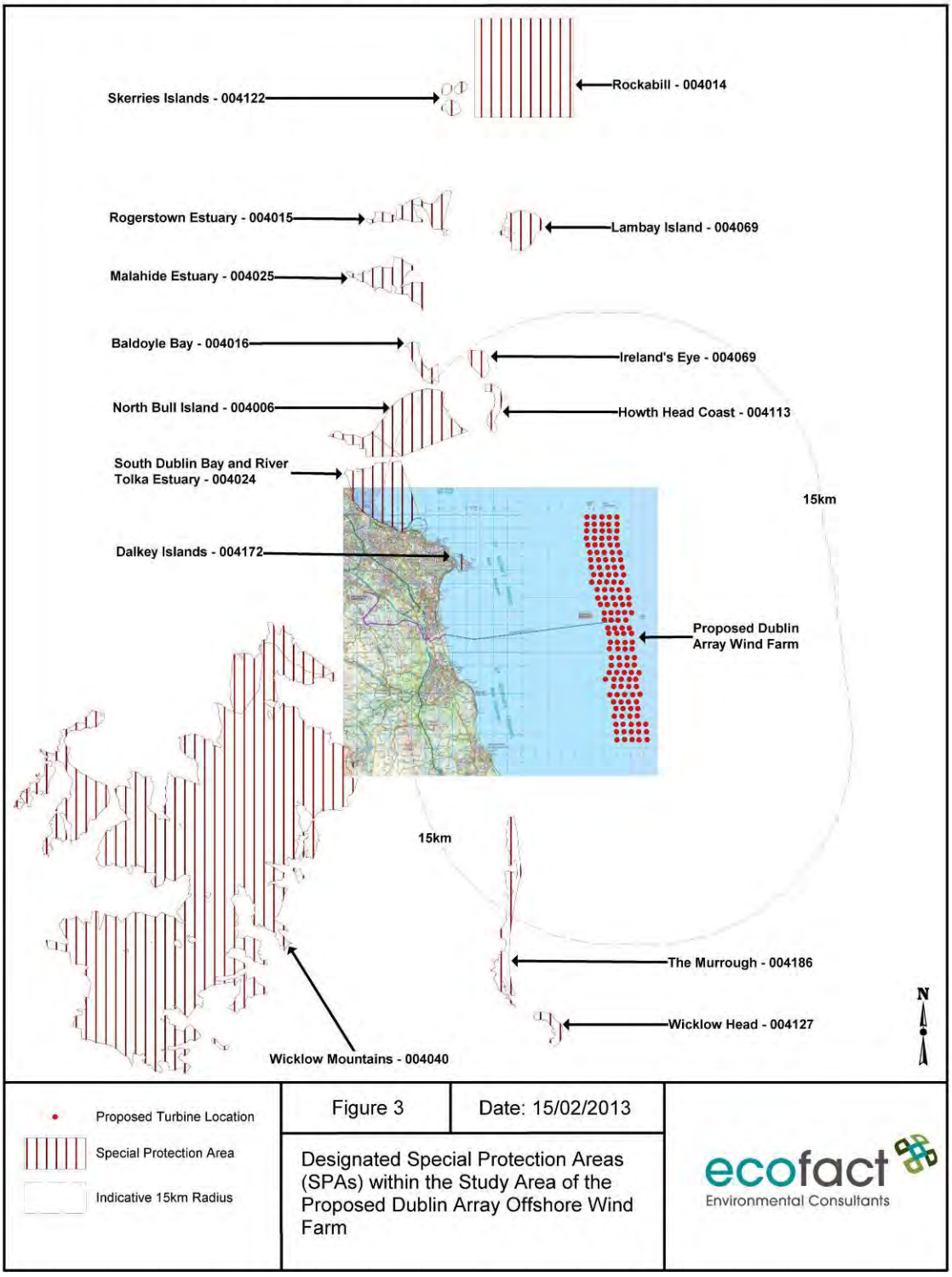

Figure 3 Map showing the locations of designated SPA sites within the study area, relative to the proposed Dublin Array Wind Farm development.

3.4 Screening assessment of likely effects

The current Screening assessment takes account of the potential for adverse effects on the qualifying interests and conservation objectives of the Natura 2000 sites potentially affected by the proposed development. Direct, indirect and cumulative impacts arising from offshore wind energy developments potentially affecting designated Natura 2000 sites are identified with regard to the following:

- direct and indirect loss of habitats;
- disturbance / fragmentation of habitats;
- disturbance to key species;
- impacts affecting the structure and function of the designated site;
- hydrological changes / water quality impacts.

From the initial screening of Natura 2000 sites within the study area for which pathways for impacts occur, the following sites are identified:

- Lambay Island cSAC with particular regard to impacts potentially affecting the Annex II listed Grey seal.
- Rockabill to Dalkey SAC (*proposed*) with regard to impacts potentially affecting Annex I reef habitats and Annex II Harbour porpoise populations.
- North Bull Island SPA with regard to impacts potentially affecting migratory shorebirds, waders and foraging seabird populations.
- Rogerstown Estuary SPA with regard to impacts potentially affecting migratory shorebirds and waders.
- Baldoyle Bay SPA with regard to impacts potentially affecting migratory shorebirds and waders.
- Rockabill SPA with regard to impacts potentially affecting foraging seabird populations and migratory shorebirds.
- South Dublin Bay and River Tolka Estuary SPA with regard to impacts potentially affecting tern species, gull species and migratory shorebirds.
- Malahide Estuary SPA with regard to impacts potentially affecting migratory shorebirds and waders.
- Lambay Island SPA with regard to impacts potentially affecting foraging seabird populations.
- Howth Head Coast SPA with regard to impacts potentially affecting foraging seabird populations.
- Ireland's Eye SPA with regard to impacts potentially affecting foraging seabird populations.
- Skerries Islands SPA with regard to impacts potentially affecting foraging seabird populations and migratory waterbirds.
- Dalkey Island SPA with regard to impacts potentially affecting foraging seabird populations.
- The Murrough SPA with regard to impacts potentially affecting foraging seabird populations and migratory waterbirds.
- Wicklow Head SPA with regard to impacts potentially affecting foraging seabird populations.

The main potential risks affecting sensitive ecological receptors, i.e. the qualifying interests of these sites, arising from offshore wind energy developments are set out in guidance published by DEFRA (2005). Potential impacts affecting marine mammals have been identified (DEFRA, 2005) and are divided into three categories:

- physiological impacts such as hearing damage as a direct result of noise produced;
- Loss of foodstock, (i.e. fish stocks or invertebrates) can result from damage, disturbance, or scouring of the sites during the development's construction or maintenance phases.
- behavioural impacts as a result of noise produced such as avoidance of a breeding, nursery or feeding area; and
- indirect effects such as noise impacts to a food source.

Potential impacts affecting seabirds identified by DEFRA (2005) align with the potential for impacts identified in later studies (OSPAR, 2008b; Langston, 2010), these include:

- collision mortality from birds striking turbine towers, nacelles or rotors particularly where large numbers of birds make regular flights through the windfarm area; especially during conditions of poor visibility;
- Disturbance and displacement may potentially occur where birds avoid turbines, or the entire area of a windfarm, due to their reluctance to feed adjacent to large structures because of a perception of threat. This has been identified as varying greatly between species, with size and spacing of turbines also resulting in differing behavioural responses. Displacement / disturbance reactions may be increased slightly by maintenance activities requiring the use of boats and helicopters, depending on species' sensitivities.
- Barrier effects result from birds changing their flight lines in response to the perceived barrier presented by a row of turbines. This relates to regular local movements, for example between feeding and roosting areas, as well as to migratory flight paths. The barrier effect could result in birds undertaking longer flights to avoid wind farms, thus resulting in increased energy expenditure and reduced time for other essential activities.
- Habitat loss and loss of foraging resources refers to the direct loss of seabed resulting from the placement of the turbine foundations and any scour protection, along with any associated losses or changes to benthos due to scour or smothering.
- the cumulative effects of these across multiple wind farms.

3.4.1 Assessment of potential direct impacts affecting the Natura 2000 sites

Ecological impacts are the effects on natural resources and on the components, structures, and functioning of affected ecosystems. Effects may include those resulting from actions which may have both beneficial and detrimental effects. Direct impacts are caused by the action and occur at the same time and place.

3.4.1.1 Lambay Island cSAC

The Lambay Island cSAC is located approximately 20km due north of the proposed Dublin Array development. In the absence of any potential pathways for impacts, the Annex I habitat 'Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]', listed as a qualifying interest of this site will not be considered further. The Annex II listed Grey seal (*Halichoerus grypus*) is a

qualifying interest of this designation and has been recorded from within the proposed Dublin Array Development site. Taking account of the distance between this Natura 2000 site and the proposed development, there will be no potential direct impacts which would give rise to adverse effects on this designation.

3.4.1.2 Rockabill to Dalkey (proposed) SAC

The Department of Arts, Heritage and the Gaeltacht has proposed the Rockabill to Dalkey Island SAC (site code 003000) for designation as a Natura 2000 site. The proposal and approval of this site by the Minister attributes the same protection that full designation affords a site; therefore, this site will be included in this assessment. The proposed Rockabill to Dalkey Island SAC is located approximately 1.6km west of the Dublin Array site boundary at its closest point and is designated for the Annex I habitat 'Reefs [1170]' and the Annex II listed Harbour porpoise.

The Dublin Array is not located within or directly adjacent to this Natura 2000 site; however the construction phase of the proposed development will require a slight increase in ship movements and transport of materials through this designation, with the potential for direct disturbance and localised displacement impacts affecting Harbour porpoise populations. No direct impacts potentially affecting the Annex I reef habitats are identified.

3.4.1.3 North Bull Island SPA

Taking account of the qualifying interests of this designation and the distance between the proposed development and this site, no direct impacts potentially affecting this site are identified.

3.4.1.4 Rogerstown Estuary SPA

Taking account of the qualifying interests of this designation and the distance between the proposed development and this site, no direct impacts potentially affecting this site are identified.

3.4.1.5 Baldoyle Bay SPA

Taking account of the qualifying interests of this designation and the distance between the proposed development and this site, no direct impacts potentially affecting this site are identified.

3.4.1.6 Rockabill SPA

Taking account of the qualifying interests of this designation and the distance between the proposed development and this site, no direct impacts potentially affecting this site are identified.

3.4.1.7 South Dublin Bay and River Tolka Estuary SPA

Taking account of the qualifying interests of this designation and the distance between the proposed development and this site, no direct impacts potentially affecting this site are identified.

3.4.1.8 Malahide Estuary SPA

Taking account of the qualifying interests of this designation and the distance between the proposed development and this site, no direct impacts potentially affecting this site are identified.

3.4.1.9 Lambay Island SPA

Taking account of the qualifying interests of this designation and the distance between the proposed development and this site, no direct impacts potentially affecting this site are identified.

3.4.1.10 Howth Head Coast SPA

Taking account of the qualifying interests of this designation and the distance between the proposed development and this site, no direct impacts potentially affecting this site are identified.

3.4.1.11 Ireland's Eye SPA

Taking account of the qualifying interests of this designation and the distance between the proposed development and this site, no direct impacts potentially affecting this site are identified.

3.4.1.12 Skerries Islands SPA

Taking account of the qualifying interests of this designation and the distance between the proposed development and this site, no direct impacts potentially affecting this site are identified.

3.4.1.13 Dalkey Island SPA

Taking account of the qualifying interests of this designation and the distance between the proposed development and this site, no direct impacts potentially affecting this site are identified.

3.4.1.14 The Murrough SPA

Taking account of the qualifying interests of this designation and the distance between the proposed development and this site, no direct impacts potentially affecting this site are identified.

3.4.1.15 Wicklow Head SPA

Taking account of the qualifying interests of this designation and the distance between the proposed development and this site, no direct impacts potentially affecting this site are identified.

3.4.2 Assessment of potential indirect impacts affecting the Natura 2000 sites

Indirect effects are caused by a factor, occur later in time or farther removed in distance, but are considered to be reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

3.4.2.1 Lambay Island cSAC

There is the potential for unmitigated pile-driving operations at the construction stage to result in indirect noise and disturbance impacts on this site which would have the potential to affect Annex II listed Grey seal populations within the cSAC. The noise generated by piling has been estimated to return to background levels at a distance of 100km for common seal (Subacoustech, 2006), with an assumption that this would be similar for Grey seal populations. The audible impact zone of off shore construction works needs to recognise that the exact distance depends on the local background noise conditions. Additional indirect impacts may potentially occur due to a reduction in foraging area and displacement of Grey seal populations within the proposed development site and South Dublin Bay during the construction phase of the proposed development. Grey seals recorded foraging within the proposed development site during the baseline biological surveys may be associated with the Lambay Island cSAC population, this leads to the requirement for further assessment within the context of the current NIS.

3.4.2.2 Rockabill to Dalkey Island SAC (proposed)

The proposed Dublin Array site is located approximately 1.6km from the eastern boundary of this proposed Natura 2000 site. There is therefore the potential for indirect noise impacts to affect Harbour porpoise populations within the cSAC boundary during the construction phase of the proposed development. Underwater noise impacts also have the potential to displace Harbour porpoise populations from the Kish and Bray banks during the construction phase of the proposed development, with implications for the foraging range of the population for which this cSAC is proposed for designation. The significance of impacts potentially affecting Harbour porpoise populations designated within this cSAC requires further assessment with regard to: noise and vibration impacts; physical disturbance and interruption of known routes and foraging grounds; disturbance during operational maintenance; and any potential barrier effects. Construction activities including piling and trench digging have the potential to give rise to dispersal of sediment within the marine environment; with possible adverse effects on the Annex I reef habitats within this designated site. The significance of impacts potentially affecting reef habitats within this cSAC requires further assessment within the context of the current NIS.

3.4.2.3 North Bull Island SPA

This SPA site is designated for a diversity of wintering waterbirds and waders, as well as the Black-headed gull. The construction of an offshore wind farm has the potential to give rise to increased collision risk for the migratory bird species for which this site is designated. Associated impacts or offshore wind developments are identified in relation to the potential creation of a ‘barrier effect’ where the proposed development may result in an impediment or obstacle for migration routes or daily feeding movements for migratory bird species. Waders

tend to fly at high altitudes whilst on migration, it is when they fly between high tide roosts and feeding grounds that they fly at lower altitudes (Exo *et al*., 2003). However, the proposed development site does not lie on any direct path between roosts and feeding grounds. Whilst it is possible that waders migrating to sites further south, may overfly the area, it is also known that waders can react to the presence of turbines either by flying higher or by changing direction (Exo *et al*., 2003). It is considered that migratory wading and waterbird species listed as conservation features of this SPA will not be significantly adversely affected; however further, detailed assessment is required in the context of the current NIS. Taking account of the distance of this site from the Dublin Array development, there are no indirect impacts identified with regard to the wetland habitats listed as conservation interests of the SPA.

3.4.2.4 Rogerstown Estuary SPA

This SPA site is designated for a diversity of wintering waterbirds and wading species. The construction of an offshore wind farm has the potential to give rise to increased collision risk for the migratory bird species for which this site is designated. Associated impacts or offshore wind developments are identified in relation to the potential creation of a 'barrier effect' where the proposed development may result in an impediment or obstacle for migration routes or daily feeding movements for migratory bird species. Waders tend to fly at high altitudes whilst on migration, it is when they fly between high tide roosts and feeding grounds that they fly at lower altitudes (Exo *et al*., 2003). However, the proposed development site does not lie on any direct path between roosts and feeding grounds. Whilst it is possible that waders migrating to sites further south, may overfly the area, it is also known that waders can react to the presence of turbines either by flying higher or by changing direction (Exo *et al*., 2003). It is considered that migratory wading and waterbird species listed as conservation features of this SPA will not be significantly adversely affected; however further, detailed assessment is required in the context of the current NIS. Taking account of the distance of this site from the Dublin Array development, there are no indirect impacts identified with regard to the wetland habitats listed as conservation interests of the SPA.

3.4.2.5 Baldoyle Bay SPA

This SPA site is designated for a diversity of wintering waterbirds and wading species. The construction of an offshore wind farm has the potential to give rise to increased collision risk for the migratory bird species for which this site is designated. Associated impacts or offshore wind developments are identified in relation to the potential creation of a 'barrier effect' where the proposed development may result in an impediment or obstacle for migration routes or daily feeding movements for migratory bird species. Waders tend to fly at high altitudes whilst on migration, it is when they fly between high tide roosts and feeding grounds that they fly at lower altitudes (Exo *et al*., 2003). However, the proposed development site does not lie on any direct path between roosts and feeding grounds. Whilst it is possible that waders migrating to sites further south, may overfly the area, it is also known that waders can react to the presence of turbines either by flying higher or by changing direction (Exo *et al*., 2003). It is considered that migratory wading and waterbird species listed as conservation features of this SPA will not be significantly adversely affected; however further, detailed assessment is required in the context of the current NIS. Taking account of the distance of this site from the Dublin Array development, there are no indirect impacts identified with regard to the wetland habitats listed as conservation interests of the SPA.

3.4.2.6 Rockabill SPA

The Rockabill SPA is located approximately 30km due north of the proposed Dublin Array development site; however, the conservation interests of this site (breeding populations of Arctic tern, Common tern and Roseate tern) are assumed to forage widely within the Dublin Bay area and may potentially be part of the tern population recorded from within the Dublin Array site during the baseline seabird surveys. The construction and operation of the proposed windfarm gives rise to the potential for indirect human disturbance during breeding season and migration; collision risk; habitat loss by way of reduced feeding ground area and loss of shallow sandbank habitat affecting feeding range of these species. There is therefore the potential for adverse effects on the populations within the SPA which requires further assessment in the context of the current NIS.

3.4.2.7 South Dublin Bay and River Tolka Estuary SPA

This SPA site is located approximately 10km west of the proposed development and is designated for a diversity of wintering waterbirds and wading species. The construction of an offshore wind farm has the potential to give rise to increased collision risk for the migratory bird species for which this site is designated. Associated impacts or offshore wind developments are identified in relation to the potential creation of a 'barrier effect' where the proposed development may result in an impediment or obstacle for migration routes or daily feeding movements for migratory bird species. Waders tend to fly at high altitudes whilst on migration, it is when they fly between high tide roosts and feeding grounds that they fly at lower altitudes (Exo *et al*., 2003). However, the proposed development site does not lie on any direct path between roosts and feeding grounds. Whilst it is possible that waders migrating to sites further south, may overfly the area, it is also known that waders can react to the presence of turbines either by flying higher or by changing direction (Exo *et al*., 2003). It is considered that migratory wading and waterbird species listed as conservation features of this SPA will not be significantly adversely affected; however further, detailed assessment is required in the context of the current NIS.

In addition to wading species, this SPA is designated for a number of seabirds including wintering populations of Black-headed gull; as well as passage populations of Roseate tern, Common tern (including breeding populations) and Arctic Tern. These seabirds are assumed to forage widely within the Dublin Bay area and may potentially be part of the seabird population recorded from within the Dublin Array site during the baseline seabird surveys. The construction and operation of the proposed windfarm gives rise to the potential for indirect human disturbance during breeding season and migration; collision risk; habitat loss by way of reduced feeding ground area and loss of shallow sandbank habitat affecting feeding range of these species. There is therefore the potential for adverse effects on the populations within the SPA which requires further assessment in the context of the current NIS. There are no pathways for impacts identified with regard to the proposed development that may give rise to adverse effects on the wetland habitats listed as conservation interests of this SPA site.

3.4.2.8 Malahide Estuary SPA

This SPA site is designated for a diversity of wintering waterbirds and wading species. The construction of an offshore wind farm has the potential to give rise to increased collision risk for the migratory bird species for which this site is designated. Associated impacts or offshore

wind developments are identified in relation to the potential creation of a 'barrier effect' where the proposed development may result in an impediment or obstacle for migration routes or daily feeding movements for migratory bird species. Waders tend to fly at high altitudes whilst on migration, it is when they fly between high tide roosts and feeding grounds that they fly at lower altitudes (Exo *et al*., 2003). However, the proposed development site does not lie on any direct path between roosts and feeding grounds. Whilst it is possible that waders migrating to sites further south, may overfly the area, it is also known that waders can react to the presence of turbines either by flying higher or by changing direction (Exo *et al*., 2003). It is considered that migratory wading and waterbird species listed as conservation features of this SPA will not be significantly adversely affected; however further, detailed assessment is required in the context of the current NIS. Taking account of the distance of this site from the Dublin Array development, there are no indirect impacts identified with regard to the wetland habitats listed as conservation interests of the SPA.

3.4.2.9 Lambay Island SPA

This SPA is located approximately 19.5km due north of the Dublin Array site and is designated for a number of seabird species, predominantly breeding populations but also wintering populations of Herring gull. These seabirds are assumed to forage widely within the Dublin Bay area and may potentially be part of the seabird populations recorded from within the Dublin Array site during the baseline seabird surveys. The construction and operation of the proposed windfarm gives rise to the potential for indirect human disturbance during the breeding season and migration; collision risk; habitat loss by way of reduced feeding ground area and loss of shallow sandbank habitat affecting feeding range of these species. There is therefore the potential for adverse effects on the populations within the SPA which requires further assessment in the context of the current NIS.

3.4.2.10 Howth Head Coast SPA

The Howth Head Coast SPA is located approximately 7km north west of the Dublin Array development site and is designated for the breeding population of a single species, Kittiwake. This species is assumed to forage widely within the Dublin Bay area and may potentially be part of the Kittiwake populations recorded from within the Dublin Array site during the baseline seabird surveys. The construction and operation of the proposed windfarm gives rise to the potential for indirect human disturbance during the breeding season and migration; collision risk; habitat loss by way of reduced feeding ground area and loss of shallow sandbank habitat affecting feeding range of this species. There is therefore the potential for adverse effects on the populations within the SPA which requires further assessment in the context of the current NIS.

3.4.2.11 Ireland's Eye SPA

This SPA is located approximately 11km due northwest of the Dublin Array site and is designated for the breeding populations of a number of seabird species. These seabirds are assumed to forage widely within the Dublin Bay area and may potentially be part of the seabird populations recorded from within the Dublin Array site during the baseline seabird surveys. The construction and operation of the proposed windfarm gives rise to the potential for indirect human disturbance during the breeding season and migration; collision risk; habitat loss by way of reduced feeding ground area and loss of shallow sandbank habitat affecting feeding range of these species. There is therefore the potential for adverse effects

on the populations within the SPA which requires further assessment in the context of the current NIS.

3.4.2.12 Skerries Islands SPA

This SPA is located approximately 30km due northwest of the Dublin Array site and is designated for the breeding and wintering populations of a number of seabird species. These seabirds are assumed to forage widely within the Dublin Bay area and may potentially be part of the seabird populations recorded from within the Dublin Array site during the baseline seabird surveys. The construction and operation of the proposed windfarm gives rise to the potential for indirect human disturbance during the breeding season and migration; collision risk; habitat loss by way of reduced feeding ground area and loss of shallow sandbank habitat affecting feeding range of these species. There is therefore the potential for adverse effects on the populations within the SPA which requires further assessment in the context of the current NIS.

The SPA is also designated for a number of wintering waterbirds and wading species. The construction of an offshore wind farm has the potential to give rise to increased collision risk for the migratory bird species for which this site is designated. Associated impacts or offshore wind developments are identified in relation to the potential creation of a 'barrier effect' where the proposed development may result in an impediment or obstacle for migration routes or daily feeding movements for migratory bird species. Waders tend to fly at high altitudes whilst on migration, it is when they fly between high tide roosts and feeding grounds that they fly at lower altitudes (Exo *et al*., 2003). However, the proposed development site does not lie on any direct path between roosts and feeding grounds. Whilst it is possible that waders migrating to sites further south, may overfly the area, it is also known that waders can react to the presence of turbines either by flying higher or by changing direction (Exo *et al*., 2003). It is considered that migratory wading and waterbird species listed as conservation features of this SPA will not be significantly adversely affected; however further, detailed assessment is required in the context of the current NIS.

3.4.2.13 Dalkey Island SPA

The Dalkey Island SPA is located approximately 8.5km due west of the proposed Dublin Array site and is designated for passage populations of Arctic tern, Roseate tern and Common tern. These seabirds are assumed to forage widely within the Dublin Bay area and may potentially be part of the seabird populations recorded from within the Dublin Array site during the baseline seabird surveys. The construction and operation of the proposed windfarm gives rise to the potential for indirect human disturbance during the breeding season and migration; collision risk; habitat loss by way of reduced feeding ground area and loss of shallow sandbank habitat affecting feeding range of these species. There is therefore the potential for adverse effects on the populations within the SPA which requires further assessment in the context of the current NIS.

3.4.2.14 The Murrough SPA

The Murrough SPA is located approximately 10km due southwest of the southern end of the proposed Dublin Array development site. This SPA is designated for a number of wintering waterbirds and wading species. The construction of an offshore wind farm has the potential to give rise to increased collision risk for the migratory bird species for which this site is

designated. Associated impacts or offshore wind developments are identified in relation to the potential creation of a 'barrier effect' where the proposed development may result in an impediment or obstacle for migration routes or daily feeding movements for migratory bird species. Waders tend to fly at high altitudes whilst on migration, it is when they fly between high tide roosts and feeding grounds that they fly at lower altitudes (Exo *et al*., 2003). However, the proposed development site does not lie on any direct path between roosts and feeding grounds. Whilst it is possible that waders migrating to sites further south, may overfly the area, it is also known that waders can react to the presence of turbines either by flying higher or by changing direction (Exo *et al*., 2003). It is considered that migratory wading and waterbird species listed as conservation features of this SPA will not be significantly adversely affected; however further, detailed assessment is required in the NIS in the context of the current NIS.

The SPA is also designated for wintering populations of Red-throated diver, a species identified as being sensitive to human disturbance and which has been recorded from the Kish and Bray banks within the proposed development site. There is therefore the potential for the proposed development to give rise to indirect disturbance impacts affecting this SPA population should it currently utilise the development site for foraging. Additional species designated within this SPA include breeding populations of Little tern and wintering populations of Herring gull and Black-headed gull. These seabirds are assumed to forage widely within the Dublin Bay area and may potentially be part of the seabird populations recorded from within the Dublin Array site during the baseline seabird surveys. The construction and operation of the proposed windfarm gives rise to the potential for indirect human disturbance during the breeding season and migration; collision risk; habitat loss by way of reduced feeding ground area and loss of shallow sandbank habitat affecting feeding range of these species. There is therefore the potential for adverse effects on the populations within the SPA which requires further assessment in the context of the current NIS. Taking account of the distance of this SPA from the Dublin Array development, there are no indirect impacts identified with regard to the wetland habitats listed as conservation interests of the SPA.

3.4.2.15 Wicklow Head SPA

The Wicklow Head SPA is located approximately 20km due southwest of the proposed Dublin Array windfarm site and is designated for the breeding population of a single species, Kittiwake. This species is assumed to forage widely within the general study area and may potentially be part of the Kittiwake populations recorded from within the Dublin Array site during the baseline seabird surveys. The construction and operation of the proposed windfarm gives rise to the potential for indirect human disturbance during the breeding season and migration; collision risk; habitat loss by way of reduced feeding ground area and loss of shallow sandbank habitat affecting feeding range of this species. There is therefore the potential for adverse effects on the populations within the SPA which requires further assessment in the context of the current NIS.

3.4.3 Assessment of potential cumulative impacts affecting the Natura 2000 sites

Cumulative impacts or effects are changes in the environment that result from numerous human-induced, small-scale alterations. Cumulative impacts can be thought of as occurring through two main pathways: first, through persistent additions or losses of the same materials

or resource, and second, through the compounding effects as a result of the coming together of two or more effects (Bowers-Marriott, 1997). As part of the Screening for an Appropriate Assessment, in addition to the proposed works, other relevant projects and plans in the region must also be considered at this stage. This step aims to identify at this early stage any possible significant in-combination or cumulative effects / impacts of the proposed development with other such plans and projects on the Natura 2000 sites.

Completed plans or projects, where they contribute to a potential cumulative effect are considered in that they have resulted in an impact upon the qualifying interests of a designated site and the continuing effect must be assessed in order to identify any pattern of continuing loss of integrity (English Nature, 2001). Potential cumulative impacts affecting species listed as conservation interests of designated Natura 2000 sites are identified with regard to the following:

- Disturbance and displacement effects of increased boat traffic, particularly during construction;
- Disturbance and potential displacement due to noise and vibration during construction and decommissioning, with the potential for cumulative background impacts during operation;
- Avoidance of turbines and subsequent displacement, including a barrier effect during operation;
- Collision with turbines during operation (bird species);
- Indirect effects through loss of, or changes to, habitat and prey species availability at all stages of construction, operation and decommissioning.

The proximity of the proposed development to the proposed Rockabill to Dalkey Island SAC gives rise to the potential for direct and indirect impacts affecting Harbour porpoise populations listed as qualifying interests of this Natura 2000 site. The potential for construction and operational phase noise impacts affecting this species is also recognised with regard to large scale offshore windfarm projects in the study area (e.g. Codling Bank and Arklow Bank projects) which would have the potential for cumulative and in-combination impacts arising from underwater noise and human disturbance impacts. Similar cumulative effects are identified with regard to Grey seal populations which are designated within the Lambay Island cSAC and which occur within the study area.

There is the potential for cumulative and in-combination adverse effects to occur with regard to wintering and breeding seabird populations within the SPA designations identified in the study area of the Dublin Array windfarm site. These may arise taking account of the existing, background levels of shipping and human traffic within the South Dublin Bay area and also with cognisance of the existing and proposed offshore wind energy developments at the Arklow Bank and Codling Bank, due south of the proposed development. The proposed Oriel windfarm due north of the Dublin Array may also give rise to cumulative adverse effects on SPA populations located to the north of the study area i.e. Rockabill SPA, Lambay Island SPA, Ireland's Eye SPA and Howth Head Coast SPA; where the bird species listed as conservation interests of these SPA sites may forage in waters to the north and to the south of these designations.

Passerines and waders are known to migrate at night and no data is available for wintering migrants which are listed as conservation interests of the coastal SPA sites within the study area. These sites are used as staging areas for North / South migrations, therefore the

proposed development, in combination with the Arklow Bank and Codling Bank wind farms gives rise to a potential barrier effect on migrating waders / passerines which will require assessment. Cumulative effects from other offshore wind energy developments and potential extraction / drilling operations acting in-combination with the proposed development depend on the temporal and spatial scales associated with the individual projects.

3.5 Screening statement with conclusions

According to the guidance published by the DoEHLG (2009), the Screening Assessment to inform the Appropriate Assessment process can identify that a Natura Impact Statement (NIS) is not required in circumstances where a project / proposal is directly related to the management of the designated site. Alternatively the Screening Assessment has the potential to conclude that there is no potential for significant impacts affecting the Natura 2000 network; or that significant effects are certain, likely or uncertain i.e. the project must either proceed to a NIS or be rejected.

The Screening Statement prepared to inform the current NIS has identified that the proposed Dublin Array Wind Farm development gives rise to the potential for direct, indirect and cumulative impacts which may give rise to adverse effects on the qualifying interests of a number of Natura 2000 sites within the study area. Based on the information provided, the current Screening Assessment has therefore determined that a Natura Impact Statement for the proposed development is required. The sites potentially affected by the proposed development and which will be subject to further assessment in the NIS are:

- Lambay Island cSAC
- Rockabill to Dalkey SAC (proposed)
- North Bull Island SPA
- Rogerstown Estuary SPA
- Baldoyle Bay SPA
- Rockabill SPA
- South Dublin Bay and River Tolka Estuary SPA
- Malahide Estuary SPA
- Lambay Island SPA
- Howth Head Coast SPA
- Ireland's Eye SPA
- Skerries Islands SPA
- Dalkey Island SPA
- The Murrough SPA
- Wicklow Head SPA

4 NATURA IMPACT ASSESSMENT (NIS)

4.1 Overview of NIS objectives

In line with the requirements of a Natura Impact Statement this section considers whether the plan or project, alone or in combination with other projects or plans, will have adverse effects on the *integrity* of a Natura 2000 site, and includes any mitigation measures necessary to avoid, reduce or offset negative effects. The proposed Dublin Array Wind Farm development has been subject to a scientific examination of the proposal and the relevant Natura 2000 sites with regard to any possible implications for the Natura 2000 sites in view of their conservation objectives, structure and function; taking account of in combination effects. From the Screening Assessment in Chapter 3 above it is concluded that the potential exists for adverse effects on the physical environment and biological communities designated within the Natura 2000 network arising from direct, indirect and cumulative impacts of the proposed development.

The overall aim of the Habitats Directive (1992) is to maintain or restore the favourable conservation status of habitats and species of Community interest. These habitats and species are afforded protection under the Birds and Natura Habitats Regulations (2011) with Special Areas of Conservation and Special Protection Areas designated to conserve the most vulnerable interests. The qualifying interests of the designated cSAC and SPA sites within the study area of the proposed Dublin Array Wind Farm, and the conservation objectives of these sites, are set out in Table 3 below. It is noted that only the qualifying interests or special conservation interests identified as being potentially affected by the proposed development (from the Screening Assessment, Chapter 3) are included in this NIS.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites. The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level. Favourable conservation status of a habitat is achieved when its natural range, and area it covers within that range, are stable or increasing; when the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future; and when the conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when the population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats; when the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and when there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

The interactions and potential adverse effects on the conservation objectives of the identified Natura 2000 sites with regard to the proposed development are addressed for each site below.

4.2 Description of the Natura 2000 sites potentially affected

Table 3 below provides a summary of the conservation interests of the Natura 2000 sites identified within the study area of the proposed Dublin Array windfarm where the potential for adverse effects on the conservation interests and conservation objectives of these sites have been identified in the Screening Assessment.

Table 3 Designated Natura 2000 sites within the study area where potential adverse effects have been identified.

Site name	Qualifying interests	Potential for impacts identified
Lambay Island cSAC	Grey seal (*Halichoerus grypus*) [1364]	Disturbance and displacement particularly during the construction phase arising from underwater noise and vibration, in addition to increased human disturbance. Potential effects on prey arising from alteration to fish behaviour.
Rockabill to Dalkey SAC (*proposed*)	Reefs [1170] Harbour porpoise (*Phocoena phocoena*) [1351]	Reef habitats within the SAC may potentially be affected by increased turbidity and re-suspension of polluted sediments during construction which would have a smothering effect on epifaunal communities. Harbour porpoise potentially affected by marine noise pollution and vibration arising from pile-driving resulting in displacement and disturbance leading to habitat loss. Operational noise and vibration requires assessment. Potential effects on prey arising from alteration to fish behaviour.
North Bull Island SPA	Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Shelduck (*Tadorna tadorna*) [A048] Teal (*Anas crecca*) [A052] Pintail (*Anas acuta*) [A054] Shoveler (*Anas clypeata*) [A056] Oystercatcher (*Haematopus ostralegus*) [A130] Golden Plover (*Pluvialis apricaria*) [A140] Grey Plover (*Pluvialis squatarola*) [A141] Sanderling (*Calidris alba*) [A144] Knot (*Calidris canutus*) [A143] Dunlin (*Calidris alpina*) [A149] Black-tailed Godwit (*Limosa limosa*) [A156] Bar-tailed Godwit (*Limosa lapponica*) [A157] Curlew (*Numenius arquata*) [A160] Redshank (*Tringa totanus*) [A162] Turnstone (*Arenaria interpres*) [A169] Black-headed Gull (*Larus ridibundus*) [A179]	Potential impacts arising during construction and operational phase with regard to: Collision; Displacement; Barrier effect; Habitat loss and degradation (including potential effects on prey arising from alteration to fish behaviour).
Rogerstown Estuary SPA	Greylag Goose (*Anser anser*) [A043] Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Shelduck (*Tadorna tadorna*) [A048] Shoveler (*Anas clypeata*) [A056] Oystercatcher (*Haematopus ostralegus*) [A130] Ringed Plover (*Charadrius hiaticula*) [A137]	Potential impacts arising during construction and operational phase with regard to: Collision; Displacement; Barrier effect; Habitat loss and degradation (including potential effects on prey arising from alteration to fish behaviour).

Site name	Qualifying interests	Potential for impacts identified
	Grey Plover (*Pluvialis squatarola*) [A141] Knot (*Calidris canutus*) [A143] Dunlin (*Calidris alpina*) [A149] Black-tailed Godwit (*Limosa limosa*) [A156] Redshank (*Tringa totanus*) [A162]	
Baldoyle Bay SPA	Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Shelduck (*Tadorna tadorna*) [A048] Ringed Plover (*Charadrius hiaticula*) [A137] Golden Plover (*Pluvialis apricaria*) [A140] Grey Plover (*Pluvialis squatarola*) [A141] Bar-tailed Godwit (*Limosa lapponica*) [A157]	Potential impacts arising during construction and operational phase with regard to: Collision; Displacement; Barrier effect; Habitat loss and degradation (including potential effects on prey arising from alteration to fish behaviour).
Rockabill SPA	Arctic Tern (*Sterna paradisaea*) [A194] Roseate Tern (*Sterna dougallii*) [A192] Common Tern (*Sterna hirundo*) [A193] Purple Sandpiper (*Calidris maritima*) [A148]	Potential impacts arising during construction and operational phase with regard to: Collision; Displacement; Barrier effect; Habitat loss and degradation (including potential effects on prey arising from alteration to fish behaviour).
South Dublin Bay and River Tolka Estuary SPA	Black-headed Gull (*Larus ridibundus*) [A179] Roseate Tern (*Sterna dougallii*) [A192] Common Tern (St*erna hirundo*) [A193] Arctic Tern (*Sterna paradisaea*) [A194] Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Oystercatcher (*Haematopus ostralegus*) [A130] Ringed Plover (*Charadrius hiaticula*) [A137] Grey Plover (*Pluvialis squatarola*) [A140] Knot (*Calidris canutus*) [A143] Sanderling (*Calidris alba*) [A144] Dunlin (*Calidris alpina*) [A149] Bar-tailed Godwit (*Limosa lapponica*) [A157] Redshank (*Tringa totanus*) [A162]	Potential impacts arising during construction and operational phase with regard to: Collision; Displacement; Barrier effect; Habitat loss and degradation (including potential effects on prey arising from alteration to fish behaviour).
Malahide Estuary SPA	Great Crested Grebe (*Podiceps cristatus*) [A005] Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Shelduck (*Tadorna tadorna*) [A048] Pintail (*Anas acuta*) [A054] Goldeneye (*Bucephala clangula*) [A067] Red-breasted Merganser (*Mergus serrator*) [A069] Oystercatcher (*Haematopus ostralegus*) [A130] Golden Plover (*Pluvialis apricaria*) [A140] Grey Plover (*Pluvialis squatarola*) [A141] Knot (Calidris canutus) [A143] Dunlin (*Calidris alpina*) [A149] Black-tailed Godwit (*Limosa limosa*) [A156] Bar-tailed Godwit (*Limosa lapponica*) [A157] Redshank (*Tringa totanus*) [A162]	Potential impacts arising during construction and operational phase with regard to: Collision; Displacement; Barrier effect; Habitat loss and degradation (including potential effects on prey arising from alteration to fish behaviour).
Lambay Island SPA	Fulmar (*Fulmarus glacialis*) [A009] Cormorant (*Phalacrocorax carbo*) [A017] Shag (*Phalacrocorax aristotelis*) [A018] Lesser Black-backed Gull (*Larus fuscus*) [A183] Herring Gull (*Larus argentatus*) [A 184] Kittiwake (*Rissa tridactyla*) [A188] Guillemot (*Uria aalge*) [A199] Razorbill (*Alca torda*) [A200] Puffin (Fratercula arctica) [A204] Greylag Goose (*Anser anser*) [A043]	Potential impacts arising during construction and operational phase with regard to: Collision; Displacement; Barrier effect; Habitat loss and degradation (including potential effects on prey arising from alteration to fish behaviour).

Site name	Qualifying interests	Potential for impacts identified
Howth Head Coast SPA	Kittiwake (*Rissa tridactyla*) [A188]	Potential impacts arising during construction and operational phase with regard to: Collision; Displacement; Barrier effect; Habitat loss and degradation (including potential effects on prey arising from alteration to fish behaviour).
Ireland's Eye SPA	Razorbill (*Alca torda*) [A200] Guillemot (*Uria aalge*) [A199] Kittiwake (*Rissa tridactyla*) [A188] Herring Gull (*Larus argentatus*) [A184] Cormorant (*Phalacrocorax carbo*) [A017]	Potential impacts arising during construction and operational phase with regard to: Collision; Displacement; Barrier effect; Habitat loss and degradation (including potential effects on prey arising from alteration to fish behaviour).
Skerries Islands SPA	Cormorant (*Phalacrocorax carbo*) [A017] Shag (*Phalacrocorax aristotelis*) [A018] Herring Gull (*Larus argentatus*) [A184] Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Purple Sandpiper (*Calidris maritima*) [A148] Turnstone (*Arenaria interpres*) [A169]	Potential impacts arising during construction and operational phase with regard to: Collision; Displacement; Barrier effect; Habitat loss and degradation (including potential effects on prey arising from alteration to fish behaviour).
Dalkey Island SPA	Arctic Tern (*Sterna paradisaea*) [A194] Roseate Tern (*Sterna dougallii*) [A192] Common Tern (*Sterna hirundo*) [A193]	Potential impacts arising during construction and operational phase with regard to: Collision; Displacement; Barrier effect; Habitat loss and degradation (including potential effects on prey arising from alteration to fish behaviour).
The Murrough SPA	Red-throated Diver (*Gavia stellata*) [A001] Greylag Goose (*Anser anser*) [A043] Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Wigeon (*Anas penelope*) [A050] Teal (*Anas crecca*) [A052] Black-headed Gull (*Larus ridibundus*) [A179] Herring Gull (*Larus argentatus*) [A184] Little Tern (*Sterna albifrons*) [A195]	Potential impacts arising during construction and operational phase with regard to: Collision; Displacement; Barrier effect; Habitat loss and degradation (including potential effects on prey arising from alteration to fish behaviour).
Wicklow Head SPA	Kittiwake (*Rissa tridactyla*) [A188]	Potential impacts arising during construction and operational phase with regard to: Collision; Displacement; Barrier effect; Habitat loss and degradation (including potential effects on prey arising from alteration to fish behaviour).

4.3 Assessment of the qualifying interests of cSAC sites potentially affected by the proposed development

In this section the cSAC sites identified as being potentially affected by the proposed wind energy development are described for further assessment. The qualifying interests of the designated Natura 2000 sites identified within the zone of impact of the proposed Dublin Array Wind Farm are described with regard to their occurrence, taking account of the potential for significant effects. Specialist reporting has been prepared for the NIS to address the key ecological receptors within the study area with regard to the Natura 2000 sites and their qualifying interests; these reports are presented as Appendices to the current NIS and are as follows:

- '*Hydrodynamic Modelling Assessment of the Dublin Array project on the Kish and Bray Banks*' (Hydro Environmental Ltd., 2013)
- *Report on Marine Mammals in relation to the Dublin Array* (BEC Consultants Ltd., 2013)
- *The Proposed Dublin Array Wind Farm – Assessment of Potential Impacts on Seabirds'* (Ecology Ireland, 2013).

4.3.1 Annex I Reef Habitat

4.3.1.1 Overview of the qualifying interest

According to the Conservation Assessment (NPWS, 2008) reef habitats within the context of the Annex I description may be composed of a rocky substrate (non-biogenic reefs) or be constructed by animals (biogenic reefs). The proposed Rockabill to Dalkey Island SAC includes the Annex I habitat 'Reefs' as a qualifying interest. According to the NPWS site synopsis these reefs are subject to strong tidal currents with an abundant supply of suspended matter resulting in good representation of filter feeding fauna such as sponges, anemones and echinoderms. The reef habitats present are intertidal and subtidal geogenic reefs, with no biogenic reefs known from within the site designation. Survey work was carried out by MERC Ltd. in 2010 on behalf of the NPWS to identify the extent of geogenic (hard substrate) reef habitats around the Dalkey Island, Muglins, Rockabill and Lambay Island intertidal and subtidal zones (Merc Consultants, 2010). Of these survey sites, the Dalkey Island / Muglins is identified as being the closest to the proposed development and also the only site where potential effects may occur. Two sublittoral geogenic reef communities were surveyed at sites in within the Dalkey Island / Muglins area (within the proposed Rockabill to Dalkey Island SAC boundary). This survey work was significantly limited by poor visibility and physical factors; however, the findings of this work in 2010 have informed the NPWS SAC designation process at the proposed Rockabill to Dalkey Island SAC site.

According to Merc (2010) a clear zonation of benthic communities of algal and faunal species was recorded; species and biotope diversity at the Dalkey Island/Muglins complex were characterised by communities of strong tidal streams. In general the sublittoral reefs at Dalkey Island were characterised by an infralittoral zone dominated by foliose red seaweeds on exposed infralittoral rock leading into a tide swept circalittoral zone dominated by *Alcyonium digitatum*. At Muglins a number of different biotopes were recorded including boulder slopes carpeted in seed mussel *Mytilus edulis*; *Flustra foliacea* on slightly scoured silty circalittoral rock; *Mytilus edulis* and coralline crusts on very exposed sublittoral fringe bedrock and faunal; and algal crusts with *Alcyonium digitatum*.

4.3.1.1.2 Potential for direct impacts

The boundary of the proposed Rockabill to Dalkey Island SAC does not extend into the proposed Dublin Array development area; nor does it include the area of the proposed cable route which makes landfall at the coast in the vicinity of Shankill / Bray.

4.3.1.1.3 Potential for indirect impacts

Potential for indirect impacts potentially affecting reef habitats within the proposed Rockabill to Dalkey Island SAC are identified with particular regard to an increase in sedimentation or pollution during the construction phase of the proposed development. The sedimentology regime of the Kish and Bray banks has been assessed by a dedicated Hydrodynamics Report

(Hydro Environmental, 2013), included in Appendix 1. From this report, based on the baseline surveys undertaken for the EIS (MRG, 2013), the shallower parts of the Kish Bank consisted of fine sand (90-95%) with some shell, along the western edge the seabed was predominantly coarse shell with sand which graded into shell and pebbles and gravel and stones along the west of the Bray Bank and larger cobbles and stones at the southern end of the Bray Bank.

This distribution indicates stronger velocities to the south which is confirmed by the modelling undertaken by Hydro Environmental (2013). The hydrodynamic modelling identified an overall clockwise circulatory movement of sediment around the banks with a northwards, residual current on the west side of the banks, closest to the Dalkey Island reef habitats. However, the tidal movement of sediment was found to retain sediment along the banks, resulting in a relatively stable depositional scenario. It was found that there is sufficient ambient shear force to mobilise surface sand layers on the Kish and Bray Banks during tidal cycles; however, this sediment is maintained within the tidal circulation pattern of the banks.

Following installation, during the operational phase, the hydrodynamic impact assessment has identified that the very localised impact of the turbines on tidal flows and velocities will not have any discernable impact on the sediment regime within the Kish and Bray banks system. The current flows and hydrodynamic regime within the proposed Bray and Kish Banks study area is such that any suspension of sediment will not be transported to the reef habitats within the proposed Rockabill to Dalkey Island SAC and there are no further pathways identified by which the proposed development may potentially give rise to significant adverse effects on this habitat.

4.3.1.1.4 Potential for cumulative or in-combination effects

In the absence of any direct or indirect impacts which may potentially affect this Annex I habitat arising from the proposed development; and taking account of the distance between the proposed development site and the Annex I habitats of the proposed Rockabill to Dalkey Island SAC there is no potential for in combination impacts identified, which would have the potential for cumulative effects.

4.3.1.1.5 Recommended mitigation measures

In line with best practice the development of a Construction Management Plan will include strict controls to minimise the risk of pollution or contamination associated with the construction stage of the proposed development including the storage and use of lubricants, placement of grout, and management of waste which will be sorted and returned to shore for recycling/disposal by a licensed contractor. Similar controls will be adopted during the operational stage of the project to prevent pollution and contamination.

4.3.1.1.6 Conclusion

It is concluded that there are no pathways for impacts arising from the proposed development which would have the potential for adverse effects on this qualifying interest within the proposed Rockabill to Dalkey Island SAC.

4.3.2 Harbour porpoise Phocoena phocoena

4.3.2.1 Overview of the qualifying interest

The Harbour porpoise *Phocoena phocoena* has been recorded from within the current study area during the baseline ecological surveys, as detailed in the EIS (MRG, 2012) and a resident population is identified within the Dublin Bay / South Dublin Bay area. The current assessment of Harbour porpoise populations and potential impacts arising from the proposed development is taken from the Marine Mammals report presented in Appendix 2 of the NIS (BEC, 2013).

In 2001 as part of the Atlantic Research Coalition (ARC) the IWDG carried out six monthly surveys through the Irish Sea between July and December. Common dolphins were the most frequently sighted species, followed by striped dolphins (*Stenella coeruleoalba*), bottlenose dolphins and harbour porpoises (Brereton *et al.* 2001). The harbour porpoise population in the Irish Sea in 2005 was estimated to be 15,230 (CV = 0.35) (Hammond & MacLeod, 2006), while the Celtic Sea population was calculated as 36,280 (CV=0.57) in 1994 and 80,616 (CV=0.50) in 2005 (the Celtic Sea survey area boundary varied somewhat between surveys) (Hammond *et al.*, 2002, Hammond & MacLeod, 2006). The harbour porpoise population in Irish coastal waters outside the Irish Sea was calculated to be 10,716 (CV=0.37; CI 95%=5,010 - 21,942) in 2005 (SCANS II, 2006). The surveys carried out by the IWDG in 2008 estimated an overall abundance of 211 (CV = 0.22, CI 95% = 137 – 327) in North County Dublin and 138 (CV 0.24, CI 95% = 86 – 221) in Dublin Bay (Berrow *et al.*, 2008). North County Dublin recorded the highest density of harbour porpoise of the sites surveyed and also the highest ratio of young to adults (8%), an important consideration when selecting a site for designation as an SAC (Berrow *et al.,* 2008). Calving in harbour porpoise occurs between May and August, with a strong peak in June (IWDG, 2012b). It is thought that harbour porpoises move offshore in the period March – June to calving/breeding areas (IWDG, 2012b).

The results of these surveys have lead to the Harbour porpoise population in Dublin Bay being designated as a qualifying interest of the proposed Rockabill to Dalkey Island SAC (site code 03000). The proposed site designation boundary is presented in Figure 2 and is approximately 1.6 km from the Dublin Array site boundary at its closest point. Two candidate Special Areas of Conservation (cSAC) have already been designated for harbour porpoises in the southwest of Ireland: Roaringwater Bay cSAC (Co. Cork) and Blasket Islands cSAC (Co. Kerry). At a national level the '*Status of EU Protected Habitats and Species in Ireland*' report (NPWS, 2008) assessed harbour porpoises as being at 'Favourable Conservation Status'.

No studies have been carried out to estimate the home range, or movements, of individual harbour porpoises in Irish waters, but data is available from Denmark and the Bay of Fundy on the east coast of North America (Sveegaard *et al.*, 2011, Johnston *et al.*, 2005). These studies have shown that harbour porpoises distribution is spatially and temporally variable. Harbour porpoises have been shown to range across large areas (7,738 – 11,289 km^2) over the course of a month, with movements tending to be focused over a smaller area (250 – 300 km^2) often around islands, headlands, or restricted channels (Johnston *et al.*, 2005). In Danish waters, harbour porpoises have also been shown to range over large areas, with seasonal shifts in their distribution (Sveegaard *et al.*, 2011).

4.3.2.2 Potential for direct impacts

The proposed development of an offshore windfarm on the Kish and Bray banks will require the transport of machinery and equipment to the site resulting in an increase in shipping movements and human disturbance within the southern portion of the proposed Rockabill to Dalkey Island SAC with regard to Harbour porpoise populations.

The impact of the noise created by the additional shipping movements to and from Dublin Port due to the construction of the Dublin Array on harbour porpoises and grey seals will not be significant when compared with the background shipping activity in the area. Dublin and Dún Laoghaire ports see a combined average of 43 ship movements per day, while the construction of the Dublin Array will see an increase in this number by one jack-up ship movement per day. The operation of smaller vessels, including recreational and fishing vessels, is highly variable throughout the year, and no significant effect will occur due to the addition of four small vessel (10m – 15m) movements per day relating to service vessels operating to and from the Dublin Array.

4.3.2.3 Potential for indirect impacts

The construction phase of the proposed development will require the use of heavy jack-up barges, piling equipment, cranes, trenching and cable laying vessels, and the deposition of rock armour which is likely to generate noise and vibrations and disturbance to seabed sediments in the vicinity of the site. Potential impacts affecting Harbour porpoise populations associated with these operations during the construction stage of the project include:

- Underwater noise / vibration which has the potential to displace animals, interfere with feeding behaviour and at high levels cause direct physical damage;
- Habitat disturbance and displacement due to the footprint of the wind farm and associated construction and operational activity
- Increased suspended sediment / pollution releases caused during construction

4.3.2.3.1 Underwater noise

Noise and vibration from shipping vessels and equipment and from operations such as pile-driving during the construction phase of the development will disturb marine mammals. Pile-driving in particular can generate very high sound levels and given the likely use of monopile foundations to support the turbines for the Dublin Array it is anticipated that the underwater noise generated by the installation of the piles during the construction stage of the project is likely to have the greatest potential effect on marine wildlife. Porpoises from the proposed Rockabill to Dalkey Island SAC are likely to forage in the vicinity of the Kish and Bray banks (though densities were not higher on the banks than the surrounding area) and therefore any serious injury, including permanent hearing damage, caused to a harbour porpoise during the piling operations would impact on the population of the proposed SAC.

The impact of construction noise, particularly activities with high sound levels, such as pile-driving, on marine mammals varies depending on the species, the sound level and frequency and the duration of the exposure. High noise levels can cause serious injury at close range, including physical injury to organs, and as one moves further away from the source effects diminish to permanent or temporary hearing impairment and behavioural change until the

noise level is audible, but causes no measurable effect. Richardson *et al*. (1995) differentiated four zones of noise impact:

- Zone of physical impairment through hearing loss or injury
- Zone of masking
- Zone of responsiveness
- Zone of audibility

Pile-driving operations using a 6.5m pile (taken as representative of a worst-case-scenario for the proposed development) have been estimated to generate noise levels of 201 - 204 dB re 1 µPa (Peak) and 175 – 178 dB re 1µPa (SEL) at 500 m in 20 m deep water (Nehls *et al*., 2007). The following noise levels have been considered to cause Temporary Threshold Shift (TTS) and Permanent Threshold Shift (PTS) in hearing of cetaceans (Ketten & Finneran, 2004):

- Temporary Threshold Shift: 183 dB SEL pulses, 224 dB peak pressure
- Permanent Threshold Shift: 215 dB SEL pulses, 230 dB peak pressure

Based on these thresholds, TTS caused by piling operations will not result in a physical impact on cetacean species (i.e. Harbour porpoise) at a range of 500m from the piling operations. Furthermore, a Harbour porpoises would need to be considerably closer to the source of the piling noise for PTS to occur. Lucke *et al.* (2009) established the pre-defined TTS criterion was exceeded at a sound pressure level of 199.7 dB_{pk-pk}re 1µPa and an SEL of 164.3 dB re 1μPa^2s at 4 kHz for a captive harbour porpoise, which are lower than the levels set by Ketten & Finneran (2004). Subacoustech Ltd (2006) estimated piling to cause permanent hearing damage in harbour porpoises at a range of 150m, while Bailey *et al*. (2010) determined that no form of injury or hearing impairment should occur at a distance of greater than 100m from pile-driving operations.

The zone of responsiveness in marine mammals is more difficult to define as the response of marine mammals to sound depends on so many factors, including the sound properties, physical and behavioural state of the animals and the acoustic and ecological features of the surrounding area (Hildebrand, 2005). Lucke *et al*. (2009) showed consistent aversive behavioural reactions in a captive harbour porpoise at sound levels above 174 dB_{pk-pk}re 1 µPa or an SEL of 145 dB re 1 μPa^2s, which is similar to the140 dB SEL suggested by Nehls *et al*. (2007). The distance at which harbour porpoises show behaviour effects or aversion have been suggested in the region of 13 - 15km (Tougaard *et al*., 2003, Subacoustech Ltd, 2006), though harbour porpoises continue to occur within this radius, with the aversion affect reducing with increasing distance from the noise source (Brandt *et al*., 2009).

The proposed Rockabill to Dalkey Island SAC is located less than 1.6km away at its closest point. Given that harbour porpoises show aversive behaviour to piling to a distance of 15km, much of the Dublin Bay area would be affected by unmitigated piling operations, resulting in reduced harbour porpoise activity in the area in the short-term. The maximum area affected by unmitigated piling constitutes 52% of the proposed Rockabill to Dalkey Island SAC, while works are occurring at the north-western area of the wind farm. Figures 5 and 6 in the Marine Mammals Report (Appendix 2) illustrate the 15 km radius centred on the mid-point of the western boundary of the Dublin Array and the southwest corner respectively, indicating the reduction in area where aversive effects would be expected in harbour porpoises to 34% and 7% of the proposed SAC respectively.

The density of harbour porpoises within the development area during the pre-construction survey was similar to that recorded outside at the control sites (0.13 porpoises km^{-1} vs. 0.12 porpoises km^{-1}), which is considerably lower than the densities recorded in North County Dublin (0.29 porpoises per km^{-1}) and Dublin Bay (0.25 porpoises per km^{-1}). This indicates that porpoise activity is already lower in the Dublin Array development site than within the proposed Rockabill to Dalkey Island SAC; increased construction noise disturbance will result in Harbour porpoises temporarily avoiding the immediate vicinity of the development works.

It should be noted that the 15km radius of effect is based on studies where acoustic activity of harbour porpoises was shown to be significantly reduced up to this distance during piling operations; however, this should not be interpreted as the creation of a 15km exclusion zone around the piling activity, as the behavioural effects diminish as one moves away from the noise source out to the 15km limit. Brandt *et al*. (2009) showed that harbour porpoises were observed as close as 3-4km from the piling source, with activity generally increasing with increasing distance and it should be noted that acoustic scaring devices were used to exclude marine mammals from the area around the piling prior to the commencement of piling to prevent injury to hearing. While the effects of piling are limited to aversive behaviour effects for harbour porpoises within the proposed Rockabill to Dalkey Island SAC, the closer an animal is to piling operations, the greater the risk of injury. It is this potential for injury to harbour porpoises outside the SAC boundaries that poses the most significant risk where those animals belong to the proposed SAC population. Given the proximity of the proposed Rockabill to Dalkey Island SAC to the Dublin Array site and the wide-ranging movements of harbour porpoises (Sveegaard *et al*., 2011, Johnston *et al*., 2005), it is almost certain that harbour porpoises move across an area that includes the proposed SAC, the Kish and Bray banks and the surrounding Irish Sea.

A 15km range for behavioural effect on harbour porpoise would result in almost all of Dublin Bay, and as far as just north of Ireland's Eye, being affected while unmitigated piling is underway at the northern end of the Kish Bank (see Figure 4 in the Marine Mammals Report, Appendix 2). The area of the proposed Rockabill to Dalkey Island SAC affected diminishes for construction activities further south (see Figures 5 and 6 in the Marine Mammals Report, Appendix 2). The area affected while unmitigated piling operations are on-going at the north end of the Kish Bank will constitute approximately 52% of the proposed Rockabill to Dalkey Island SAC, though the main effect will be on the southern half of the proposed SAC site, where lower numbers of harbour porpoises were recorded and there is a lower ratio of young to adults when compared with the North Dublin Coast area (Berrow *et al*., 2008).

The area between the Kish and Bray banks and the coastline will all be within the 15km range of likely behavioural effects for harbour porpoise for much of the construction period, which will result in effects on harbour porpoises in the area surrounding the proposed Rockabill to Dalkey Island SAC and also any porpoises from the proposed SAC area that occur outside the boundary of the site. Mitigation measures will be implemented to reduce the risk of noise effects on marine mammals, including the use of marine mammal observers (MMOs), 'soft-start' piling procedures and noise-reduction systems (e.g. proposed cofferdam system, or equivalent) while piling.

The operational phase of the proposed development gives rise to potential long term noise and vibration effects; however, based on literature review (Koschinski *et al*., 2003, Tougaard *et al*., 2005; 2009) these are expected to be limited to audible levels within a few hundred

metres for Harbour porpoise. Operational noise impacts are therefore limited to indirect effects on the proposed Rockabill to Dalkey SAC. Post-construction, Harbour porpoises including the population designated within the Dublin Bay area, are almost certain to move over a large area foraging, including the development site, based on studies of the range of harbour porpoises in other countries (Sveegaard *et al*., 2011, Johnston *et al*., 2005). The noise levels generated by the operational wind farm will not have a significant adverse effect on harbour porpoises foraging in the immediate vicinity of the wind farm, as harbour porpoises have been shown to approach the sound of operating wind turbines, meaning there will be no exclusion of porpoises from around operating wind turbines (Kochinski *et al*., 2003).

4.3.2.3.2 Disturbance and habitat loss

As the Dublin Array is not located within any Natura 2000 site designated for marine mammals, there will be no direct effect due to habitat disturbance during construction (e.g. presence of ships, jack-up rigs, *etc.*). Harbour porpoises and grey seals occur throughout the Study Area and its surrounds and so it is certain that there will be some disturbance to the habitat utilised by these species during construction. The development site is 5,400 hectares, and less than 5% of the area will have construction activities on-going. Localised, temporary disturbance may impact the foraging activities of Harbour porpoises from the proposed Rockabill to Dalkey Island SAC, but this will not constitute a significant adverse effect due to the limited area affected as compared to the area available for foraging i.e. only 0.03% of the Kish and Bray Banks will be directly affected the footprint impact of the proposed turbines.

During the operational stage of the proposed development it is considered that the turbine foundations and associated scour protections structures may act as Fish Aggregation Devices (FADs), attracting fish to shelter around them (Vella *et al*., 2001). Fish have been found to aggregate around marine structure such as oil rigs (Valdemarsen *et al*., 1979) and despite the less complex structures involved, aggregation of fish around wind turbines does occur (Wilhelmsson *et al*., 2006). An increase in the fish resource present within the wind farm will make the area more attractive to foraging marine mammals. In some instances harbour porpoise abundance has increased within a wind farm, possibly due to the 'reef effect' or reduced operation of vessels within the area (Scheidat *et al*., 2011). No significant adverse effect on the Harbour porpoise population within the proposed Rockabill to Dalkey Island SAC will occur due to habitat loss from the development of the Dublin Array; in fact, it is evaluated that the potential 'reef effect' may have an overall positive impact on Harbour porpoise foraging potential on the Kish and Bray Banks with indirect positive effects for the population within the proposed Rockabill to Dalkey Island SAC.

Maintenance of the wind farm will require the operation of vessels in the area, estimated to be two small boats per day. Dublin Bay and its surrounds already have high, but variable, levels of marine traffic including cargo ships, ferries, fishing vessels and leisure craft. Harbour porpoises in the Dublin Bay area are well-accustomed to the temporary disturbance caused by vessels and the additional boat movements related to the maintenance of the wind farm will not cause a significant adverse effect on species or the population within the proposed Rockabill to Dalkey Island SAC.

4.3.2.3.3 Increased suspended sediment / pollution

Taking account of the current movements within the study area as described in the Hydrodynamic Report (Hydro Environmental, 2013), the proposed development will not give

rise to increased turbidity or suspended solids impacts at a scale which would have the potential to significantly affect the waters within the proposed Rockabill to Dalkey Island SAC designation, identified as the closest Natura 2000 site to the proposed development. While piling operations are on-going, coinciding with localised increases in suspended solids, Harbour porpoises are expected to remain outside the area of direct habitat disturbance.

The operation of shipping and plant in the construction of the Dublin Array could pose a risk to marine mammals and their prey through the release of pollutants such as hydrocarbons. However, proper maintenance of machinery and ships and general construction site 'house-keeping', including an Environmental Management Plan (EMP) and a Construction Management Plan (CMP) prepared in advance will ensure that the risk of a serious pollution event occurring is minimal, and so does not constitute a significant adverse effect on marine mammals from surrounding SAC sites. Vessels involved in the installation of the wind turbines will be built and operated to Det Norske Veritas and Lloyds standards.

4.3.2.3.4 Electromagnetic fields

Electromagnetic field associated with the Dublin Array wind farm will be created by the inter-turbine cables as well as the onshore transmission cable. These are all located outside any Natura 2000 site and so will have no direct effect on the Harbour porpoise population of the proposed Rockabill to Dalkey Island SAC. Field strengths related to wind turbines that are comparable to geomagnetic fields are expected at a distance of less than 1 m (Hoffman *et al.*, 2000). Harbour porpoises foraging in the vicinity of the Dublin Array will not be affected by the fields due to their localised effect. Alternating Current (AC) has less of an effect on marine mammals and magnetic fields are mainly used by migrating species of cetacean rather than species that use sonar and visual cues for navigation i.e. Harbour porpoise. The cables will also be shielded to reduce any potential for interference. No significant adverse effect is likely due to the presence of electromagnetic fields in the vicinity of the Dublin Array.

4.3.2.4 Potential for cumulative or in-combination effects

When assessing the cumulative impacts it is necessary to also consider the effect of other developments that, together with the current project, could have a cumulative impact on the Harbour porpoise populations of the proposed Rockabill to Dalkey Island SAC. To date two offshore wind farms have been granted a Foreshore Lease off the east coast. The Arklow Bank and the Codling Bank wind parks off the coast of County Wicklow. The Arklow Bank is located approximately 40 km south of the Kish and Bray banks, while the proposed Codling Wind Park is located just southeast of the Dublin Array. These developments are, therefore, outside the range at which the construction noise would impact directly on the Harbour porpoise populations within the proposed Rockabill to Dalkey Island SAC designation and therefore would not have a significant adverse effect on the Natura 2000 site. As no timeframe is set for the construction of the Dublin Array or the Codling Bank Wind Park; no firm statements can be made with regard to the cumulative impacts outside the proposed Rockabill to Dalkey Island SAC and with regard to harbour porpoise populations from this proposed SAC without the designation boundary, foraging in the wider study area. Consideration should be given to this issue in the planning process and it may be appropriate to agree an appropriate construction schedule to minimise impacts on Harbour porpoise populations in the area. The range at which a harbour porpoise is expected to hear an operating wind turbine is in the region of 100-300 m, with the zone of responsiveness even

less (Tougaard *et al*., 2005). Therefore, there is no cumulative effect expected in terms of operational noise, should the above wind farm developments proceed to operation.
In addition to operation of other wind farms in the surrounding environment, other sources of undersea noise need to be considered as cumulative with the proposed wind farm. The Irish Sea is an important shipping corridor, with regular ferries operating out of Dublin Port and Dún Laoghaire Harbour and ships generate considerable noise when in transit. Shipping noise in close proximity to a wind farm will mask the turbine noise (Madsen *et al*., 2006). Given that ships generate transient noise and harbour porpoises continue to occur in areas with high levels of shipping, no significant adverse effect will be caused by any accumulation of these noise sources.

4.3.2.5 Decommissioning

Decommissioning of a wind farm is essentially the reverse of its construction, with the removal of rotors, nacelles, towers and piles using similar vessel types. The fact that piling does not occur during decommissioning means that there will be no significant adverse effect on Harbour porpoise populations during the decommissioning phase, with regard to the proposed Rockabill to Dalkey Island SAC.

4.3.2.6 Recommended mitigation measures

In order to minimise any potential impact on the proposed Rockabill to Dalkey Island SAC, as well as any other marine mammals present in the area, the following mitigation measures are to be implemented. A detailed Construction Management Plan (CMP) and Environmental Management Plan (EMP) will be prepared prior to the commencement of any works and these plans will include detail of the mitigation measures to be implemented and will incorporate any conditions imposed by the consenting authority. The vessels involved in the installation of the wind turbines will be built and operated to Det Norske Veritas and Lloyds standards.

4.3.2.6.1 Noise and vibration

In considering the potential impact of construction noise on harbour porpoises, the impact of pile-driving with no mitigation measures was considered. Unmitigated pile-driving poses the risk of physical injury at very close ranges (<100 m), with some disturbance effects of up to 15 km. The German Federal Maritime and Hydrographic Agency (BSH) has set limits for pile-driving noise of 160 dB (SEL) and 190 dB (peak) at a distance of 750 m from the pile for the protection of harbour porpoise. In order to reduce the likely effect on marine mammals from pile-driving operations, the following mitigation measures will be implemented; however, potential future improvements in technology, that are proven to be effective at a commercial level, will also be considered prior to the commencement of construction:

- Marine Mammals Observers (MMOs) – MMOs will be employed during the construction period in order to minimise the possibility of injury to marine mammals as a result of piling operations. MMOs will ensure the area around the piling is clear of marine mammals prior to the commencement of piling. MMOs will follow the '*Draft Guidance to Manage the Risk to Marine Mammal from Man-made Sound Sources in Irish Waters*' (DAHG, 2012). Reference to the JNCC (2010) guidance for minimising piling impacts on marine mammals is also recommended.

- Soft-starts – In combination with the use of MMOs, and in line with the '*Draft Guidance to Manage the Risk to Marine Mammal from Man-made Sound Sources in Irish Waters*' (DAHG, 2012), 'soft-starts' or ' ramp-up' procedures will be used when commencing piling in order to reduce the risk of injury to marine mammals. By gradually increasing the power of the piling equipment, any marine mammals in the immediate vicinity of the piling operations will have sufficient warning to vacate the area prior to the piling reaching full power.
- Cofferdam noise-reduction – It is proposed to utilise a cofferdam system during piling operations in order to reduce the propagation of noise out into the water column. However, future improved noise-reduction systems for offshore piling will be considered for implementation; once it meets equivalent or improved standards achieved by the proposed cofferdam system. The cofferdam consists of a steel tube of greater diameter than the pile, which is put in place before the pile is installed. Water is pumped out from between the pile and the cofferdam before piling commences, thus reducing the ability of the sound to travel into the water column. Tests have shown that a reduction of 22 dB (SEL) and 18 dB (peak) is possible using this technology and that it is capable of meeting the 160 dB (SEL) and 190 dB (peak) limits set by the German BSH for offshore piling operations (Ramboll, 2012). These tests were carried out using a 2 m pile, but are likely to be effective for larger piles once the water is pumped out from between the pile and the cofferdam and there is no hard contact (Christopher Maxon, Ramboll, pers. comm.).

4.3.2.6.2 Loss or alteration to habitats

The following mitigation measures will be adopted to minimise the impact of the construction and operation of the wind farm on existing habitats and feeding grounds used by Harbour porpoise:

- In order to minimise the extent of potential habitat loss associated with the construction and operation of the wind farm the extent of seabed disturbed to facilitate the installation of the piles, scour protection and cable trenches will be kept to a minimum.
- Cable trenches will be formed, the cable installed and the trench backfilled in a single operation using a purpose-designed plough thereby allowing immediate re-colonisation of the affected substratum from surrounding unaffected areas by the natural hydrodynamic regime over the banks.
- Scour protection will be provided on the seabed around the base of each pile in order to limit the extent of seabed affected by scour associated with the alteration of hydrodynamic flows around the pile.

4.3.2.6.3 Increased suspended sediment / pollution

The following mitigation measures will be adopted to minimise the impacts associated with increased suspended sediment and turbidity during the construction and operational stages of the wind farm on marine mammals:

- In order to minimise the extent of potential sediment disturbance associated with the construction and operation of the wind farm the extent of seabed disturbed to facilitate the installation of the piles, scour protection and cable trenches will be kept to a minimum.

- Scour protection will be provided on the seabed around the base of each pile in order to limit the extent of seabed affected by scour associated with the alteration of hydrodynamic flows around the pile.
- The development of a Construction Management Plan will include strict controls to minimise the risk of pollution or contamination associated with the construction stage of the proposed development including the storage and use of lubricants, placement of grout, and management of waste which will be sorted and returned to shore for recycling/disposal by a licensed contractor. Similar controls will be adopted during the operational stage of the project to prevent pollution and contamination.

4.3.2.6.4 Electromagnetic Fields

Subsea transmission cables will be appropriately shielded to minimise any localised effect on marine mammals.

4.3.2.7 Conclusion

Harbour porpoises are found all along the Irish coast and their distribution varies spatially and temporally (Berrow *et al*., 2008), so any temporary displacement of harbour porpoises from the proposed Rockabill to Dalkey Island SAC can be facilitated by movement of those individuals into surrounding areas. Indeed it is almost certain that the harbour porpoises that occur within the proposed Rockabill to Dalkey Island SAC already exploit a much wider area as suggested by the variability of the results from the IWDG survey in 2008 (Berrow *et al*., 2008) and other studies on the range of harbour porpoises (Sveegaard *et al*., 2011, Johnston *et al*., 2005). Harbour porpoises have been shown to return to areas where wind farms have been constructed following the cessation of piling works (Tougaard *et al*., 2006, Brandt *et al*., 2009, Scheidat *et al*., 2011). In some cases (Egmond ann Zee) this return was rapid and a positive effect was seen once the wind farm was operational (Scheidat *et al*., 2011), while in other cases (Nysted) the harbour porpoise numbers have shown a more gradual recovery (Tougaard *et al*., 2006; Teilman, 2012), attributed to the low baseline densities of this species at the Nysted site. Brandt *et al.* (2009) showed that harbour porpoise activity reduced in the immediate vicinity of piling operations at Horns Rev II, but it returned to pre-piling levels within days of the cessation of piling. The return to pre-piling levels occurred more quickly at greater distances, with 'normal' activity resumed within a few hours at a distance of 6-9 km.

The reduction in activity of harbour porpoises within a 10 km radius of active piling operations means that there will be a temporary reduction in harbour porpoise activity in the southern part of the proposed Rockabill to Dalkey Island SAC. This reduction will be temporary and harbour porpoise distribution will begin to return to its previous pattern once piling operations have ceased within the section of the Dublin Array within 10 km of the proposed Rockabill to Dalkey Island SAC. The return to pre-piling levels is expected to occur over hours or days following the cessation of piling due to the high density of harbour porpoises that occur along the Irish Coast. Low pre-construction numbers were considered the reason that recovery to pre-construction activity levels within the Nysted wind farm have taken an extended period of time (Tougaard *et al*., 2006; Teilman, 2012), especially when compared with the recovery results for Horns Rev II (Brandt *et al*., 2009).

The Dublin Array is not located within any Natura 2000 site and lies outside of the proposed Rockabill to Dalkey Harbour SAC designated for Harbour porpoise. Harbour porpoises are found throughout the Irish Sea, particularly to the north, away from the construction site, and

so there is ample habitat to be exploited by animals temporarily displaced by piling operations. According to Berrow *et al.* (2008; 2011) Harbour porpoise densities in the Irish Sea are relatively high (North Dublin Coast – 2.03 km^{-2}, Dublin Bay 1.19 km^{-2} and offshore North Irish Sea – 1.6 km^{-2}) when compared to those of the Baltic Sea (0.1 km^{-2} according to Tougaard *et al*., 2006). This results in a conclusion that harbour porpoise densities and activity will return to normal within the proposed Rockabill to Dalkey Island SAC more rapidly.

The potential for adverse effects on Harbour porpoise populations listed as a qualifying interest of the proposed Rockabill to Dalkey Island SAC has been identified with regard to unmitigated noise and vibration impacts extending beyond the proposed development site. North County Dublin was evaluated by Berrow *et al*. (2008) as being an area with the highest harbour porpoise density in Ireland, also with one of the highest proportion of young. It is noted that the estimate impact zone with regard to behavioural effects on Harbour porpoise populations does not extend into this area of the proposed SAC designation. The use of an effective noise-reduction system, such as the proposed cofferdam system (or equivalent) and the temporary, localised nature of the piling operations (over approximately 3 years) during the construction programme will limit impact to approximately <5% of the development site at a time. This means that a maximum of 40% of the southern part of the proposed Rockabill to Dalkey Island SAC will be affected to a level that may cause aversive reaction in harbour porpoise and for a limited period. This maximum effect will occur while construction is on-going at the northwest corner of the construction site and the effect will be less for construction further south and east (18% at the mid-point of the western boundary of the Dublin Array, and 0% at the southern end of the Dublin Array).

The implementation of MMOs and 'soft-start' procedures will ensure that there is no direct, physical impact on Harbour porpoises in the area around construction operations. No permanent or temporary hearing loss will occur in harbour porpoises from the nearby proposed Rockabill to Dalkey Island SAC that may be present in the Kish and Bray banks area. The lack of physical injury to species listed as qualifying interests of the proposed SAC populations prevents any direct impacts on the population dynamics through loss of individuals.

The use of a cofferdam system, or equivalent noise-reduction system, will reduce the underwater noise levels by 22 dB (SEL) and 18 dB (peak); which equates to an approximate power reduction of a factor of 100. While meeting the German BSH's limits with regard to noise generated during pile-driving operations does reduce the area over which disturbance may occur, it does not eliminate it. Unmitigated pile-driving may result in aversive reactions in harbour porpoises up to a distance of 15 km (Tougaard *et al*., 2003), while Merck (2012) suggests that meeting the 160 dB (SEL) limit set by the German government reduces the range of this behavioural response to below 10 km. Based on this figure, taking account of the proposed noise reduction mitigations, the maximum area affected by piling constitutes 40% of the proposed Rockabill to Dalkey Island SAC when construction is occurring in the north-western corner of the development site. This area is approximately three-quarters of the area that would be affected by unmitigated piling and only extends slightly north of Howth Head. As one moves south during the construction of the Dublin Array, the area of likely behavioural response decreases to 18% half way down the development site and 0% at the southern end. When construction is on-going at the mid-point of the Dublin Array, the area of the proposed SAC affected by mitigated piling is approximately half of that affected by unmitigated piling. Construction operations at the southern end of the Dublin Array will be outside the range that may cause behavioural response in harbour porpoises in the proposed

Rockabill to Dalkey Island SAC. It is important to note that only 5% of the site area will be worked on at any time.

Therefore, it is concluded that the development will not have a significant adverse effect once mitigation measures are adhered to. Direct injury to marine mammals by piling operations will be avoided through the use of MMOs and 'soft-start' procedures and the use of effective noise-reduction systems (such as the proposed cofferdam or equivalent performing system) during piling operations. There will be no long-term impact on the integrity of the proposed SAC, as the wind farm is outside the boundary of the proposed SAC designation and the operation of the wind turbines will not result in the exclusion of harbour porpoises from the wind farm area. The temporary and reversible nature of this effect will not prevent the proposed Rockabill to Dalkey Island SAC from achieving its Conservation Objectives or result in significant adverse effects on the integrity of the site. The northern section of the proposed Rockabill to Dalkey Island SAC has been noted as being most important for Harbour porpoise calves and this area is outside the range of the effects of the piling.

4.3.3 Grey seal Halichoerus grypus

4.3.3.1 Overview of the qualifying interest

The Grey seal *Halichoerus grypus* is listed as a conservation interest of the Lambay Island cSAC and was recorded during the marine surveys undertaken within the current study area (MRG, 2013). The current assessment of Grey seal populations and potential impacts arising from the proposed development is based on the specialist Marine Mammal report (BEC, 2013) presented in Appendix 2. Dalkey Island is identified as a haul-out and breeding site for grey seals from the mapping provided in the Conservation Assessment for this species (NPWS, 2008). Grey seals forage on a wide range of prey preferences with a strong emphasis on demersal (i.e. seafloor) fish species (e.g. whiting *Merlangius merlangus*, *Trisopterus* species, flatfish), sandeels (*Ammodytidae*) and cephalopods; species available within the Dublin Array study area.

Recent population estimates for grey seals in Ireland put the population in the range 5,509-7,083 (Ó'Cadhla *et al*., 2007), with a minimum population estimate (based on a moult survey) of 5,343 (Ó'Cadhla & Strong, 2007). The main colonies are located on the Atlantic seaboard, with Inishkea North (Co. Mayo) and Great Blasket Island (Co. Kerry) supporting 45% of the population (Ó' Cadhla & Strong, 2007). The Lambay Island population was estimated to be 45-60 in 1995 (NPWS, 1995) and 203-261 in 2005 (Ó' Cadhla *et al*., 2007), indicating an increasing population. The Status of EU Protected Habitats and Species in Ireland report (NPWS, 2008) assessed grey seals as being at 'Favourable Conservation Status'. According to the NPWS (2008) Conservation Assessment for this species individual grey seals of all ages can range widely and remain at sea for extended periods when foraging, using haul-out sites up to several hundred miles from breeding areas. There is the potential for individuals from the Lambay Island cSAC population to be foraging within the Kish and Bray Banks study area.

Grey seals are highly mobile predators, with studies showing movement of seals across the Irish Sea between Ireland and Wales and also between Irish sites, though female grey seals may show a degree of inter-annual site fidelity (Kiely *et al*., 2000). Grey seals spend more time hauled out during the breeding season (September – December) and the moulting season (November – March) (Kiely *et al*., 2000). The most prominent gaps in distribution

occur along the eastern (i.e. Irish Sea) coast, most likely due to reduced availability of uninhabited/undisturbed coastal habitat (NPWS, 2008). From the results of the 2005 population study it is considered that islands of the east and southeast coasts (i.e. Lambay Island, Ireland's Eye and the Saltee Islands) indicate that pup production may have increased since the 1996-98 period. This increases the importance of existing haul-out and breeding sites on the eastern seaboard. Sightings of grey seals within the Study Area during the survey area carried out by EcoServe were low (MRG, 2013) and equivalent to those recorded along the control transects. This shows that the proposed wind farm area is of no greater importance to foraging grey seals than the surrounding sea area.

4.3.3.2 Potential for direct impacts

The grey seal population in Lambay Island cSAC is approximately 20 km away from the Dublin Array at its closest point. Therefore there will be no direct effect on the Grey seals within the cSAC from either the construction or operational phase of the proposed development.

4.3.3.3 Potential for indirect impacts

4.3.3.3.1 Noise and disturbance

The presence of Grey seal within the study area gives rise to potential associations with the Lambay Island cSAC population and the likelihood of seals from this population foraging within the proposed Dublin Array site. Grey seals occurring within the development site, and without the cSAC would be potentially affected by noise and vibration impacts. Pile-driving in particular can generate very high sound levels and given the likely use of monopile foundations to support the turbines for the Dublin Array it is anticipated that the underwater noise generated by the installation of the piles during the construction stage of the project is likely to have the greatest potential effect on Grey seals within the impact zone. High noise levels can cause serious injury at close range, including physical injury to organs, and as one moves further away from the source effects diminish to permanent or temporary hearing impairment and behavioural change until the noise level is audible.

As discussed in relation to Harbour porpoise, pile-driving operations, evaluated using a 6.5 m pile as a worst-case-scenario, have been estimated to generate noise levels of 201 - 204 dB re 1 µPa (Peak) and 175 – 178 dB re 1µPa (SEL) at 500 m in 20 m deep water (Nehls *et al*., 2007). The following noise levels have been considered to cause Temporary Threshold Shift (TTS) and Permanent Threshold Shift (PTS) in hearing of pinnipeds (Ketten & Finneran, 2004):

- Temporary Threshold Shift: 163 dB SEL pulses, 204 dB peak pressure
- Permanent Threshold Shift: 210 dB peak pressure

Based on these thresholds, TTS may be caused by noise impacts at the above levels at a range of 500m in seals. No audiogram is available for grey seals, but based on best available scientific data, grey seals would show aversive reaction to pile-driving at 9km (Subacoustech Ltd, 2006), based on the findings in relation to the closely related Common seal. The impact of the noise created by the additional shipping movements to and from Dublin Port due to the construction of the Dublin Array affecting Grey seals will not be significant when compared with the background shipping activity in the area.

The noise generated by the Dublin Array, once operational, will not be sufficient to be heard by a Grey seal more than a few hundred metres away (Koschinski *et al*., 2003, Tougaard *et al*., 2005; 2009). There will, therefore, be no direct impact on the Lambay Island cSAC populations due to the noise generated by the operation of the Dublin Array. Maintenance of the wind farm will require the operation of vessels in the area, estimated to be two small boats per day. Dublin Bay and its surrounds already have high, but variable, levels of marine traffic including cargo ships, ferries, fishing vessels and leisure craft. Grey seals in the area are well-accustomed to the temporary disturbance caused by vessels and the additional boat movements related to the maintenance of the wind farm will not cause a significant adverse effect on species or the population within the cSAC. There will not be any significant adverse effect on Grey seals from the Lambay Island cSAC due to the noise generated by the operation of the Dublin Array.

4.3.3.3.2 Habitat disturbance

Grey seals occur throughout the study area and its surrounds and so it is certain that there will be some disturbance to the habitat utilised by these species during construction. The development site is 5,400 hectares, and less than 5% of the area will have construction activities on-going. Only a small percentage (0.03%) of the banks will be lost under the footprint of the development and therefore no significant adverse effect is expected on Grey seals foraging in the area. Localised, temporary disturbance may impact the foraging activities of grey seals from the Lambay Island cSAC, but this will not constitute a significant adverse effect due to the limited area affected as compared to the area available for foraging. While piling operations are on-going Grey seals will remain outside the area of direct habitat disturbance.

Fish have been found to aggregate around marine structure such as oil rigs (Valdemarsen *et al.*, 1979) and despite the less complex structures involved, aggregation of fish around wind turbines does occur (Wilhelmsson *et al*., 2006). An increase in the fish resource present within the wind farm will make the area more attractive to foraging Grey seals. No significant adverse effect on the Grey seal populations of the Lambay Island cSAC will occur due to habitat loss from the development of the Dublin Array.

4.3.3.3.3 Increased suspended sediments / pollution

As the Dublin Array is not located within any Natura 2000 site designated for marine mammals, there will be no direct effect due to increased suspended sediments during construction. The main tidal current direction along the coast off Dublin and Wicklow is along a north-south axis, flooding north and ebbing south. This current pattern means that any suspended solids generated within the wind farm area will not be carried in towards the identified SACs.

Therefore, the effect of increased suspended solids will be a localised, temporary effect, which may impact on foraging Grey seals from Lambay Island cSAC occurring within the development site; but not on the cSAC waters themselves. Construction noise will be the most likely source of disturbance and will result in Grey seals avoiding the immediate vicinity of the construction works and therefore the area of increased suspended sediment. Based on these factors, increased suspended sediment will not constitute a significant adverse effect on the Grey seal population of Lambay Island cSAC.

The operation of shipping and plant in the construction of the Dublin Array could pose a risk to marine mammals and their prey through the release of pollutants such as hydrocarbons. However, proper maintenance of machinery and ships and general construction site 'house-keeping', including an Environmental Management Plan (EMP) and a Construction Management Plan (CMP) prepared in advance will ensure that the risk or a serious pollution event occurring is minimal, and so does not constitute a significant adverse effect on Grey seals from the Lambay Island cSAC. Vessels involved in the installation of the wind turbines will be built and operated to Det Norske Veritas and Lloyds standards.

4.3.3.4 Potential for cumulative or in-combination effects

When assessing the cumulative impacts it is necessary to also consider the effect of other developments that, together with the current project, could have a cumulative impact on the Grey seal populations of Lambay Island cSAC. To date two offshore wind farms have been granted a Foreshore Lease off the east coast. The Arklow Bank and the Codling Bank wind parks off the coast of County Wicklow. The Arklow Bank is located approximately 40km south of the Kish and Bray banks, while the Codling Wind Park would be located just southeast of the Dublin Array. These developments are, therefore, outside the range at which the construction noise would impact directly on the Grey seal population of Lambay Island cSAC and therefore will not have a significant adverse effect on this Natura 2000 site.

The Irish Sea is an important shipping corridor, with regular ferries operating out of Dublin Port and Dún Laoghaire Harbour and ships generate considerable noise when in transit. Shipping noise in close proximity to a wind farm would mask the turbine noise (Madsen *et al*., 2006). Given that ships generate transient noise, and grey seals continue to occur in areas with high levels of shipping, no significant adverse effect will be caused by any accumulation of these noise sources.

4.3.3.5 Recommended mitigation measures

In order to minimise any potential impact on the Grey seal population of the Lambay Island cSAC the following mitigation measures are to be implemented. A detailed Construction Management Plan (CMP) and Environmental Management Plan (EMP) will be prepared prior to the commencement of any works and these plans will include detail of the mitigation measures to be implemented and will incorporate any conditions imposed by the consenting authority. The vessels involved in the installation of the wind turbines will be built and operated to Det Norske Veritas and Lloyds standards.

The following mitigation measures will be implemented for the protection of marine mammals, including Grey seals, it is further proposed that future improvements in technology that are proven to be effective at a commercial level, will also be considered prior to the commencement of construction:

- Marine Mammals Observers (MMOs) – MMOs will be employed during the construction period in order to minimise the possibility of injury to marine mammals as a result of piling operations. MMOs will ensure the area around the piling is clear of marine mammals prior to the commencement of piling. MMOs will follow the '*Draft Guidance to Manage the Risk to Marine Mammal from Man-made Sound Sources in Irish Waters*' (DAHG, 2012). Implementation of the measures set out in the JNCC

(2010) guidance in relation to minimising the impacts of piling on marine mammals is also recommended.

- Soft-starts – In combination with the use of MMOs, and in line with the '*Draft Guidance to Manage the Risk to Marine Mammal from Man-made Sound Sources in Irish Waters*' (DAHG, 2012), 'soft-starts' or ' ramp-up' procedures will be used when commencing piling in order to reduce the risk of injury to marine mammals. By gradually increasing the power of the piling equipment, any marine mammals in the immediate vicinity of the piling operations will have sufficient warning to vacate the area prior to the piling reaching full power.
- Cofferdam, or equivalent noise reduction system – the current proposal is to utilise a cofferdam system during piling operations in order to reduce the propagation of noise out into the water column; future advancement in noise-reducing systems may result in an equivalent or superior system to be employed at the site. The cofferdam consists of a steel tube of greater diameter than the pile, which is put in place before the pile is installed. Water is pumped out from between the pile and the cofferdam before piling commences, thus reducing the ability of the sound to travel into the water column. Tests have shown that a reduction of 22 dB (SEL) and 18 dB (peak) is possible using this technology and that it is capable of meeting the 160 dB (SEL) and 190 dB (peak) limits set by the German BSH for offshore piling operations (Ramboll, 2012). These tests were carried out using a 2m pile, but are likely to be effective for larger piles once the water is pumped out from between the pile and the cofferdam and there is no hard contact (Christopher Maxon, Ramboll, pers. comm.).

In order to minimise the extent of potential habitat loss associated with the construction and operation of the wind farm the extent of seabed disturbed to facilitate the installation of the piles, scour protection and cable trenches will be kept to a minimum. Cable trenches will be formed, the cable installed and the trench backfilled in a single operation using a purpose-designed plough thereby allowing immediate re-colonisation of the affected substratum from surrounding unaffected areas by the natural hydrodynamic regime over the banks.

The Construction Management Plan will include strict controls to minimise the risk of pollution or contamination associated with the construction stage of the proposed development including the storage and use of lubricants, placement of grout, and management of waste which will be sorted and returned to shore for recycling/disposal by a licenced contractor.

4.3.3.6 Conclusion

The implementation of MMOs, 'soft-start' procedures and a noise-reduction system to minimise acoustic impacts of pile-driving (i.e. the proposed cofferdam system, or equivalent) will ensure that there is no direct, physical impact on Grey seals in the area around construction operations. No permanent or temporary hearing loss will occur in Grey seals from the nearby Lambay Island cSAC that may be present in the Kish and Bray Banks area. The lack of physical injury to Grey seals, listed as qualifying interests of the Lambay Island SAC, prevents any direct impacts on the population dynamics through loss of individuals.

It is concluded that the Grey seals occurring within the Lambay Island cSAC are outside the area of behavioural effect that will be caused by the piling operations on the Kish and Bray banks. Any impact on this population would be due to the effect on individuals operating in the construction area of the Dublin Array. This is not considered significant due to the wide

area available for foraging for grey seals in the Irish Sea and that seal numbers recorded in the Kish and Bray banks area were no greater than those recorded at the control sites.

4.4 Assessment of the Conservation Interests of SPA sites potentially affected by the proposed development

The Kish Bank and the Bray Bank comprise important shallow water feeding locations for a diversity of seabird species listed as conservation interests of the surrounding SPA sites, primarily due to foraging range of the majority of these seabird species with regard to the flight distance between the banks and the breeding / wintering sites within the SPAs. From the results of baseline surveys undertaken (MRG, 2013) it is clear that the proposed development site is used by high numbers of the following species: Fulmar, Razorbill, Manx Shearwater, Northern gannet, Cormorant, Little gull, Herring gull, Kittiwake and Guillimot. All of these species are listed as special conservation interests of the numerous SPA sites identified within the study area. Furthermore Puffin, Red-throated diver and Common scoter were recorded in low numbers. Common Scoter, tern species, auk species and gull species are identified as being sensitive to offshore wind energy development in varying degrees with potential impacts affecting each species group in different ways. Offshore wind energy developments have the potential to give rise to bird disturbance leading to displacement or exclusion and habitat loss; however, it is recognised that various species may habituate to this disturbance over time (European Commission, 2010).

This section provides an assessment of each individual conservation interest of the SPA sites within the study area and evaluates the potential for significant effects which would affect these species populations with regard to the conservation objectives of the SPA sites. The description of the seabird populations and impact assessment with regard to the potential for adverse effects on designated Natura 2000 sites is informed by the Seabird Report (Ecology Ireland, 2013) presented in Appendix 3.

4.4.1 Red-throated Diver

4.4.1.1 Overview of the qualifying interest

The 2001 survey recorded a maximum count of two birds, whilst the 2010 survey found a peak of 22 birds concentrated in foraging groups on the water at the south end of the bank in late March. The record of 22 birds is unusual as all other records for this species are of one, two or three birds on any one survey. Numbers of divers increase along the coast of Counties Wicklow and Wexford in April and May as they migrate northwards (Newton & Trewby 2011).

4.4.1.2 Potential for direct impacts

The proposed development is not located within or adjacent to any SPA site for which this species is a conservation interest and no direct impacts are identified.

4.4.1.3 Potential for indirect impacts

Red-throated divers are known to be prone to disturbance and the surveys note that during the boat based surveys, divers were often flushed from the water surface some distance from the boat so that most of the records are of birds in flight. Cook *et al*. (2012) found that mean flight height for Red-throated Divers was 4.5m, and that this species rarely flies at heights that

would bring them within a typical rotor sweep of offshore wind turbines (<2% of flights at greater than 20m).

Red-throated diver is a key species for wind farms situated off the North Wales coast in Liverpool Bay. Post construction monitoring of the North Hoyle wind farm, indicates that divers may have made less use of the operational wind farm but the data is inconclusive given the small data set. Furness & Wade (2012) note that this species is of high concern in relation to displacement and disturbance. The Murrough SPA is the only one within the 35 km hinterland that has Red-throated diver as a key species. The site synopsis presents a mean peak count over five years of 32 birds. Crowe (2005) gives an All-Ireland total for wintering Red-throated diver as 832. Crowe also notes that wintering Red-throated divers are mobile and their numbers fluctuate in response to food availability.

The pattern of usage of the Banks recorded during the dedicated seabird surveys found that numbers of divers that have been found to use the Kish/Bray is generally very low. On one occasion 22 birds were recorded at the end of the winter period in March, when birds are on passage back to the breeding grounds. Given their response to disturbance, any birds using the Banks during the construction phase are likely to be displaced from the area. However, as construction will only be ongoing in a small part of the wind farm area at any one time, any displacement of Red-throated Divers will be localised and will affect an insignificant number of birds.

During operation of the wind farm, the low numbers of Red-throated divers may be displaced from the wind farm. Recent work as reported in Furness & Wade 2012, concludes '*While it is clear that some seabirds do strongly avoid wind turbines at sea, recent work modelling the cumulative impact of disturbance by wind turbines suggests that the impact of these through increased travel distances and habitat loss is trivial, even for species that show especially strong avoidance behaviour, such as red-throated divers'*.

4.4.1.4 Conclusion

Given the very low numbers of Red-throated divers using the Banks in the winter period it is concluded that there is no likelihood of a significant impact on the Red-throated divers using the Murrough SPA arising from the Dublin Array wind farm.

4.4.2 Great Crested Grebe

4.4.2.1 Overview of the qualifying interest

Great Crested Grebe is a feature for the Malahide Estuary SPA where it is noted that wintering numbers are of regional importance. Crowe (2005) gives the All-Ireland wintering population as 7,030. During the two surveys of the Kish/Bray banks, only one record of a single bird flying east in August 2010 was noted.

4.4.2.2 Potential for direct impacts

The proposed development is not located within or adjacent to any SPA site for which this species is a conservation interest and no direct impacts are identified.

4.4.2.3 Potential for indirect impacts

Given the very low incidence of this species on the banks, there will be no impact on the Malahide Estuary SPA for this feature arising from the Dublin Array wind farm.

4.4.2.4 Conclusion

Given the very low number of Great Crested Grebe using the Banks (1 bird recorded during 2010/2011) it is concluded that there is no likelihood of a significant impact on the population of this species within the Malahide Estuary SPA arising from the Dublin Array wind farm.

4.4.3 Fulmar

4.4.3.1 Overview of the qualifying interest

The only SPA in the hinterland where this species is noted as a key feature is Lambay Island. The site synopsis states that it supports a nationally important population of breeding Fulmar with a count of 635 pairs in 1999. The last major census of all seabird colonies in Ireland and Britain was the Seabird 2000 project, the results of which are given in Mitchell *et al*., 2004. They report that the All-Ireland breeding population is 38,910 Apparently Occupied Sites (AOS), with 926 AOS in counties Wicklow and Dublin. Fulmars were recorded in both the 2001 and 2010 surveys. The peak figures in 2001 were higher than 2010, with 42 birds recorded in August 2002 and only 14 in June 2010 and again in March 2011. Birds were more numerous in spring and summer which lead Newton & Trewby (2011) to suggest that the majority were local breeding birds and the bank is not a favoured wintering area for this species.

4.4.3.2 Potential for direct impacts

The proposed development is not located within or adjacent to any SPA site for which this species is a conservation interest and no direct impacts are identified.

4.4.3.3 Potential for indirect impacts

Newton & Trewby (2011) also recorded flight heights for this species, showing that mean flight heights varied from 0.5 to 3.8 m above the water level, with a maximum height of 10m recorded. This accords with Cook *et al*, (2012) who found that less than 0.2% of recorded flights were at collision heights. This is well below the proposed lowest height of the rotor blade tips for the proposed turbines of 30m; where the proposed rotor sweep will be from 30m to the maximum tip height of 160m.

Fulmar was identified as a key species for the off-shore wind farms in Liverpool Bay; however, no issues were reported in relation to this species in the post-construction monitoring (Budgey & Ormston, 2009), although it is noted that Fulmar was recorded in such low numbers at these sites that it was not possible to determine any effect of the wind farm on their populations. Fulmar is a species that has a high tolerance of disturbance (Furness & Wade, 2012) meaning that construction activity as well as operation of the wind farm is unlikely to lead to displacement of this species.

4.4.3.4 Conclusion

Given the relatively low usage of the Kish/Bray banks by this species, coupled with the fact that they are generally a species that flies low to the water surface ('dynamic soaring')

reducing any likelihood of collision risk, and are tolerant of disturbance, it is concluded that the proposed Dublin Array wind farm will not have an impact on this species within the Lambay Island SPA.

4.4.4 Cormorant

4.4.4.1 Overview of the qualifying interest

This species is a key feature for three SPAs; Lambay Island, Ireland's Eye and Skerries Islands. It is recorded as a breeding species with populations of 675, 438 and 558 pairs respectively. The breeding colony on Lambay Island is the largest in Ireland and is of international significance. Mitchell *et al*. (2004) gives the All-Ireland population as 4,736 Apparently Occupied Nests (AON). Newton & Trewby (2011) found that birds were most numerous within the Dublin Array study area during the summer months, when they were frequently seen roosting on the Kish lighthouse, in numbers which Newton & Trewby describe as 'significant'. They also found Cormorants more often in shallower water. In the 2001 survey numbers of Cormorants on the bank were lower than in 2010 during the breeding season, roughly similar from late summer onwards and almost absent in winter. This is analogous to the situation found at the North Hoyle wind farm, where numbers dropped off during the summer when it was thought that birds were foraging closer to their breeding sites (nPower Renewables, 2005).

Interestingly, post-construction monitoring from the North Hoyle wind farm found that birds were using the meteorological masts and marker buoys for roost sites. Birds were also found to be associated with turbines and it was suggested they were foraging on fish which were using newly formed reefs around the turbine foundations. The data from North Hoyle indicates an increase in Cormorant numbers following construction. These data suggest that Cormorants are not displaced from foraging grounds by the presence of wind turbines. No other issues in relation to Cormorants were reported at 10 UK off-shore wind farms (Budgey & Ormston, 2009).

4.4.4.2 Potential for direct impacts

The proposed development is not located within or adjacent to any SPA site for which this species is a conservation interest and no direct impacts are identified.

4.4.4.3 Potential for indirect impacts

Flight heights gathered during the 2010 survey (Newton & Trewby, 2011) found Cormorants flying at a maximum height of 10 m, with a mean flight height of less than 2 m, well below the proposed minimum rotor blade sweep of 30m. Based on the recorded flight heights, collision risk is not an issue for the Cormorants that use the Kish/Bray banks. Cormorant is placed low down in Furness & Wade's evaluation of flight height/collision risk (Furness & Wade, 2012). Cormorants are highly mobile and may forage over long distances (Langston gives the maximum foraging range as 50 km although the mean is 8.46 km). The 2001 and 2010 surveys do not provide any information on whether the birds seen on the Kish/Bray banks are drawn from local breeding colonies but as a precautionary measure, the assumption is that, at least, the majority of the birds present on the banks are from local breeding colonies, including Lambay Island and Ireland's Eye SPAs.

According to Lindeboom *et al* (2011), there is no evidence that Cormorants are permanently displaced from feeding habitat by the presence of wind turbines. Furness & Wade (2012) give them a relatively high score for disturbance, suggesting there may be short term temporary disturbance during construction but again a phased approach to construction will limit this to local areas. During construction, there is the potential for temporary impacts on fish populations and, subsequently, potentially on Cormorant distribution.

A detailed study of impacts on the commercial fisheries and marine ecology has been undertaken by Ecoserve and is presented in the Environmental Impact Statement (EIS) for the Dublin Array offshore wind farm. This study has shown that, during construction, habitat loss will be minimal and will largely be confined to the footprint of the turbines. Mitigation measures to include back filling trenches with a similar material and to the same original bed level together with the strong tidal currents and natural sedimentation will quickly restore marine habitats. Noise and vibration impacts can also impact on fish populations but mitigation measures to include using mechanical and acoustic soft start procedures will be effective to mitigate against any significant impacts on fish during piling operations. According to a literature review of benthic monitoring programmes for constructed wind farm sites (Slengesol *et al*., 2010) there are no reported statistically significant differences in fish abundance affected by the construction or presence of wind farm developments assessed (examples cited include Barrow, Kentish Flats, North Hoyle, Horns Rev and Nysted offshore wind farm developments).

Construction is proposed to take place over a two to three year period, including only approximately 5% of the development site at any time; this will allow for the benthic habitats to recover from any localised temporary disturbance associated with cable-laying. Providing the phased construction approach and the mitigation measures proposed to protect fish populations are followed, and fish population impacts are insignificant, then Cormorant numbers will not be impacted during construction; as their food supply will be protected together with this species' tolerance of disturbance.

4.4.4.4 Conclusion

There is no likelihood of any significant adverse impacts on the Cormorant populations found within the Lambay Island, Ireland's Eye or Skerries Islands SPAs arising from the proposed Dublin Array wind farm.

4.4.5 Shag

4.4.5.1 Overview of the qualifying interest

The breeding colonies of Shag on Lambay Island and Skerries Islands make them a key feature for these two SPAs. The Lambay Island colony at 1,122 pairs is the largest in Ireland and of international importance. Both surveys of the Kish/Bray banks found birds present most of the year round. The 2001 survey recorded their peak numbers (293) in September, whilst the 2010 peak (588) was in June. Again neither survey give an indication of the origin of these birds but the assumption is made that they are from local breeding colonies (including Lambay Island), although both sites are outside the quoted maximum foraging range of 20km for Shag (Birdlife International datasheet). Given the numbers of birds recorded during the surveys, it suggests that birds from Lambay are travelling to the bank to

forage. Percival (2002) noted that most of the Shag records were from shallower water, particularly in the northern section, particularly around the Kish lighthouse.

4.4.5.2 Potential for direct impacts

The proposed development is not located within or adjacent to any SPA site for which this species is a conservation interest and no direct impacts are identified.

4.4.5.3 Potential for indirect impacts

Newton & Trewby (2011) recorded flight heights for this species, with a maximum recorded flight height of only 5m, with mean flight heights of less than 2 m, well below the lowest point of the turbine blades. Data from the North Hoyle wind farm suggest that there is an increase in Shag records in the wind farm since it became operational although the statistical analysis is not able to show this. As with Cormorant, collision risk and displacement are not significant factors for Shag populations (Budgey & Ormston, 2009).

4.4.5.4 Conclusion

There is no likelihood of any significant impact on Shag populations in the SPAs that have been designated for this species.

4.4.6 Waders and waterbirds

4.4.6.1 Overview of the qualifying interest

This group includes all wading bird species that have been recorded on the Kish/Bray banks and are also features of the relevant SPAs, i.e. Oystercatcher, Ringed Plover, Sanderling, Turnstone, Dunlin, Black-tailed Godwit and Curlew. Typically these birds are listed conservation features for the estuarine SPAs; namely North Bull Island, South Dublin Bay, the Tolka Estuary and Malahide Estuary and also the Rogerstown Estuary and Baldoyle Bay SPA sites further north. Turnstone is also a feature for the Skerries Islands SPA. Similarly, this grouping includes the geese – Light-bellied Brent Goose and Greylag Goose- conservation features of many of the coastal SPAs. None of these species were recorded in the 2001 survey, although it is possible that they were seen but not reported on as they are not true 'seabirds'. They were recorded in the 2010 survey but chiefly as single records of one bird (Ringed Plover, Sanderling and Turnstone), two birds (Curlew), three birds (Oystercatcher) and five birds (Black-tailed Godwit). Dunlin was recorded on three separate occasions with a single bird in July, another single in early September and 12 birds in late September. Newton & Trewby (2011) note that all of these birds are migrants, they are not using the Kish/Bray banks for feeding or roosting as there is no suitable habitat for them.

4.4.6.2 Potential for direct impacts

The proposed development is not located within or adjacent to any SPA site for which this species is a conservation interest and no direct impacts are identified.

4.4.6.3 Potential for indirect impacts

Percival (2001) notes that risk of collision with migrant waterfowl (i.e. wildfowl and wading birds) should be low / negligible if the wind farm is located several kilometres offshore. Waders tend to fly at high altitudes whilst on migration, it is when they fly between high tide roosts and feeding grounds that they fly at lower altitudes (Exo *et al*, 2003). The Banks do not lie on any direct path between roosts and feeding grounds. Whilst it is possible that waders migrating to sites further south, may overfly the area, it is also known that waders can react to the presence of turbines either by flying higher or by changing direction (Exo *et al*, 2003.). The Dublin Array wind farm does not lie on the migratory route of either Light-bellied Brent Goose or Greylag Goose. Similarly, Greenland White-fronted Geese Anser albifrons *flavirostris*, which winter in internationally important numbers in Wexford, will be at no significant risk of disturbance or collision based on what is known of their migratory routes (Stroud *et al*. 2002; Fox *et al*. 2003).

4.4.6.4 Conclusion

Given the low usage of the banks by these bird species added to the proposed location along the Kish/Bray banks, the likelihood of the Dublin Array wind farm impacting on the populations of these bird species within the relevant SPAs is considered negligible. A cumulative impact assessment has not been undertaken for these species as there is no potential for significant effects on these species identified, negating the potential for the development to contribute to any significant cumulative effect on these species.

4.4.7 Black-headed gull

4.4.7.1 Overview of the qualifying interest

Wintering Black-headed gull numbers are a feature for three of the SPAs in the 35 km hinterland area; North Bull Island (2,996 birds), South Dublin Bay and the Tolka Estuary (3,040) and the Murrough (997). None of the relevant SPAs have been designated for breeding populations of black-headed gulls. Both the 2001 and 2010 surveys found very low numbers of Black-headed gulls using the Kish/Bray banks, with peak counts of eight (2001) and 6 (2010). Birds were only recorded in the period August to January, with no birds recorded during the breeding season.

4.4.7.2 Potential for direct impacts

The proposed development is not located within or adjacent to any SPA site for which this species is a conservation interest and no direct impacts are identified.

4.4.7.3 Potential for indirect impacts

Newton & Trewby (2011) recorded flight heights for this species within the study area, where all flight heights were below 20m (0.8-8 m). This is in line with the findings set out by Cook *et al* (2012), where their literature review found only a small number of all recorded flights were within rotor height (7.9%). This species also seems tolerant to disturbance with Furness & Wade (2012) only giving it a score of '2' for disturbance to helicopter and boat traffic, indicating that construction activities will not lead to disturbance for this species.

4.4.7.4 Conclusion

Given the very low numbers of this species using the banks, coupled with their low flight heights, the proposed wind farm will not have any impact on the very large numbers of wintering Black-headed Gulls using the SPAs in the wider hinterland.

4.4.8 Herring Gull

4.4.8.1 Overview of the qualifying interest

The breeding Herring Gull colonies found around Dublin Bay are nationally important. The colony on Lambay Island is the largest in Ireland with 1,806 pairs. The other SPAs to hold breeding colonies are Ireland's Eye (250 pairs) and the Skerries Islands (170). Additionally, wintering numbers on the Skerries Islands and the Murrough are key conservation features for these two SPAs. Table 4 below presents the peak monthly counts for Herring Gulls from the boat transect surveys from both the 2001 and 2010 surveys.

Table 4 Peak monthly counts of Herring Gulls (from the 2001 and 2010 surveys).

Month	2001	2010
January		26
February		
March	16	304
April	26	4
May		5
June		14
July		42
August	6	35
September	113	9
October		298
November	3	107
December	30	19

Table 4 shows that there was a marked increase in the numbers of Herring Gulls recorded in 2010 as opposed to 2001. In 2010, birds were recorded in all months except February, whilst in 2001 there were nil counts for May, June and July (no counts were undertaken in October, January and February due to unsuitable weather conditions). Newton & Trewby (2011) speculate that the increase in Herring Gull numbers is due, in part, to an increase in the breeding population at Lambay Island. Peak numbers occurred in March (2010), September (2001), October and November (both 2010), with relatively few numbers occurring during the summer months. This suggests that the birds using the banks are passage birds and not necessarily summer residents. Again, following the peak in mid-October, numbers of birds fall during the winter period, suggesting that they, at best, represent a small percentage of the wintering populations using the Skerries Islands SPA or The Murrough SPA. Both studies found that Herring Gulls were distributed throughout the study area, although with some concentration in the northern sections. Newton & Trewby (2011) note that the wide distribution of this species is influenced by the presence of fishing boats; with Herring Gulls being attracted to the boats.

4.4.8.2 Potential for direct impacts

The proposed development is not located within or adjacent to any SPA site for which this species is a conservation interest and no direct impacts are identified.

4.4.8.3 Potential for indirect impacts

Furness & Wade (2012) and Cook *et al*. (2012) both give Herring Gull a high score for being at risk of collision with wind turbines. This is due to their recorded flight heights, although it is acknowledged that this is a species that has a high degree of flight manoeuvrability. Recently, estimates of avoidance rates for many seabirds have been revised upwards (SNH, 2012) recognising the ability of these species to navigate successfully through wind farms. Flight height studies by Newton & Trewby (2011) did record birds flying at up to 70 m high, within the rotor sweep of any turbines. They present their results giving mean flight heights per month. In only two months (September and October) did the mean flight height exceed 30 m i.e. within the rotor sweep of the proposed turbines. However, these two months are outside the breeding season and so are unlikely to significantly impact on any of the breeding Herring Gulls. Whilst birds occurring on the banks in September and October are flying at higher levels than at other stages of the year and are potentially at higher risk of collision with the turbine rotors, Scottish Natural Heritage (2012) now recognises that the basal avoidance rate should be increased from 95% to 98% for species considered to be less capable of avoiding collision. For the majority of species an avoidance rate of in excess of 99% is now considered appropriate. This reflects the growing evidence that actual collision risk is considerably lower than calculated estimates from early models. Collision risk for birds occurring on the banks in September and October will also be accordingly lower than the Furness and Wade score suggests.

Petersen *et al*., 2006 conducted a review of two wind farms constructed off the Danish coast. Their study looked at pre- and post-construction populations of birds using the wind farm areas. Herring Gulls were present at both wind farms year round, but with late autumn peaks in abundance. Their study concluded that for both wind farms considered, there was no effect on the distribution of Herring Gulls following construction. Furness & Wade (2012) have undertaken a study to assign vulnerability scores to differing seabird species in order to determine which species could be potentially impacted by offshore wind farms in Scotland. In this study they concur that Herring Gulls will not be displaced from wind farm sites through disturbance, or by the presence of wind farm structures. In fact they conclude that there may be some gain for Herring Gulls as they may use permanent structures such as the turbines or meteorological masts as perches. Newton & Trewby (2011) speculate that similar use of man-made structures is already happening on the Kish Bank, with the observation that a pair of Herring Gulls may have nested on the Kish lighthouse. Furness & Wade (2012) also score Herring Gull as being very low for disturbance, meaning that construction activities will not lead to any disturbance impacts on this species.

4.4.8.4 Conclusion

From the analysis of the survey data, combined with a review of the available literature we have concluded that there will be no significant adverse impact on Herring Gull populations at any of the SPAs as a result of disturbance or displacement. Given the timing of the peak numbers of Herring Gulls occurring on the banks, the main period for usage of the bank is during passage migration. It might be expected that if birds from local breeding colonies were using the banks to a large extent that high numbers would be seen in late July/September when adults and fledged birds are dispersing from the breeding colonies. However, it can be seen that peak numbers are in October and again in March, suggesting that the majority of these birds are on passage. This coincides with the time when birds seemingly are most often

flying at heights that could lead to risk of collision with turbines. This leads to the conclusion that birds that are at most risk of collision are passage birds and not the breeding birds present in the relevant SPAs. SNH's recent revision of collision risks (SNH, 2012) also concludes that for gull species actual collision risk is lower than predicted in models. The likelihood of there being a significant impact on the features of the SPAs is low.

4.4.9 Lesser Black-backed Gull

4.4.9.1 Overview of the qualifying interest

The only SPA that lists Lesser Black-backed Gull as a key conservation feature is Lambay Island. The site synopsis notes that in 1999, 309 pairs were recorded, making this site nationally important for breeding Lesser Black-backed Gulls. The 2001 and 2010 surveys found very low numbers of birds using the study area. The peak number of birds in the 2001 survey was five, with a peak of eight individuals in 2010. Numbers of birds using the bank during the breeding season was also very low with two birds recorded in April 2001 and none again until another two birds were noted in August. In 2010, birds were recorded in May, June and July but the highest number recorded during the breeding season was four.

4.4.9.2 Potential for direct impacts

The proposed development is not located within or adjacent to any SPA site for which this species is a conservation interest and no direct impacts are identified.

4.4.9.3 Potential for indirect impacts

The 2010 study recorded two flight heights for this species; 4 m and 6 m. These flight heights are low in comparison with those predicted by Cook *et al.* (2012) whose model gave 25.2% of recorded flights being at a height that brings them into risk of collision with rotor blades. It is to be noted that their study used a minimum rotor height of 20 m, not the 30 m that is proposed for the Dublin Array wind farm. Furness & Wade (2012) placed this species as third most sensitive to collision risk, due to the Cook *et al*. (2012) analysis of the percentage of flights at rotor height. Whilst there is a collision risk for this species, it is to be considered against the very low numbers of birds that use the Kish and Bray banks with peaks of five and eight birds in 2001 and 2010 respectively. This species also seems tolerant to disturbance with Furness & Wade (2012) only giving it a score of 2 for disturbance to helicopter and boat traffic, indicating that construction activities will not lead to disturbance for this species.

4.4.9.4 Conclusion

Given the very low numbers of this species using the bank, coupled with the low recorded flight heights, there will be no impact on the Lesser Black-backed Gulls of Lambay Island SPA.

4.4.10 Kittiwake

4.4.10.1 Overview of the qualifying interest

Four of the SPAs within the 35 km hinterland have breeding Kittiwakes as key features of the SPA; Lambay Island (4,091 pairs), Howth Head (2,269 pairs), Ireland's Eye (941 pairs in

1999, 1,024 in 2001) and Wicklow Head (956 pairs). All of these SPAs are considered to be nationally important for this species. Table 5 below presents the peak monthly numbers of Kittiwakes recorded during the boat transect surveys in 2001 and 2010. Kittiwakes were recorded most of the year round but with a definite peak in July, August and September. The September count in 2001 recorded an exceptional 4,382 birds. These high counts include adults feeding fledged chicks and presumably include birds dispersing from breeding colonies. In 2001, a second peak occurred in April, probably including some birds on passage returning to the breeding colonies. Birds were recorded throughout the survey area although highest numbers were found on the bank itself and in the northern section. The 2010 survey also noted that birds were seen in the waters to the east of the bank.

Table 5 Peak monthly Kittiwake counts (from the 2001 and 2010 survey data).

	2001	2010
January		31
February		
March	266	191
April	1,052	101
May		323
June	117	419
July	479	1,577
August	530	1,753
September	4,382	1,034
October		88
November	144	111
December	149	79

Recorded flight heights in 2010 show that only in one month, November, did mean flight heights exceed 20 m (38.3 m), although the figures for August, September, October and December range from 16.9 to 19.8 m, indicating that some of these birds would have been flying at an altitude in excess of 20 m. The highest recorded flight height was 60 m.

4.4.10.2 Potential for direct impacts

The proposed development is not located within or adjacent to any SPA site for which this species is a conservation interest and no direct impacts are identified.

4.4.10.3 Potential for indirect impacts

As with Herring Gulls, Budgey & Ormston, (2009) did not report any issues with Kittiwakes at operational wind farms in the UK. Petersen *et al*., (2006) concluded that for two wind farms off the Danish coast, there was no effect on the distribution of gulls (including Kittiwakes) following construction. Furness & Wade (2012), undertook a review of seabird sensitivities to wind farms and as with Herring Gulls, it was concluded that Kittiwakes will not be displaced from wind farm sites through disturbance or by the presence of wind farm structures, in fact there may be some positive gain as they may use permanent structures such as the turbines (e.g. landing platforms and guard rails) or meteorological masts as perches. Newton & Trewby (2011) recorded birds perched on the Kish lighthouse. Furthermore, a low score was assigned to Kittiwake for disturbance from boat and helicopter traffic, (Furness & Wade, 2012) leading to the conclusion that construction activity will not lead to any disturbance. As previously described the impact assessment on fisheries undertaken for the EIS showed that providing the mitigation measures are followed, that construction activities will not significantly

impact on fish populations. The presence of prey for Kittiwakes, coupled with their tolerance of disturbance, means that construction activity will not impact Kittiwake populations.

Furness and Wade (2012) do consider Kittiwakes to be of some collision risk concern due to their range in flight height, although they do note that Kittiwakes are a highly manoeuvrable species reducing the risk of collision. Cook *et al*. (2012) assign Kittiwake to the medium collision risk group, although they note that the majority, but not all, birds tend to fly at low altitudes, below the minimum height of any turbine's rotor blades. Their model predicts that 15% of all Kittiwake flights will be at height where they are at risk of collision with the turbine rotors. For their model, they used a minimum tip height of 20 m, while the minimum proposed tip height for the Dublin Array is 30 m, suggesting that the percentage of birds flying at a height where they are at risk of collision is somewhat less than 15%. Again, due to a lack of detailed behavioural observations, the *actual* collision risk – that is taking into account the avoidance behaviour of the birds – is not available in the literature.

Birds are highly capable of avoiding collision and it is worth noting that in generic Collision Risk Modelling (e.g. Band *et al*. 2007; Band 2011) that it is noted that in cases where avoidance rates have been derived from empirical data, that the avoidance rates are higher than 95%. The Band Model adopts a conservative approach to application of avoidance rates and all Gull species are assigned a 98% avoidance rate classifying them as at low risk of collision even when flying at heights within rotor sweep. Scottish Natural Heritage (2012) now recognises that the basal avoidance rate should be increased from 95% to 98% for species considered to be less capable of avoiding collision. For the majority of species an avoidance rate of in excess of 99% is now considered appropriate. This reflects the growing evidence that actual collision risk is considerably lower than calculated estimates from early models.

It is concluded that Kittiwake populations will not be impacted through displacement, however, the question of collision risk and the potential impacts on Kittiwake breeding colonies is worthy of further discussion. Large numbers of Kittiwakes were also recorded in the vicinity of the (then) proposed Arklow Bank wind farm in the Irish Sea. Potential impacts on the breeding population was a concern raised during the planning process for the Arklow Bank wind farm, and as part of the post-construction monitoring of the wind farm, the closest breeding Kittiwake colony, at Wicklow Head, was monitored on an annual basis. The most up to date, complete monitoring report available is for the period July 2007 to June 2008, year 8 of post construction monitoring. Monitoring of the Wicklow Head colony showed a slight decline in overall Kittiwake numbers between 2001 and 2008 (courtesy of *SSE Renewables*, unpublished reports). However, this has to be considered in terms of the national demographics for this species during this time-frame.

Mavor *et al*. (2008) report a considerable drop in Kittiwake numbers at other Irish Kittiwake colonies and suggest that, as with similar declines observed in the UK, it may be attributed to observed declines in key prey species (Note that an impact assessment of the proposed Dublin Array offshore wind farm on fish populations has been undertaken which concludes, that with mitigation measures, there will be no significant impact on fish populations). There is no compelling evidence that Kittiwakes are in decline at Wicklow Head as a result of the Arklow Bank wind farm. Although the shallow water around sand banks undoubtedly support high numbers of Kittiwakes, particularly during the post-breeding period, the vast majority of these birds will be flying at heights that are lower than the rotor height of the proposed turbines, greatly reducing collision risk.

4.4.10.4 Conclusion

From the review of available literature we have concluded that there will be no significant adverse impacts on Kittiwake breeding numbers at the SPAs as a consequence of the proposed Dublin Array wind farm.

4.4.11 Tern species (Common Tern, Arctic Tern and Roseate Tern)

4.4.11.1 Overview of the qualifying interest

The three Tern species are mentioned as conservation features for three SPAs; Rockabill, Dalkey Islands and South Dublin Bay and River Tolka estuary. Rockabill and Dalkey Islands are breeding colonies for all three Tern species. Rockabill is particularly noted for its Roseate Tern populations. Birdwatch Ireland figures give the population as 1,200 pairs, representing 90% of the north-western European population. Dalkey Islands have variable numbers of Terns breeding, although 11 pairs of Roseate Terns nested here in 2004. South Dublin Bay and River Tolka estuary supports a breeding colony of Common Terns (400 pairs in 2007). It is also notable for the numbers of Terns roosting there in the autumn, with up to 10,000 birds being recorded.

Table 6 below shows the peak monthly numbers of the three Tern species recorded during the boat transect surveys in 2001 and 2010; clearly illustrating that Terns use the Kish and Bray banks in the late summer period with peak numbers of birds occurring in August and September. It is also clear that the banks are not important feeding areas for these birds during the breeding period. Terns are using the study area post-fledging when adults and young birds are to be found. Terns are summer migrants to Ireland and not surprisingly do not figure in any of the counts during the winter and early spring period, i.e. October through to April.

Table 6 Peak monthly Tern counts (from the 2001 and 2010 baseline surveys).

	Roseate Tern		Common Tern		Arctic Tern	
	2001	2010	2001	2010	2001	2010
January						
February						
March						
April						
May			78			62
June	4		48	35	2	2
July		2	172	146	26	157
August	282	78	583	654	120	46
September	250	323	487	391	144	2
October						
November						
December						

Newton & Trewby (2011) note that Roseate Terns initially use the northern section of the banks, using the Kish lighthouse as a base to undertake foraging flights. In late September, the birds had moved to the south-eastern section of the study area. Common Terns were present throughout the study area although did tend to be associated with the Roseate Terns in the northern section.

4.4.11.2 Potential for direct impacts

The proposed development is not located within or adjacent to any SPA site for which this species is a conservation interest and no direct impacts are identified.

4.4.11.3 Potential for indirect impacts

Budgey & Ormston (2009) note that Tern species are species of interest for a number of UK off-shore wind farms but again do not report that any issues of concern have arisen following construction. The Kentish Flats wind farm reports that no changes in Common Tern numbers have been recorded but that there is some indication of a change to a flight line to a regularly used foraging area although this change is considered to be insignificant (Gill *et al*., 2008).

Everaert & Stienen (2007) report high levels of mortality in Common Tern, Sandwich Tern and Little Terns at a colony in Zeebrugge. It should be noted that the Terns were nesting on an artificial peninsula developed immediately adjacent to a wind farm. No other studies have reported issues with collision risk and it is concluded that the problems at Zeebrugge were attributable to the siting of the wind farm so close to the breeding colony. Cook *et al*. (2012) have used data from offshore wind farms in the UK to model flight heights and look at collision risk for a variety of species. They have placed all three species of Terns in the medium collision risk category. Newton & Trewby (2011) recorded flight height for all three Tern species, none of which had mean flight heights that exceeded 20 m. The highest mean flight height recorded was for Roseate Tern at 12.8 m, with the maximum recorded height for this species of 16 m. Arctic Tern had a peak mean flight height of 10.3 m (range 1 to 15 m), with Common Tern having a peak mean flight height of 11.9 m (range 1 to 20 m). These recorded flight heights are consistent with those reported in the literature (e.g. PMSS 2007, NPR *et al*. 2012) resulting in an evaluation of low collision risk for all three Tern species for the Dublin Array wind farm.

Furness & Wade (2012) look at potential displacement risks for seabirds and assign scores of 8 (Common Tern), 9 (Roseate Tern) and 10 (Arctic Tern) for the three species. They suggest that '*species with scores over 15 (divers, scoters, Goldeneye, Scaup, Eider, Black Guillemot, Slavonian Grebe) should be considered as focal species for concern about potential displacement effects, while species with scores below 8 (Fulmar, Storm-petrels, shearwaters, gulls, skuas, Gannet, Little Auk, and White-tailed Eagle) seem very unlikely to be affected by displacement'.* The three Tern species are therefore not considered as species of high concern with regard to displacement effects.

Lindeboom *et al*. (2011) studied an offshore wind farm in the Netherlands and noted *gulls, Cormorants and Terns did not avoid the farm and used it for foraging*', although they are not specific about the Tern species they observed. Similarly, Wade & Furness (2012) give scores for species according to their sensitivity to disturbance (from turbines, boat and helicopter traffic) with a score of 5 being the highest sensitivity. All three tern species were given a score of 2 in terms of sensitivity to disturbance, suggesting that construction activity is likely to have little impact in tern species.

Nonetheless, during construction, there will be restrictions on piling activities which would have the potential to disturb concentrations of roosting Roseate terns, particularly in the areas close to Kish Lighthouse in the north of the construction area. No piling activity will be undertaken within a buffer zone of 3km of the Kish roosting area during the

August/September period when the area is used by post-fledging terns. As discussed in the Cormorant and Kittiwake sections, construction activities do have potential to impact on fish populations but mitigation measures are proposed so that these impacts are not significant and also unlikely to reduce food sources for tern species.

4.4.11.4 Conclusion

From the review of the bird survey data and literature on existing wind farms (relating to Terns) it is evaluated that there is no likelihood of significant displacement and collision effects on Terns using the Kish and Bray banks during the breeding and post-fledging/staging periods with the implementation of specific mitigation measures for these conservation features. There will be no significant adverse impacts on Tern species listed as conservation features of the SPAs in the wider hinterland of the proposed Dublin Array wind farm.

4.4.12 Auks (Guillemot, Razorbill and Puffin)

4.4.12.1 Overview of the qualifying interest

Only two SPAs within the 35 km hinterland have auk species as key conservation features; Lambay Island (Puffin, Guillemot and Razorbill) and Ireland's Eye (Guillemot and Razorbill). Lambay Island, in particular, has large breeding populations with 59,824 Guillemots, 4,337 razorbills and 265 puffins. Guillemots were recorded year-round in both 2001 and 2010 surveys. Peak numbers in 2001 were recorded in April with 14,218 birds whilst in 2010, peak numbers were found in July with 6,932 noted. Razorbills were also recorded throughout the survey season. Peak numbers were similar (3,110 in 2001 and 2,685 in 2011) but timing was different with the 2001 peak occurring in September and the 2010 peak in July. Puffin numbers were very low and they were not recorded at all times of the year. A peak count of five Puffins was recorded in 2001, with six being the peak noted in 2010.

4.4.12.2 Potential for direct impacts

The proposed development is not located within or adjacent to any SPA site for which this species is a conservation interest and no direct impacts are identified.

4.4.12.3 Potential for indirect impacts

Auk species are typically low flying birds and the highest recorded flight height for any of the species during the 2010 study was 8 m. Cook *et al*. (2012) showed that, in general, auks fly at low heights, considerably below collision risk height. They give less than 0.01% of Guillemot flights are at collision risk height, 0.4% of Razorbill flights and less than 0.1% of Puffin heights are at collision risk heights. Collision risks impacts for all three auk species are considered insignificant.

Puffin numbers using the study area are so low, that it is clear there will be no impact on Puffin populations within the relevant SPAs arising from the Dublin Array wind farm. Furness & Wade (2012) give Guillemot and Razorbill a medium score for disturbance from helicopter and boat traffic. There may be some localised disturbance during construction but the phased approach to construction will minimise these effects. Research conducted at Danish wind farms (Petersen *et al.*, 2006) has looked at populations of Guillemots and Razorbills pre- and post-construction of two offshore wind farms. The two species do not show an increased avoidance of the wind farm area. However, the authors note the distribution of these species

is largely related to their prey species, pelagic fish and wide variations in their distributions from year-to-year have been recorded. Conversely, post construction monitoring of the North Hoyle wind farm (a wind farm situated in a position that is more comparable to the Dublin Array) found that Guillemots showed a statistically increased preference for the wind farm area post-construction, with an increase in numbers of 55%. There was no change in Razorbill distribution following construction (nPower renewables 2005). Fish populations and distribution are likely to be the influential factors on these two species and not the wind farm *per se*. The impact of the wind farm on fish populations has been assessed by Ecoserve and is reported in the EIS (MRG, 2013). The potential impacts and required mitigation measures are proposed and are given in detail in the Cormorant section above. Following mitigation measures, the impacts on fish are considered to be insignificant.

4.4.12.4 Conclusion

Taking account of the low numbers of Puffins within the study area and providing the wind farm does not lead to a significant change in fish species, the likelihood of a significant impact on these conservation features of any SPA site arising from the wind farm is considered negligible.

4.4.13 Gannet

4.4.13.1 Overview of the qualifying interest

Gannets were recorded in considerably higher numbers in the 2010 survey than the 2001 survey. In 2001, the peak figure was 107 birds with a peak of 1,326 in 2011. For all months where Gannets were recorded, the monthly peaks were higher in 2010 than 2001, except for April when figures were very similar.

Gannet is not a feature for any of the SPA's within the 35 km study area. Gannets are known to breed on Lambay Island and Ireland's Eye. Data from the JNCC online seabird register (www.jncc.defra.gov.uk), gives counts from 2010 of 138 and 360 Apparently Occupied Nests (AON) respectively. The numbers of Gannets recorded using the Banks, particularly during the 2010 survey, are considerably higher than the numbers of birds at both of these colonies and, as Newton & Trewby 2011 note, birds from the large Welsh colony at Grassholm are likely to be using the Banks. It is also possible that birds from the Saltee Islands in Co. Wexford are also foraging on the banks. The colony on Grassholm was found to be in excess of 39,000 AON's in 2009 and the Great Saltee colony was 2,446 AON's in 2004 (www.jncc.defra.gov.uk). The Grassholm colony in 1994 was considered to make up more than 12.5% of the North Atlantic breeding population. Gannets have a large foraging range, with a mean of 140 km, and a maximum recorded range of 640 km (Langston, 2010). Both Grassholm and the Saltee Islands are designated as SPA's and have Gannet as a feature for the SPA designation.

4.4.13.2 Potential for direct impacts

The proposed development is not located within or adjacent to any SPA site for which this species is a conservation interest and no direct impacts are identified.

4.4.13.3 Potential for indirect impacts

Newton & Trewby (2011) recorded flight heights for Gannets. This showed considerable variation in height with the lowest recorded being 0.5 m and the highest 75 m. The monthly mean heights recorded show that the mean height did not exceed 30 m, the proposed minimum rotor height. However, in August, the mean height was 29.6 m, only just outside the minimum rotor height. During the key months of May and June, the mean recorded flight heights were 3.4 and 5.8 m respectively; however, no data is presented for July. Cook *et al* (2012), showed that 9.6 % of Gannet flights would be at a collision risk height, a figure they classed as very high. Cook *et al.* (2012) were using 20 m as the minimum rotor tip height, not the 30 m height as proposed for the Dublin Array. They further noted:

'The model for Northern Gannet shows that most, but not all birds tend to fly at low altitudes, below the minimum height of any turbines rotor blades.'

Furness & Wade (2012), give Gannet a low score for displacement and comment that this species is unaffected by displacement. Construction work and operation of the wind farm will not have any impacts, therefore on Gannet populations.

Gannet is a very important breeding seabird species in the UK and Ireland (261,000 nesting pairs according to Wanless *et al*. 2005). The risk of collision for Gannets is unclear (Langston & Boggio 2011) but as it lacks the manoeuvrability of some other seabirds it is considered to be at increased risk of collision. Several studies are underway in the UK to describe the foraging patterns of nesting Gannets (e.g. Langston & Boggio 2011, Langston & Teuten 2012; Soanes *et al*. 2012) using satellite or GPS tags to describe the foraging patterns of this large seabird. Soanes *et al*. (2012) found that Gannets do not depend on specific feeding sites – varying their foraging locations opportunistically, with foraging ranges in excess of 100 km not uncommon. A thorough risk assessment for Gannets in Britain & Ireland arising from increased offshore wind development has been prepared by the Wetland & Wildfowl Trust (2012). This study includes a Population Viability Assessment (PVA) to model various scenarios and assess the impact on the population demographics. This report concludes that the Gannet population of the British Isles is robust to collision mortality because the population is large and increasing. Some 10,000 gannets per year (across all age classes in proportion to their abundance) could be taken from the population before there would be a high likelihood of a decline in overall breeding numbers, providing other aspects of gannet ecology do not change drastically.

4.4.13.4 Conclusion

Taking account of the above it is not considered that the Dublin Array Wind Farm has the potential to significantly adversely impact upon the Gannet population as a whole or in the protected SPA breeding colonies from which the birds observed are drawn.

4.4.14 Manx Shearwater

4.4.14.1 Overview of the qualifying interest

Peak numbers for Manx shearwater were recorded in August in both survey years (2001 and 2010), with maximum counts of 3,764 and 4,513 respectively. The 2001 survey recorded higher numbers in the late spring period than in 2010 but thereafter throughout the rest of the summer period, numbers are similar for both surveys. As Newton & Trewby 2011 note the majority of these birds are likely to originate from the Pembrokeshire Islands of Skomer and

Skokholm (Manx shearwaters have a large foraging range, mean of 171 km, Langston, 2010). Manx shearwater is not a feature for any of the SPA's within the 35 km study area, although Lambay Island is known to support a small population, the site synopsis quotes 50 pairs. Skomer and Skokholm form part of a single SPA and has a breeding Manx shearwater population in excess of 150,000 pairs forming more than 50% of the total breeding population.

4.4.14.2 Potential for direct impacts

The proposed development is not located within or adjacent to any SPA site for which this species is a conservation interest and no direct impacts are identified.

4.4.14.3 Potential for indirect impacts

Manx shearwater is a low flying species. Furness & Wade (2012) give it a score of zero in terms of collision risk, with Cook *et al*. (2012) determining that only 0.04% of flights are at collision risk height. This is borne out by the recorded heights on the Banks, with a maximum height of only 5 m and the peak monthly mean height of 1.3 m (Newton & Trewby, 2011). Collision risk arising from the Dublin Array wind farm will not affect Manx shearwater populations.

Furness & Wade (2012) also give Manx shearwater a low score for disturbance and displacement, including disturbance form boat and helicopter traffic. In previous sections, impacts on fish populations and recommended mitigation measures have been discussed and conclusions from a fish impact assessment have concluded that fish populations will be insignificantly impacted.

4.4.14.4 Conclusion

It is evaluated that the construction activity and operation of the wind farm will have no impact on Manx shearwater populations within designated SPA sites.

4.4.15 Cumulative Impacts potentially affecting SPA sites

Cumulative impacts for offshore wind farms are usually considered under four categories: Collision Mortality, Disturbance, Barrier Effect and Displacement (SNH, 2012). The Seabirds Assessment (Ecology Ireland, 2013) literature review included the potential for collision mortality of bird species of conservation importance – in particular those listed as conservation features of interest for SPAs in the wider hinterland, as well as the potential for significant disturbance or displacement of birds; based on the field data and the construction plan. Available information from existing offshore wind farms in the Irish Sea and the proposed and permitted wind farms in this area were also reviewed to inform the current assessment. According to the OSPAR Commission (2008b) the assessment of cumulative / in-combination effects on bird populations is currently underdeveloped with specific reference to the lack of completed large wind-farms located adjacent to each other, or within the ecological range of key species / populations which results in cumulative impact assessments requiring prediction of effects in the absence of measured data.

There are a number of sand bank sites within the Irish Sea; from north to south they include the Bennet, Burford, Kish, Frazer, Bray, Codling, India, Arklow, Seven Fathom Bank, Glassgorman, Rusk, Blackwater/Moneyweights, Lucifer, Long and Holdens Banks. There are

two additional wind-farm projects that need to be especially considered in conjunction with the proposed Dublin Array wind farm in order to assess any cumulative impacts on the features of the relevant SPAs. These are the Arklow Bank wind farm and the Codling Bank wind farm.

The Codling Bank wind farm has permission for the construction of 220 turbines; although no have been erected to date an application for an extension to the licence has been submitted. Monitoring of the birds using the bank took place between March 2001 and April 2003 using both boat-based and aerial surveys (CWC, 2009). The key species present were Manx Shearwater, Guillemot, Razorbill, Shag and Gannet. Little detailed information is available on the results of the monitoring other than the conclusion that the Codling Bank is *'not considered to be of particular sensitivity for birds'* (CWC, 2009).

The impact assessment of the Dublin Array wind farm on fish populations includes a cumulative impact assessment, taking account of other offshore wind farm developments. This impact assessment states that fish populations can be impacted through loss of habitat and species, alteration in hydrology and impacts arising through vibration, noise and electromagnetic fields. The fish impact assessment concludes that the cumulative impacts on fish populations will be minimal. As there will be only minimal impacts on fish, it can be concluded that the food source for the breeding and wintering seabirds in the relevant SPAs will not be impacted through the development of the Dublin Array wind farm, in combination with the existing and consented offshore wind farms.

Arklow Bank has permission for 200 turbines, but to date only seven turbines have been erected. These turbines became operational in 2004. The EIS for this project identified Red-throated Diver and Little Gull as the most sensitive species at this location. Monitoring of the seabirds using the survey area around the wind farm following construction was undertaken on an annual basis up to June 2010. The monitoring programme followed boat based transect survey methods as standard as well as monitoring numbers and productivity of the nearest seabird breeding colony of note at Wicklow Head.

The most recent full report available on the monitoring programme is for year 8, 2008. This unpublished report for Airtricity (now *SSE Renewables*) looks at the results for year 8 but also compares them with previous years' data in order to determine if there are any long term declines in any of the species using the Arklow Bank. The only statistically significant result is for Red-throated Diver, which is showing a decline in numbers using Arklow Bank. This species has only been found in extremely low numbers at the Kish and Bray banks. If Red-throated Divers are indeed being displaced from Arklow Bank, then they are not using the Kish Bray banks as an alternative feeding ground. Similarly, the EIS for Codling Bank wind farm recorded very low numbers of Red-throated Divers in the area between Arklow Bank and the Kish/Bray Banks. Therefore it can be concluded that the erection of the Dublin Array wind farm will not have any significant additive or synergistic, adverse impact on the Red-throated Diver population in the Irish Sea.

The extensive literature review undertaken to inform the Seabird Assessment for the NIS (included as Appendix 3) referred to numerous Environmental Impact Statements and post construction monitoring reports for operational offshore wind farms that are located in the eastern Irish Sea; including Barrow, Burbo Bank, North Hoyle, Rhyl Flats and Gwynt y Môr. These wind farms were also included in Budgey & Ormston's review of post-construction monitoring of UK offshore windfarms (Budgey & Ormston, 2009). To date, no issues have

arisen with any of these windfarms that suggest significant adverse impacts on bird populations and species of elevated conservation importance.

4.4.16 Mitigation measures for the avoidance of significant effects at SPA sites

For the Dublin Array wind farm, mitigation measures are proposed for the construction period. These measures are largely to prevent impacts to local fish populations which provide a food source for many of the seabird species that use the Kish and Bray banks. Mitigation measures proposed are:

- During construction, there will be restrictions on piling activities which would have the potential to disturb concentrations of roosting terns, particularly in the areas close to Kish Lighthouse in the north of the construction area. No piling activity will be undertaken within a buffer zone of 3km of the Kish roosting area during the August/September period when the area is used by post fledging terns.
- Cable trenches are to be refilled with material of a similar particle size as the original material and to the same depth in order to allow benthic habitats to recover.
- Mechanical and acoustic soft start procedures are to be used during piling operations to minimise noise and vibration impacts on fish populations. These include the use of a cofferdam or equivalent noise-reduction system.
- Construction is to take place over a two to three year period to reduce any potential disturbance impacts to birds and to allow benthic habitats to recover.

A full monitoring programme to determine seabird abundance and distribution is to be instigated using the same boat based survey methodology as undertaken by Percival during 2001 and Newton & Trewby in 2010. The monitoring programme is to be carried for one full 12 month period prior to construction, during all years where construction is taking place and for at least three years following construction.

4.5 Implications for the conservation objectives of the Natura 2000 sites within the study area

4.5.1 Conservation Objectives of the cSAC sites

The Conservation Objectives of both the proposed Rockabill to Dalkey Island SAC and the Lambay Island cSAC are the same, based on the NPWS generic conservation objectives presented for designated Natura 2000 sites; that is '*to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected'*. In the case of the proposed Rockabill to Dalkey Island SAC this is with regard to Annex I Reef habitats and Annex II Harbour porpoise populations and for the Lambay Island cSAC this is in regard to Annex I Vegetated sea cliffs of the Atlantic and Baltic coasts and Annex II listed Grey sea populations.

Based on the above Conservation Objectives, taking account of the data obtained and available for the assessments used to inform the current NIS and with regard to published literature addressing the interactions of off-shore wind energy and these ecological interests it is concluded that the proposed development either alone or in-combination will not cause an adverse effect on the integrity of the relevant SACs with regard to their conservation interests.

4.5.2 Conservation Objectives of the SPA sites

The Conservation Objectives of all SPA sites within the study area of the proposed development and assessed in the current NIS are based on the NPWS generic conservation objectives; that is '*to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for the SPA*'. The bird species listed as conservation interests within each SPA site have been assessed individually in the current assessment, with regard to their conservation condition within the relevant SPA sites.

Based on the above Conservation Objectives, taking account of the data obtained and available for the assessments used to inform the current NIS and with regard to published literature addressing the interactions of off-shore wind energy and these ecological interests it is concluded that the proposed development either alone or in-combination will not cause an adverse effect on the integrity of the relevant SPAs with regard to their conservation interests.

4.6 Conclusions

Evidence to date illustrates that wind power does not have to threaten wildlife but appropriate siting is critical and must be a first goal of the planning process (European Commission, 2010). In a position statement by Birdlife International (Birdlife International, 2003), there was a strong consensus that the location selected for a wind farm is critically important in determining the likelihood of deleterious impacts on sensitive species, particularly birds. It is stated by Birdlife International that wind farms must be located, designed and managed so that there are no significant adverse impacts on birds of acknowledged national and international importance, or their habitats. Hence there should be precautionary avoidance of locating wind farms in the following:

- Special Protection Areas (SPAs) and Important Bird Areas
- Statutorily designated or qualifying international (Natura 2000 sites) or national sites for nature conservation
- Other locations of significance for bird species identified by BirdLife International as being of Unfavourable Conservation Status in Europe.
- Sites along major migration routes and especially migration bottlenecks where large numbers of birds are highly concentrated, for example mountain passes.
- Habitats where wind farms are known to pose high collision risks to birds (to be assessed through site specific risk assessment). Wetlands and mountain ridges are examples of especially critical locations.

Research has also shown that in the case of many of the wind-farms and species considered that there is no indication that the construction and operation of appropriately sited offshore wind farms has any significant adverse impacts on the bird species using these areas (e.g. Topping and Petersen, 2011). The proposed Dublin Array Wind Farm meets the above location criteria; where the proposed development is not located within or directly adjacent to any designated Natura 2000 sites. The potential for impacts on Natura 2000 sites resulting from the proposed development have been recognised. Appropriate conservation measures are identified for implementation to ensure maintenance of the habitats and species for which the above sites have been designated to a favourable conservation status (compliance with Article 6(1) of the EU Habitats Directive). The proposed development will also avoid damaging activities that could significantly disturb these species or deteriorate the habitats of

the protected species or habitat types (compliance with Article 6(2) of the EU Habitats Directive).

The designated SAC sites within the study area of the proposed wind energy development were assessed with particular regard to potential impacts affecting marine mammals; i.e. Grey seals and Harbour porpoises, Annex II species listed as qualifying interests of two SAC sites within the study area. From the conclusions of the Marine Mammals assessment (BEC, 2013) it is evaluated that the development will not have a significant adverse effect on these Natura 2000 sites; with the implementation of prescribed mitigation measures. Mitigation measures proposed will avoid direct injury to marine mammals during construction. Although a temporary reduction in Harbour porpoise activity is identified within the proposed Rockabill to Dalkey Island SAC during piling operations, this reduces to nil while construction is on-going at the southern end of the Array. The temporary and reversible nature of this effect will not prevent Natura 2000 sites from achieving their Conservation Objectives or result in significant adverse effects on the integrity of the site. The operation of the wind turbines will not result in the exclusion of harbour porpoises from the wind farm area. There will be no long-term impact on the integrity of these SAC sites, as the wind farm is located outside the designated boundaries of both the proposed Rockabill to Dalkey Island SAC and the Lambay Island cSAC.

In recent years advances in survey methodology and technological advances such as bird RADAR and satellite/GPS tagging of birds have led to a proliferation of peer reviewed literature examining the pre- and post-construction behaviour and distribution of birds at offshore wind farm sites. The predicted impact of the erection of these structures was informed by observation at onshore wind-farms and intuitive forecasts from experienced ecologists. Thus the risk to seabirds of collision with turbines, displacement from feeding or roosting area and disturbance to migration by means of the creation of a 'barrier' to movement, were postulated as potential impacts arising from the development of offshore wind farms. The Seabird Assessment (Ecology Ireland, 2013) provides an analysis of the available literature, in combination with the collated baseline survey data on the bird species using the proposed Dublin Array development area. This report concluded that the nature and extent of the predicted impacts on seabird species is not of a scale that will have any significant adverse impacts on any SPA sites, or their conservation objectives.

Taking account of the mitigation measures proposed for the avoidance and reduction of adverse effects on the qualifying interests and conservation objectives of the designated Natura 2000 sites within the study area it is concluded that the proposed Dublin Array Wind Farm development will not result in direct, indirect or cumulative impacts which would have the potential to adversely affect the qualifying interests / special conservation interests of the Natura 2000 sites within the study area with regard to the range, population densities or conservation status of the habitats and species for which these sites are designated.

The provisions of Article 6 of the 'Habitats' Directive 92/43/EC (2000) defines 'integrity' as the 'coherence of the site's ecological structure and function, across its whole area, or the habitats, complex of habitats and / or population of species for which the site is or will be classified'. It is considered that the proposed wind farm development, with the implementation of the prescribed mitigation measures, will not give rise to significant impacts affecting the integrity of any designated site within the Natura 2000 network.

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APPENDIX 1 Hydrodynamic Modelling Assessment (Hydro Environmental, 2013)

APPENDIX 2 Report on Marine Mammals (BEC, 2013)

APPENDIX 3 Seabird Impact Assessment Report (Ecology Ireland, 2013)