

DUBLIN ARRAY

An Offshore Wind Farm on the Kish and Bray Banks

Environmental Impact Statement

Addendum (February 2013)

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1 Introduction

Kish Offshore Wind Ltd and Bray Offshore Wind Ltd propose to develop an offshore wind farm, to be known as Dublin Array, on the Kish and Bray Banks approximately 10 km off the coasts of Dublin and Wicklow.

The proposed development will comprise up to 145 wind turbines with a maximum blade tip height of 160m (max. rotor diameter of 130m and max. hub height of 100m) above mean sea level and associated infrastructure including the turbine foundations, inter-turbine/export cabling and offshore substation. It will be located within an area of 54 km² in water depths ranging from 2 to 30m.

An Environmental Impact Statement (EIS) was compiled on behalf of the project promoters to accompany the application for the Foreshore Leases for the project. The full Environmental Impact Statement described in detail the need for the development, the process of site and cable route selection and the design, construction, operation and eventual decommissioning of the wind farm. It also assessed the environmental impacts of the proposed development on the physical, biological and human environments and identifies appropriate mitigation measures and monitoring.

Following initial feedback from the Marine Licensing Vetting Committee (MLVC), who reviewed the original EIS documentation on behalf of the Department, further surveys and assessments were commissioned in order to facilitate a detailed response to the additional information requested by the MLVC and in late 2011 MRG Consulting Engineers Limited were engaged by the project promoters to review and update the Environmental Impact Statement accordingly. The revised EIS was submitted to the Department in February 2012.

This document comprises an Addendum to the revised EIS and provides updated information in relation to the following aspects of the development.

Section 1 – Introduction

This section outlines the scope of the addendum and provides updated information in relation to policy applying to the development.

Section 2 – Addendum to Chapter 2 of Dublin Array EIS (Description of the Proposed Development)

This section updates the Description of the Proposed Development included in Chapter 2 of the Environmental Impact Statement to include the proposed adoption of developing technology comprising the use of steel cofferdams to reduce the transmission of underwater noise during pile driving operations associated with the installation of the steel monopiles supporting the offshore wind turbines and to exclude piling activity from a 3 km buffer zone around the Kish roosting area during the August/September period when the area is used by post fledging terns.

Section 3 - Addendum to Chapter 4 of the Dublin Array EIS (Physical Environment)

Following completion and submission of the EIS to the Department of Environment, Community & Local Government, Hydro Environmental Ltd were commissioned by Saorgus Energy Limited to further investigate the potential hydrodynamic impact of the proposed Dublin Array Wind Farm. Their report attempts to quantify the hydrological and sedimentological impacts of the proposed 145 turbine wind farm development on the Kish and Bray banks through a calibrated hydrodynamic model of the subject waters. The

purpose of this addendum to Chapter 4 of the Environmental Impact Statement is to review the magnitude and significance of potential impacts of the proposed Dublin Array on the Physical Environment in the context of any additional information presented in their assessment. A full copy of their report titled Hydrodynamic Modelling Assessment of the Dublin Array project on the Kish and Bray Banks is presented in full in Appendix A of this Addendum to the Environmental Impact Statement.

Section 4 - Addendum to Chapter 9 of the Dublin Array EIS (Birds)

Following completion and submission of the EIS to the Department of Environment, Community & Local Government, Ecology Ireland were engaged by the project promoters to undertake a further assessment of the potential impacts of the development on seabirds. The purpose of their assessment was to inform the Appropriate Assessment for the project and it examined the potential for impacts on birds, in particular seabirds, and any likely significant impacts of the development of the Dublin Array on any Natura 2000 site, where birds are a key conservation feature of interest.

The purpose of this addendum to Chapter 9 of the Environmental Impact Statement is to include any additional information in relation to the potential impact of the development on birds identified in the Ecology Ireland report entitled THE PROPOSED DUBLIN ARRAY WIND FARM – ASSESSMENT OF POTENTIAL IMPACTS ON SEABIRDS (Information in support of the Appropriate Assessment of the proposed Wind Farm). A copy of the report is included in Appendix B of this Addendum to the Environmental Impact Statement.

Section 5 - Addendum to Chapter 10 of the Dublin Array EIS (Marine Mammals and Turtles)

Following completion and submission of the EIS to the Department of Environment, Community & Local Government, BEC Consultants were engaged by the project promoters to undertake a further assessment of the potential impacts of the development on marine mammals. The purpose of their assessment was to inform the Appropriate Assessment for the project and it examined the potential for impacts on marine mammals, and any likely significant impacts of the development of the Dublin Array on any Natura 2000 site, where marine mammals are a key conservation feature of interest.

The purpose of this addendum to Chapter 10 of the Environmental Impact Statement is to include any additional information in relation to the potential impact of the development on marine mammals identified in the BEC Consultants report entitled 'Report on Marine Mammals in relation to the Dublin Array Natura Impact Statement'. A copy of the report is included as an Appendix of this Addendum to the Environmental Impact Statement.

Section 6 - Addendum to Chapter 12 of the Dublin Array EIS (Landscape and Visual Impact Assessment)

Chapter 12 of the Dublin Array EIS (Volume 2) submitted to the Department of Environment, Communications and Local Government in February 2012 included a detailed description of the likely visual impacts of the proposed development based on the ZTV Maps and Photomontages (Volumes 4 and 5 of EIS) which had previously been submitted to the Department. Given the time which has elapsed since the preparation of these initial photomontages and ZTV maps in 2004, with changes to landscape context and updates to best practice and technology, as well as minor amendments to the proposed locations of the turbines based on more detailed geotechnical and bathymetric survey data, it was deemed appropriate to update the ZTV Maps and Photomontages as part of the current Addendum to the EIS. Revised Volumes 4 (ZTV Maps) and 5 (Photomontages) are therefore included with the Addendum documentation being submitted to the Department in February 2013. Section 6 of this Addendum includes Amended Tables 12.1 (Description of Viewshed Reference

Points (VRP's)), 12.2 (Assessment of Landscape Sensitivity of Viewshed Reference Points) and 12.3 (Summary of Landscape Impact from each of the VRPs) as well as updated Landscape Impact Assessments from each of the Viewsheds to reflect the revised images. Details of the Methodology used by Macro Works Ltd in the preparation of the revised viewsheds and photomontages is included in Appendix E of this Addendum to the Dublin Array EIS.

The following paragraphs provide an update on current government policy in relation to renewable energy since the completion of the EIS.

In February 2008 the Minister for the Department of Communications, Energy & Natural Resources announced that the REFIT scheme will include offshore wind energy projects at a value of €14 per MWh. In September 2009 the offshore REFIT support measures were published by the Department. However, in 2012, Government announced that offshore REFIT would not be progressed for the time being, due to the global economic downturn. However, at the same time, Government began to actively explore the possibilities for export of Irish renewable energy to the UK. Such renewable energy could include both onshore and offshore wind energy projects and there are several such projects actively seeking to connect to the UK and supply electricity in the medium term.

This process has now reached the stage where the Irish and UK Governments signed a Memorandum of Understanding on Energy Trading on January 24th 2013. At the signing of this agreement, Minister Rabbitte said:

"Ireland has the potential to generate far more wind energy than we could consume domestically. The opportunity to export this green power presents an opportunity for employment growth and export earnings which we must seize if we can. Today the two Governments are committing themselves to a programme of work.

"We will work closely with the UK government so we are in a position to move towards a formal agreement on energy trading. We will tease out the very complex engineering and market issues so that, subject to their successful resolution and a decision by UK and Irish Ministers to proceed, in a year's time, we will be in a position to make an intergovernmental agreement providing a formal basis for energy trading."

It is therefore clear that the Governments intend to facilitate large scale wind energy projects that will contribute to the achievement of Irish and UK 2020 EU targets. This is a clear signal to wind energy developers. Dublin Array therefore has two potential routes to market. Government may, depending on the prospects for achieving current and future mandatory EU targets, proceed with a scheme to construct offshore wind energy for domestic consumption in Irish waters. If so, Dublin Array will be in a position to assist in the achievement of targets in this way. The revenue of the project in this case will come from sales of electricity onto the Irish market together with a market-based investment support initiated by Government.

Alternatively, the measures to be proposed in the forthcoming Intergovernmental Agreement in relation to green energy export may allow offshore wind energy projects in the Irish Sea to export renewable energy to the UK, either by way of "statistical transfer" as mandated by the EU Renewables Directive or by way of new interconnector cables across the Irish Sea. The revenue of the project in this case will come from sales of electricity onto the UK market together with a market-based investment support initiated by the UK Government. The exact nature of such a scheme is dependent on measures yet to be introduced by both Governments. However, it is clear as of the time of writing in February

2013 that both Governments wish to encourage Irish export projects such as Dublin Array. In this sense, it is important that projects such as Dublin Array are ready to proceed to construction once the relevant enabling framework is put in place by the authorities. Dublin Array is completing the necessary consenting programme in parallel with these government initiatives.

The Offshore Renewable Energy Development plan (OREDPA) was commenced in 2009 and involved a broad examination of the renewable energy resources available within Irish coastal waters and to what degree these resources could be developed sustainably. As part of the OREDPA, a strategic environmental assessment (SEA) was carried out. The SEA provides for strategic environmental consideration at an early stage in the decision making process, and is designed to complement the environmental impact assessment (EIA) process which is undertaken on individual projects such as Dublin Array. The Dublin Array was included in the SEA and in the formulation of the OREDPA. In determining how much offshore wind could be accommodated in the Irish Sea sustainably, the SEA classified Dublin Array as existing infrastructure.

The SEA found that cumulative effects across receptors for development of up to 1500 MW of offshore wind along the east coast to be negligible. This was divided into 600 MW in the northern part of the Irish Sea and 900 MW in the southern part of the Irish Sea. Dublin Array straddles the SEA boundary between the northern and southern parts and the proposed capacity of the project is within the range predicted by the SEA to have negligible effects.

The draft OREDPA, SEA and Natura 2000 assessment was put out for public consultation in 2010 and the consultation was closed in May 2011. The OREDPA has remained in draft form since then and final publication is expected in 2013. This EIS has been prepared in the context of the long standing draft OREDPA as published, a copy of which is included in Appendix A of this Addendum to the Dublin Array EIS. This EIS will be updated as necessary when the OREDPA is published in final form.

2 Addendum to Chapter 2 of Dublin Array EIS (Description of the Proposed Development)

Chapter 2 of the Dublin Array EIS provides a description of the proposed development. As detailed in Section 2.3.3, it is envisaged that each of the wind turbines at the Dublin Array will be supported on a foundation consisting of a steel monopile and a transition piece. A monopile is a long cylindrical steel tube with a diameter in the range 4.0 to 6.5 m, wall thickness of 60 to 80 mm and weights of up to 600 tonnes. These foundations are installed in the seabed to a depth of between 20 and 40 metres by a large special purpose ship or rig.

As detailed in Chapters 8 and 10 of the Dublin Array EIS the underwater noise generated by the installation of these foundations can have significant impacts on fish and marine mammal species including permanent or temporary hearing loss and aversive behaviour depending on their proximity to the installation operations. Mitigation measures identified in the Dublin Array EIS to minimize the effects of underwater noise generated by these operations included the use of MMO's (marine mammal observers) and soft start techniques.

Subsequent to the completion of the Dublin Array EIS a further mitigation measure to reduce the level of sound transmitted to the water column during offshore piling operations has been developed and tested. This involves the use of a cofferdam comprising a large steel tube which sits on the seabed and surrounds the pile during pile-driving operations. Water within the cofferdam is pumped out prior to commencement of pile driving operations so that the pile sits within the cofferdam with minimal contact with the surrounding seawater. The lack of direct contact with the pile as well as the barrier effect formed by the cofferdam significantly reduces the sound energy transferred to the surrounding water column. Full scale testing of such a system developed by Lo-Noise ApS was completed at Arhus Bay in Denmark in late 2011 and measurements showed that significant reductions in the noise transferred to the water column can be achieved. As detailed in Section 5 of this Addendum to the Dublin Array EIS, the use of such a cofferdam system during pile driving operations for the Dublin Array is now proposed as a further mitigation measure in order to reduce the potential impact of underwater noise on harbour porpoise within the proposed Rockabill to Dalkey Island pcSAC.

Another mitigation measure identified subsequent to the completion of the Dublin Array EIS, following completion of the further impact assessment on birds detailed in Section 4 of this document was that though it acknowledged that construction activity was likely to have little impact on tern species, it was suggested that restrictions on piling activities with the potential to disturb concentrations of roosting terns, particularly in the areas close to the Kish Lighthouse in the north of the construction area would be appropriate. A mitigation measure comprising the exclusion of piling activity from a buffer zone of 3 km of the Kish roosting area during the August/September period when the area is used by post fledging terns was proposed.

The purpose of this section of the Addendum to the Dublin Array EIS is to note the amendment of the Description of the Proposed Development to include the two mitigation measures identified above, which can be summarized as follows:

- A steel cofferdam system will be used during pile-driving operations to restrict the transmission of underwater noise. This will follow latest available commercial technology in relation to such installations.
- No pile driving operations will take place within a 3 km buffer zone of the Kish roosting area for terns during the August/September period when the area is being used by post fledging terns.

3 Addendum to Chapter 4 of Dublin Array EIS (Physical Environment)

3.1 Introduction

Chapter 4 of the Environmental Impact Statement prepared for the Dublin Array described the existing physical environment within and around the proposed Foreshore Lease Area and along the cable route to shore including underlying bedrock geology, sedimentology, bathymetry, hydrology and coastal morphology and examined the potential impacts of the proposed wind farm development on these environments during the construction and operational stages of the project.

In order to supplement existing geological, bathymetric and hydrological data for the site and to inform the EIA process, Saorgus Energy had commissioned the following additional surveys for the proposed development:

- Bathymetric and geophysical survey of Kish and Bray Banks was undertaken by Hydrographic Surveys Ltd between June and September 2008. A copy of their report titled ***Kish and Bray Banks, Proposed Turbine Location Feasibility Study, Hydrographic and Geophysical Report of Survey, Volume 1, June – September 2008, PN 18/08*** was included in full in Volume 3, Appendix B of the EIS.
- Geotechnical investigations comprising three exploratory boreholes by cable percussion methods, sampling, insitu and laboratory testing were undertaken by Glover Site Investigations Ltd. in September 2008. Copy of their report titled ***Proposed Kish & Bray Banks Offshore Windfarm, Preliminary Site Investigation, Report No: 08-0585*** was included in full in Volume 3, Appendix B of the EIS.

Chapter 4 of the EIS was further informed by a report prepared by Prof. John R. Graham, Department of Geology, University of Dublin, Trinity College who had been commissioned by Saorgus Energy to carry out an impact assessment for the proposed development on the physical environment. A copy of his report titled ***Geological Report on the Environmental Impact of the Proposed Kish & Bray Banks Wind Farm Development*** is presented in full in Volume 3, Appendix B of the Environmental Impact Statement.

The EIS concluded that the proposed development would have an insignificant effect on the hydrography and sediment transport processes of the banks, and the effects on coastal stability and coastal erosion would be negligible.

Following completion and submission of the EIS to the Department of Environment, Community & Local Government, Hydro Environmental Ltd were commissioned by Saorgus Energy Limited to further investigate the potential hydrodynamic impact of the proposed Dublin Array Wind Farm. Their report attempts to quantify the hydrological and sedimentological impacts of the proposed 145 turbine wind farm development on the Kish and Bray banks through a calibrated hydrodynamic model of the subject waters.

A full copy of their report titled ***Hydrodynamic Modelling Assessment of the Dublin Array project on the Kish and Bray Banks*** is presented in full in Appendix B of this Addendum to the Environmental Impact Statement.

The purpose of this addendum to Chapter 4 of the Environmental Impact Statement is to review the magnitude and significance of potential impacts of the proposed Dublin Array on the Physical Environment in the context of any additional information presented in the above report.

3.2 Outline Description and Results of Hydrodynamic Modelling Assessment

In order to provide baseline information on the tidal regime along the banks as input to the Hydrodynamic Modelling Assessment and to provide a data set for model calibration, a detailed hydrographic survey was carried out for the project by Aquafact International over a four week period commencing in late August 2012. The survey measured the vertical varying currents and water depths from 23rd August to the 19th September 2012 at two sites, one located at the northern end of the Kish Bank and the second on the southern end of the Bray Bank. Two further locations midway along the banks were monitored over a 24 hour period from 19th to 20th September 2012. The results of the hydrographic survey are presented in a separate report entitled **Marine Hydrographic Survey of the Kish Bank Co. Wicklow – August September 2012** which is included as an Appendix to the main Hydro Environmental Report in Appendix B of this Addendum to the Dublin Array EIS.

A hydrodynamic mathematical model capable of accurately simulating tidal dynamics in the vicinity of the proposed Dublin Array and the Kish and Bray Sand Banks study area was developed by Hydro Environmental using the TELEMAC Hydraulic Software System, a powerful integrated modeling tool suited to modeling the complicated hydrodynamics of the Irish Sea coastal waters off the Wicklow and Dublin coastline. The total model domain extended from Skerries near Rush, North Dublin 66km south to Wicklow Head and from the Irish shoreline 43 km eastward into the Irish Sea, giving an overall model domain of 2,786km² with the immediate Dublin Array at 54km². The bathymetry within the domain area was produced by triangulation of the data collected for the project by Hydrographic Surveys Limited in 2008, GSI Informar Lidar Surveys (highly refined seabed lidar survey for much of the domain including the north and middle sections of the Kish and Bray Sand Banks) and the BODC (British Oceanographic Data Centre) European Shelf 0.5 minute bathymetry. The hydrodynamic model was then calibrated and validated against the tidal velocity and depth measurements performed by Aquafact in August/September 2012 which provided an excellent data set for the purpose. This confirmed that at all of the measured sites the computed and measured hydrodynamic data agreed well with each other, in particular the timing of peak and slack velocities, the tidal heights being extremely consistent over the measurement period and the magnitude and direction of tidal flows. The variation in tidal range and velocities was also well demonstrated by the model with the tidal range decreasing significantly from north to south as it approaches the amphidromic point of Arklow, whereas the velocities increased southwards. The results, as presented in the Hydro Environmental Report in Appendix A of this Addendum to the Dublin Array EIS, clearly demonstrated that the hydrodynamic model prepared for the study area was robust and accurate and replicates extremely well the complex tidal regime in the vicinity and across the Kish and Bray Sand Banks. It was therefore concluded that the Dublin Array Hydrodynamic Model was fit for purpose in quantifying the baseline hydrodynamic conditions and in measuring the potential impact of the steel monopiles supporting the turbines locally and on the far field.

Having confirmed the validity of the hydrodynamic model, a 30-day simulation period set from the 23rd August to the 22nd September 2012 representing the tidal characteristics of a full lunar cycle that included spring, mean and neap tides was used to assess the baseline

tidal flow regime within the area of interest and to assess the hydrodynamic impact of the proposed development. The hydrodynamic study confirmed that the tidal flow velocities and their corresponding bed shear stresses were high throughout the study area. The computed average bed shear stress over the simulation period was found to be of sufficient magnitude to be capable of mobilizing (eroding) a coarse to very coarse sand and that maximum computed shear velocities along the crest of the sand bar and to the south were sufficient to mobilize a fine gravel. These high ambient shear stresses indicate a mobile surface bed layer given that the bed survey shows the majority of the bank area to consist of fine to medium sands. The study concluded therefore that the upper sand layer within the banks is mobile and capable of successive erosion and deposition taking place over spring and neap tide cycles. Computation of the residual currents which reveal the overall net transport characteristics revealed a clockwise circulation along the banks with a northwards trending residual flow on the west side and southwards trending residual flow on the east side. Such residual flow pattern maintains the sand bank integrity by retaining sediment within the circulation.

The hydrodynamic impact assessment between the existing and proposed cases showed only a minor local impact on current velocities and revealed no discernible cumulative/combined impact from the 145 monopiles within the 54 km² area and no impact on the residual circulation of the banks and wider area covered by the model. The modelling revealed only very localized increases in tidal velocity at the monopile structures with increases of 0.2 to 0.4 m/s and only within 5 to 10m of each monopile. These localized increases in velocity will increase the local scour effects which can easily be mitigated by the provision of rock armour scour protection on the seabed around the base of each monopile as detailed in Section 2.3.4 of the EIS.

The simulations show that the main effect of the monopiles is to reduce tidal velocities at the upstream stagnation point and at the downstream wake of the monopile. The maximum wake effect from the piles is generally 100 to 150m at a 0.05m/s reduction (the simulation average effect is typically 50m from the pile at a reduction of 0.05m/s and greater).

In terms of sediment transport, the hydrodynamic impact assessment concluded that the local impact on tidal velocities, identified in the simulations, will have no discernible impact on the sediment regime within the Kish and Bray sand bank system. In the absence of appropriate mitigation measures (scour protection) local erosion is likely in the immediate vicinity of the monopiles but will be limited to within 5 to 10m of each pile. The localized reduction in tidal velocities as a result of the wake effect from the monopiles will not give rise to any noticeable deposition effects as the returning tidal flow will remove any such additional deposition.

The overall conclusions from the hydrodynamic modelling study is that very localized changes in tidal velocity will arise as a result of the development of the Dublin Array, but on the scale of normal ambient tidal currents such changes will not be significant and will not alter the hydrodynamic regime of the Kish and Bray Sand Bank system. Given the localized minor scale of the impact the study concluded that there would be no perceptible hydrodynamic impact to the adjacent Irish shoreline or the neighbouring sand bank areas such as the Codling Bank to the South.

3.3 Review of Potential Impacts and Significance in Context of Hydrodynamic Modelling Assessment

The Dublin Array EIS concluded that the proposed development would have an insignificant effect on the hydrography and sediment transport processes of the banks, and the effects on coastal stability and coastal erosion would be negligible. This is reinforced by and fully consistent with the conclusions of the Hydrodynamic Modelling Assessment as outlined above.

4 Addendum to Chapter 9 of Dublin Array EIS (BIRDS)

4.1 Introduction

Chapter 9 (Birds) of the Environmental Impact Statement prepared for the Dublin Array addressed the potential impacts of the proposed development on the many species of seabird which are known to use the waters on and around the banks.

The impact assessment was informed by two surveys of the birds using the Kish and Bray banks undertaken on behalf of the Developers. Initial boat transect seabird surveys to establish the existing ornithological environment on the banks were conducted by Ecology Consulting on behalf of the Developers between September 2001 and September 2002. Further surveys to collect up to date baseline information were undertaken by BirdWatch Ireland on behalf of the Developers between June 2010 and June 2011. In total, 45 bird species were recorded in the survey area between the two surveys. This included seven species of wader and eight species of passerine. Passerines and waders were migrants over the bank in late summer and autumn. The remainder of the species are true seabirds or waterbirds (divers, grebes and ducks) that use marine waters of the Irish Sea in the non-breeding season. Between 10 and 23 species were recorded on any one survey and species diversity was highest between July and September and lowest in mid-winter from December through to the end of March. The range of species recorded 2010-2011 survey was very similar to that reported in 2001-02, with minor differences in the less frequently recorded shearwaters, divers and grebes. Total abundance recorded in any one survey varied from a few hundred to several thousand individuals and followed a similar pattern to the species richness. The abundance was highest in July and September and lowest from October to early March.

In order to facilitate an assessment of the impacts of the proposed development on birds, key species were selected on the basis of survey work and desk studies based on their likely occurrence in the wind farm area, the sensitivity of the population and their conservation status. Sea bird species recorded in low numbers, less frequently recorded species and rare species recorded in the vicinity of the proposed wind farm area which are not of conservation importance were not identified as key species and the likelihood of a significant impact on the total Irish population or European population of these species was considered to be very low. Key species identified for further assessment in the Environmental Impact statement on this basis included Roseate, Common and Arctic Tern; Great Black-backed, Herring and Black Headed Gulls; Cormorant; Shag; Manx Shearwater; Northern Gannet; Kittiwake; Razorbill and Common and Black Guillemot.

The predicted impacts of the proposed development on the key species identified were assessed using an environmental impact matrix to identify the significance of risk for each of the key species. The assessment was based on both the baseline survey data and a desk study, which included a review of available survey data from other offshore wind farms. The EIS concluded that the significance of the impact of the proposed development on each of the key bird species identified would be low to negligible.

Following completion and submission of the EIS to the Department of Environment, Community & Local Government, Ecology Ireland were engaged by the Developers to undertake a further assessment of the potential impacts of the development on seabirds. The purpose of their assessment was to inform the Appropriate Assessment for the project and it examined the potential for impacts on birds, in particular seabirds, and any likely

significant impacts of the development of the Dublin Array on any Natura 2000 site, where birds are a key conservation feature of interest.

The purpose of this addendum to Chapter 9 of the Environmental Impact Statement is to review the potential impacts of the development and their significance for seabirds using the Kish and Bray banks identified in the original Environmental Impact Statement in the context of any additional information presented in the Ecology Ireland report entitled **THE PROPOSED DUBLIN ARRAY WIND FARM – ASSESSMENT OF POTENTIAL IMPACTS ON SEABIRDS (Information in support of the Appropriate Assessment of the proposed Wind Farm)**. A copy of the report is included in Appendix C of this Addendum to the Dublin Array EIS. The report was prepared by Dr. Gavin Fennessy (Director & Principal Ecologist, Ecology Ireland Ltd.), an expert Ornithologist with extensive experience in the assessment of both onshore and offshore wind energy projects as well as other large infrastructural projects. In preparing his assessment the following issues were considered:

- Usage of the Kish and Bray Banks by birds,
- The Natura 2000 sites that may be affected, and their bird interest,
- What is known of the potential impacts on birds resulting from the development of offshore wind farms and whether any of these impacts are likely to arise from the development of the Dublin Array wind farm during the construction and operation phases?

In carrying out the assessment, Dr. Fennessy undertook an extensive literature review focusing on the results of pre- and post-construction monitoring of existing offshore wind farms. Wind farms with a similar range of species, habitat types and (generally) located either around the UK coastline or elsewhere in north-west Europe were used to inform the assessment. Several of the existing wind farms considered are located in the Irish Sea and were also useful in the evaluation of cumulative impacts.

The scope of the literature review undertaken by Dr. Fennessy, as part of his assessment, included a number of significant references published since completion of the EIS for Dublin Array. Of particular relevance are the following publications:

- **Furness, B. & Wade, H. (2012).** *Vulnerability of Scottish Seabirds to Offshore Wind Turbines*. Report prepared for Marine Scotland by MacArthur Green Ltd. This report comprises a guidance note developed with the aim of devising criteria for quantifying the vulnerability of Scottish seabirds to offshore wind farms in order to facilitate the preparation of ornithological impact assessments against objective scientific criteria. The key results of the report are ranked species concerns lists in relation to both collision mortality impacts and displacement impacts on bird populations. Given the similarity in the range of species of seabird, this document provides a sound basis for assessing potential impacts associated with collision mortality and displacement for each of the species known to use the Kish and Bray banks.
- **Cook et al. (2012).** *A review of flight heights and avoidance rates of birds in relation to offshore windfarms*. Crown Estate Strategic Ornithological Support Services. Project SOSS-02. This report reviews current information on the flight heights and avoidance rates of key seabird species that occur in UK waters and that are thought most susceptible to effects of collisions with offshore wind farms and which typically may need to be considered in EIAs. Recommendations are provided on the use of this information and where further work is needed. The review included an extensive literature search

undertaken to investigate the flight heights and avoidance rates of seabirds in relation to offshore wind farms. Data from 40 surveys of 32 existing, proposed and permitted offshore wind farms were studied and in total 427,936 birds and 39 species were identified and assigned to a variety of flight height bands. There was sufficient data to construct models for 25 species identifying the proportion of bird flights within the collision risk window for a turbine with rotor blades a minimum of 20m above sea-level and a diameter of 130m. It is noted that the proposed turbines for the Dublin Array will have a minimum rotor height of 30m above sea level further reducing the proportion of birds at risk of collision than identified in this report.

- **Budgey, R. & Ormston, C. (2009).** *Strategic Review of Offshore Wind farm Monitoring Data associated with FEPA Licence Conditions.* Bird Management Unit, Food and Environmental Research Agency (FERA), Sand Hutton, York.
This report assesses the conformity of ornithological monitoring at ten UK offshore wind farm developments to FERA licensing requirements. These included post construction monitoring for a number of operational wind farms in the eastern Irish Sea. Ecology Ireland's review noted that to date, no issues have arisen at any of these wind farms that suggest significant adverse impacts on bird populations and species of elevated conservation importance.
- **Langston, R.H.W. (2010).** *Offshore Wind farms and birds: Round 3 zones, extensions to Round 1 and 2 sites & Scottish Territorial Waters.* RSPB Research report No. 39.

This document focuses on seabirds and waterbirds in UK continental shelf waters, their coastal breeding colonies and non-breeding coastal and marine distributions. The purpose of the document was to identify bird species which were most likely to be priorities for data collation and collection as part of the planned further development of offshore wind energy developments and subsequent Environmental Impact Assessments for individual projects particularly within the areas designated for such development by the Crown Estate.

Similarly to the Dublin Array EIS, the Ecology Ireland assessment identified a study zone of 35km from the proposed wind farm location as appropriate for their assessment based on the foraging range of the majority of seabird species that have been recorded using the Banks and that are identified as qualifying features of the relevant SPA's within this range. Within this study area, there are 11 Special Protection Areas (SPA) that could potentially be impacted by the proposed wind farm. The wind farm is not located within any area that has been designated as an SPA and if there are any potential impacts arising, it will be on the key bird species that are features of the individual SPAs within the study area. Of the 38 bird species that are listed as qualifying features of the relevant SPAs within the study area, 22 have been recorded during the 2001 and 2010 surveys of the Kish/Bray banks. The absence of the remaining species is attributed to three of the SPAs within the study area (North Bull Island, Malahide Estuary and South Dublin Bay & River Tolka) being sites with large estuarine habitats, attracting large numbers of wading birds and waterfowl: species that would not normally be expected to be recorded at off-shore areas like the Kish/Bray banks. The remaining eight SPAs are coastal sites or islands, with breeding colonies of seabirds, species that would be expected to be found on the Kish/Bray banks. Two additional species, Gannet and Manx Shearwater, although not features of the SPA's within the 35 km study area, were identified as key species for consideration given their exceptional foraging ranges of 140km and 171 km respectively.

As identified in Chapter 9 of the Dublin Array EIS, off-shore wind farms can potentially impact on birds in the following ways:

1. Disturbance during construction and/or operation of the wind farm,
2. Direct collision with the turbines,
3. Indirect habitat loss through displacement
4. Disruption of migration routes (barrier effect).

Section 4 of the Ecology Ireland report provides a detailed review of each of the 22 key bird species that are common to the SPAs and the Kish/Bray banks and considers the potential for adverse impacts upon each taxa through development of the Dublin Array wind farm. The two additional species, Gannet and Manx Shearwater, identified above are also considered.

This addendum to Chapter 9 of the Dublin Array EIS reviews the potential impacts from the proposed project on each of the key bird species identified in the context of the additional information provided through the Ecology Ireland assessment.

4.2 Species Accounts

4.2.1 Red-throated Diver

Relevant SPAs identified within 35km study area

The Murrough SPA is the only one within the 35km study area that has Red-throated Diver as a key species with the site synopsis presenting a mean peak count over 5 years of 32 birds.

Summary of dedicated survey data

The Ecology Ireland assessment acknowledges the low numbers of divers that have been found to use the banks. 22 birds were recorded only on one occasion and that date was at the end of the winter period in March, when birds are on passage back to the breeding grounds, and all other records for this species are of one, two or three birds on any one survey.

Relevant Information identified in Ecology Ireland Literature Review

The literature review undertaken as part of the Ecology Ireland Assessment identified the following relevant information for consideration in relation to the potential impacts of offshore wind farm developments on this species:

- Cook *et al.* (2012) found that Red-throated Divers are a species that rarely fly at heights that would bring them within a typical rotor sweep of an offshore wind turbines (<2% of flights).
- Furness & Wade (2012) note that this species is of high concern in relation to displacement and disturbance. However, they concluded '*While it is clear that some seabirds do strongly avoid wind turbines at sea, recent work modeling 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 behavior, such as red-throated divers*'.

- Post-construction monitoring from North Hoyle wind farm off the North Wales coast in Liverpool Bay indicates that divers may have made less use of the operational wind farm, although the data was considered inconclusive given the small data set.

Ecology Ireland Assessment of Impacts on Red-throated Divers using the banks

Ecology Ireland made the following conclusions with respect to the likely impact of the project on the small number of this species which use the banks:

- Given their response to disturbance, any birds that use the Banks during the construction phase are likely to be displaced from the area. However, on the basis that construction works at any one time will be limited to only a small proportion of the overall habitat available on the banks, this displacement may well be localized and will affect an insignificant number of birds.
- During the operation of the wind farm, the low numbers of Red-throated divers which use the banks may be displaced from the wind farm.
- Given the very low numbers of birds 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.

Significance of Impacts identified in Dublin Array EIS

Red-throated Diver was not identified as a key species in Chapter 9 of the Dublin Array EIS on the basis of the limited number of birds recorded using the banks during the dedicated seabird surveys. It was considered that the likelihood of a significant impact on birds not identified as key species in the EIS was very low.

Review of Potential Impacts and Significance in Context of Ecology Ireland Assessment

As identified in the Ecology Ireland Assessment, construction stage impacts on this species are likely to be limited to localized displacement of an insignificant number of birds from the area in which construction operations are actively taking place at that time.

Operational Stage Impacts could include the displacement of the small number of birds which use the wind farm.

Given the low number of Red-throated divers recorded using the banks and the Ecology Ireland conclusion that there is no likelihood of a significant impact on those associated with the Murrough SPA, it is concluded that the Dublin Array will have no significant adverse impact on this species. This is consistent with the conclusions of the original EIS (i.e. that the likelihood of a significant impact on birds not identified as key species was very low).

4.2.2 Great Crested Grebe

Relevant SPAs identified within 35km study area

Great Crested Grebe is a feature for the Malahide Estuary SPA where the site synopsis notes that the wintering numbers are of regional importance. Crowe (2005) gives the All-Ireland wintering population as 7,030 birds.

Summary of dedicated survey data

As noted above, only one sighting of a single bird flying east was recorded in August 2010 during the dedicated seabird surveys.

Relevant Information identified in Ecology Ireland Literature Review

Ecology Ireland did not identify any further significant information in relation to the impact of offshore wind farm developments on this species.

Ecology Ireland Assessment of Impacts on Great Crested Grebe using the banks

The Ecology Ireland report concludes, on the basis of the very low incidence of this species recorded on the banks, that there will be no impact on the Malahide Estuary SPA for this feature arising from the Dublin Array wind Farm.

Significance of Impacts identified in Dublin Array EIS

Great Crested Grebe was not identified as a key species in Chapter 9 of the Dublin Array EIS on the basis that only one sighting of a single bird flying east was recorded in August 2010 during the dedicated seabird surveys. It was considered that the likelihood of a significant impact on birds not identified as key species in the EIS was very low.

Review of Potential Impacts and Significance in Context of Ecology Ireland Assessment

Given the very low incidence of Great Crested Grebe recorded on the banks and the Ecology Ireland conclusion that there will be no impact on the Malahide Estuary SPA for this feature, it is concluded that the Dublin Array will have no significant adverse impact on this species. This is consistent with the conclusions of the original EIS (i.e. that the likelihood of a significant impact on birds not identified as key species was very low).

4.2.3 Fulmar

Relevant SPAs identified within 35km study area

The only SPA within the 35km study area where this species is identified as a key feature is the Lambay Island SPA. The site synopsis states that it supports a nationally important population of 635 pairs in 1999. Mitchel *et al* (2004) report that the All-Ireland breeding population is 38,910 Apparently Occupied Sites (AOS), with 926 AOS in counties Wicklow and Dublin.

Summary of dedicated survey data

Fulmars were recorded on the banks during both the 2001 and 2010 surveys with higher peak figures in the earlier survey. 42 birds were recorded on the banks 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 that the bank is not a favoured wintering area for this species. The 2010 survey also recorded flight heights for the species, showing that mean flight heights varied from 0.5 to 3.8m above water level, with a maximum height of 10m recorded.

Relevant Information identified in Ecology Ireland Literature Review

The literature review undertaken as part of the Ecology Ireland Assessment identified the following relevant information in relation to the impacts of offshore wind farm developments on this species:

- The flight heights recorded during the 2010 survey accord with Cook *et al* (2012) who found that less than 0.2% of recorded flights were at collision heights.
- Fulmar is a species that has a high tolerance of disturbance (Furnass & Wade, 2012).
- No issues were reported in relation to this species in the post-construction monitoring for the offshore wind farms in Liverpool Bay (Budgey & Ormston, 2009).

Ecology Ireland Assessment of Impacts on Fulmar using the banks

Given the relatively low usage of the Kish/Bray banks by this species, Ecology Ireland made the following conclusions with respect to the likely impacts of the project:

- Given that they are tolerant of disturbance, construction activity as well as operation of the wind farm is unlikely to lead to displacement of this species.
- The fact that they are generally a species that fly low over the water surface ('dynamic soaring') will reduce any likelihood of collision risk.
- The proposed wind farm will not have an impact on this species within the Lambay Island SPA.

Significance of Impacts identified in Dublin Array EIS

Fulmar was not identified as a key species in Chapter 9 of the Dublin Array EIS on the basis of the relatively low numbers recorded on the banks relative to the All-Ireland population and low conservation importance. It was considered that the likelihood of a significant impact on birds not identified as key species in the EIS was very low.

Review of Potential Impacts and Significance in Context of Ecology Ireland Assessment

Given the relatively low numbers of Fulmar using the banks and the additional information regarding the tolerance of this species to disturbance and lack of collision risk together with Ecology Ireland's conclusions regarding lack of an impact on this species within the Lambay Island SPA it is concluded that there should be no significant adverse impact on this species associated with the construction and operation of the Dublin Array. This is consistent with the conclusions of the original Dublin Array EIS (i.e. that the likelihood of a significant impact on birds not identified as key species was very low).

4.2.4 Cormorant

Relevant SPAs identified within 35km study area

Cormorant is identified as a key feature of three SPA's within the 35km study area; 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. Mitchel *et al* (2004) gives the All-Ireland population at 4,736 Apparently Occupied Nests (AON).

Summary of dedicated survey data

Newton & Trewby, in the 2010 survey, found that this species were most numerous within the study area during the summer months, when they were frequently seen roosting on the Kish lighthouse in numbers which the authors describe as 'significant'. They also found cormorants more often in shallower water. In the 2001 survey numbers of cormorants observed on the banks were lower than 2010 during the breeding season, roughly similar from late summer onwards and almost absent in winter. Flight heights gathered during the 2010 survey found Cormorants flying at maximum height of 10m, with a mean flight height of 2m, well below the minimum rotor blade sweep of 30m for the proposed turbines.

Relevant Information identified in Ecology Ireland Literature Review

The literature review undertaken as part of the Ecology Ireland Assessment identified the following relevant information in relation to the impacts of offshore wind farm developments on this species:

- The variation in Cormorant numbers observed over the survey period is analogous to the situation found at the North Hoyle wind farm site off the Welsh coast where

numbers dropped off during the summer when it was thought that birds were foraging closer to their breeding sites (nPower Renewables, 2005).

- Post construction monitoring from the North Hoyle site 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 that 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.
- No other issues in relation to Cormorants were reported at 10 UK off-shore wind farms (Budgey & Ormston, 2009).
- Cormorants are highly mobile and may forage over long distances (Langston, 2010 gives the maximum foraging range as 50 km although the mean is closer to 8.5 km).
- Cormorant was placed low down in Furness & Wade's table for flight height/collision risk (Furness & Wade, 2012)
- Cormorants do not appear to be permanently displaced from feeding habitat by the presence of wind turbines, in fact they may even show some attraction as they will use permanent structures as roost sites (Lindeboom et al, 2011)
- Furness & Wade (2012) give Cormorant a relatively high score for disturbance, suggesting there may be short term temporary disturbance during construction.

Ecology Ireland Assessment of Impacts on Cormorants using the banks

Ecology Ireland made the following conclusions with respect to the origin of the birds observed on the banks and the likely impacts of the project on the species:

- Although Cormorants are highly mobile and may forage over long distances, as a precautionary measure it was assumed 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.
- Collision risk would not appear to be a problem for the Cormorants that use the Kish/Bray banks.
- There may be short term disturbance during construction, but this will be limited to local areas in the vicinity of the works at that time.
- During construction there is the potential for temporary impacts on fish populations and accordingly on Cormorant distribution which forage on the fish.
- There are unlikely to be any significant impacts on the Cormorant populations found within the Lambay Island, Ireland's Eye or Skerries Islands SPAs arising from the Dublin Array wind farm.

Significance of Impacts identified in Dublin Array EIS

Cormorant was identified as a key species with a medium baseline sensitivity in Chapter 9 of the Dublin Array EIS on the basis of the numbers recorded on the banks and its amber listing on BirdWatch Ireland's list of species of conservation concern.

The magnitude of construction stage impacts comprising disturbance to feeding sites and indirect effects from changes to food source were both assessed as being of very low magnitude on the basis that the area of the site impacted by the construction at any one time would be small compared with the overall area of the habitat available on the banks. This resulted in an overall significance of impact rating of very low for construction stage impacts.

With respect to operational stage impacts, the magnitude of impact associated with collision risk was assessed as being very low on the basis that the species were known to fly at altitudes of less than 7m for the majority of the time. The magnitude of impact associated with disturbance to feeding sites was assessed as being low on the basis of the overall area

of the sand bank available to feed relative to the area impacted by the operation of the turbines and the widely recorded distribution of the species. It was also concluded that the cover provided by the scour protection around the base of the turbines would result in an increase in food sources for the Cormorant. The magnitude of impact of disturbance to flight patterns was assessed as very low on the basis of case studies recording the species flying through wind farms. The overall significance of operation stage impacts on Cormorant was therefore assessed as being very low.

Review of Potential Impacts and Significance in Context of Ecology Ireland Assessment

As identified in the Ecology Ireland Assessment, construction stage impacts on this species are likely to be limited to localized disturbance to Cormorant as well as temporary impacts on fish populations and accordingly on the distribution of this species which forage on the fish. Given that these impacts are likely to be limited to the immediate area in which construction operations are actively taking place at that time the magnitude and associated significance of these impacts is considered to be very low.

The Ecology Ireland Impact Assessment reinforces the conclusions regarding the very low risk of collision for this species during the operational phase of the wind farm. Evidence from other operational offshore wind farm projects presented in the Ecology Ireland Assessment would indicate Cormorants do not appear to be permanently displaced from feeding habitat by the presence of wind turbines, in fact they may even show some attraction as they will use permanent structures as roost sites.

On the basis of the above and the Ecology Ireland conclusion that there is no likelihood of a significant impact on the Cormorant populations found within the Lambay Island, Ireland's Eye or Skerries Islands SPAs arising from the Dublin Array wind farm, it is concluded that the Dublin Array will have no significant adverse impact on this species. This is consistent with the conclusions of the original EIS.

4.2.5 Shag

Relevant SPAs identified within 35km study area

The breeding colonies of Shag on Lambay Island and Skerries Island make them a key feature for these two SPAs. The Lambay colony at 1,122 pairs is the largest in Ireland and of international importance.

Summary of dedicated survey data

Both surveys of the Kish and Bray banks found birds of this species present most of the year round. The 2001 survey recorded peak numbers (293) in September, whilst the 2010 peak (588) was in June. Newton & Trewby (2011) recorded flight heights for this species, with a maximum recorded height of only 5m, and mean flight heights of less than 2m, well below the lowest point of the proposed rotor sweep of the turbines.

Relevant Information identified in Ecology Ireland Literature Review

The literature review undertaken as part of the Ecology Ireland Assessment identified the following relevant information in relation to the impacts of offshore wind farm developments on this species:

- Data from North Hoyle wind farm suggest that there is an increase in Shag records in that wind farm since it became operational although it is noted that the statistical analysis is not able to show this.
- It would appear that collision risk and displacement are not significant factors for Shag populations (Budgey & Ormston, 2009).

Ecology Ireland Assessment of Impacts on Shag using the banks

Ecology Ireland made the following conclusions with respect to the origin of the birds observed on the banks and the likely impacts of the project on the species:

- Although both the Lambay Island and Skerries Islands SPA's are outside the quoted maximum foraging range of 20 km for Shag (Birdlife International), the assumption is made, given the numbers recorded, that the birds observed on the banks are from local breeding colonies, including Lambay Island, which travel to the banks to forage.
- There is no likelihood of any significant impact on Shag populations in the SPAs that have been designated for this species.

Significance of Impacts identified in Dublin Array EIS

Shag was identified as a key species in with a medium baseline sensitivity in Chapter 9 of the Dublin Array EIS on the basis of the numbers recorded on the banks and its amber listing on BirdWatch Ireland's list of species of conservation concern.

The magnitude of construction stage impacts comprising disturbance to feeding sites and indirect effects from changes to food source were both assessed as being of very low magnitude on the basis that the area of the site impacted by the construction at any one time would be small compared with the overall area of the habitat available on the banks. This resulted in an overall significance of impact rating of very low for construction stage impacts.

With respect to operational stage impacts, the magnitude of impact associated with collision risk was assessed as being very low on the basis that the species were known to fly at altitudes of less than 7m for the majority of the time. The magnitude of impact associated with disturbance to feeding sites was assessed as being low on the basis of the overall area of the sand bank available to feed relative to the area impacted by the operation of the turbines. It was also concluded that the cover provided by the scour protection around the base of the turbines would result in an increase in food sources for the Shag. The magnitude of impact of disturbance to flight patterns was also considered to be very low. The overall significance of operation stage impacts on Shag was therefore assessed as being very low.

Review of Potential Impacts and Significance in Context of Ecology Ireland Assessment

Construction stage impacts on this species are likely to be limited to localized disturbance to Shag as well as temporary impacts on fish populations and accordingly on the distribution of this species which forage on the fish. Given that these impacts are likely to be limited to the immediate area in which construction operations are actively taking place at that time the magnitude and associated significance of these impacts is considered to be very low.

The Ecology Ireland Impact Assessment reinforces the conclusions regarding the very low risk of collision for this species during the operational phase of the wind farm. Evidence from other operational offshore wind farm projects presented in the Ecology Ireland Assessment would also indicate Shag do not appear to be permanently displaced from feeding habitat by the presence of wind turbines, with an increase in numbers identified at some sites.

On the basis of the above and the Ecology Ireland conclusion that there is no likelihood of a significant impact on the Shag populations found within the Lambay Island and Skerries Island SPAs arising from the Dublin Array wind farm, it is concluded that the Dublin Array will have no significant adverse impact on this species. This is consistent with the conclusions of the original EIS.

4.2.6 Waders and Waterbirds

Relevant SPAs identified within 35km study area

This group includes any wading bird species such as Oystercatcher, Ringed Plover, Sanderling, Turnstone, Dunlin, Black-tailed Godwit or Curlew that may have been recorded on the Kish and Bray banks and are features of the estuarine SPA's within the study area. These include North Bull Island, South Dublin Bay, the Tolka Estuary and Malahide Estuary as well as the Rogerstown Estuary and Baldoyle Bay SPA sites further north. Turnstone is also a feature for the Skerries Islands SPA. The grouping also includes geese species, such as Light-bellied Brent Goose and Greylag Goose, which are conservation features of many of the coastal SPAs.

Summary of dedicated survey data

None of these species were recorded in the 2001 survey although it is considered possible that they may have been seen but not recorded 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 in early September and 12 birds in late September. Newton 7 Trewby (2011) noted that all of these birds are migrants and were not using the Kish and Bray banks for feeding or roosting as there is no suitable habitat for them.

Relevant Information identified in Ecology Ireland Literature Review

The literature review undertaken as part of the Ecology Ireland Assessment identified the following relevant information in relation to the impacts of offshore wind farm developments on these 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). 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 changing direction (Exo et al, 2003).
- The proposed Dublin Array wind farm does not lie on the migratory route of either Light-bellied Brent Goose or Greylag Goose.
- The proposed Dublin Array wind farm does not lie on the migratory routes of either Light-bellied Brent Goose or Greylag Goose. Similarly, Greenland White-fronted Geese, 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).

Ecology Ireland Assessment of Impacts on Waders and Waterbirds using the banks

Ecology Ireland made the following conclusions with respect the likely impacts of the project on these species:

- Given the low usage of the banks by these bird species added to it's proposed location along the banks, the likelihood of the Dublin Array wind farm impacting on the populations of these bird species within the relevant SPAs is considered negligible.

Significance of Impacts identified in Dublin Array EIS

No waders or waterbirds were identified as a key species in Chapter 9 of the Dublin Array EIS on the basis of the very limited numbers of these species recorded on the banks.

Review of Potential Impacts and Significance in Context of Ecology Ireland Assessment

Given that waders and waterbird species do not use the banks for feeding or roosting due to the lack of suitable habitat for them there should be no construction stage impacts associated with disturbance to feeding grounds or food source for waders and waterbird species.

As identified in the Ecology Ireland Assessment, collision risk should not be an issue for any of these species given the lack of migration routes or passage routes between feeding grounds and roosts through the wind farm. Again, given that waders and waterbird species do not use the banks for feeding or roosting, there should therefore be no operational stage impacts on these species.

Given Ecology Ireland's conclusions that the likelihood of the Dublin Array wind farm impacting on the populations of these bird species within the relevant estuarine SPAs was negligible, it is concluded that the overall significance of the impacts of the Dublin Array on these species is negligible. This is consistent with the conclusions of the original Dublin Array EIS (i.e. that the likelihood of a significant impact on birds not identified as key species was very low).

4.2.7 Black Headed Gull

Relevant SPAs identified within 35km study area

Wintering Black-headed gull numbers are identified as key features of three of the SPAs within the 35 km study area; North Bull Island (2,996 birds), South Dublin Bay and the Tolka Estuary (3,040) and the Murrrough (997). None of the relevant SPAs have been designated for breeding populations of black headed gulls.

Summary of dedicated survey data

Both the 2001 and 2010 surveys recorded very low numbers of this species using the Kish/Bray banks, with peak counts of eight (2001) and six (2010). Birds were only recorded in the period August to January, with no birds recorded during the breeding season. Flight heights were also recorded during the 2010 survey with all flights below 20m (0.8 to 8.0m).

Relevant Information identified in Ecology Ireland Literature Review

The literature review undertaken as part of the Ecology Ireland Assessment identified the following relevant information in relation to the impacts of offshore wind farm developments on these species:

- Cook *et al.* (2011) concurs with the above observations regarding flight heights, with only 7.9% of flight heights occurring within rotor height.
- 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 are unlikely to lead to disturbance for this species.

Ecology Ireland Assessment of Impacts on Black-headed Gulls using the banks

Ecology Ireland made the following conclusions with respect the likely impacts of the project on these species:

- 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.

Significance of Impacts identified in Dublin Array EIS

Black Headed Gull was identified as a key species with a high baseline sensitivity to potential impacts in Chapter 9 of the Dublin Array EIS on the basis its red listing on BirdWatch Ireland's list of species of conservation concern.

The magnitude of construction stage impacts including disturbance to feeding sites and indirect effects from changes to food source were considered negligible given the predicted increase in gull activity predicted as a result of the ship activity associated with the construction of the wind farm on the basis of case studies from other offshore wind farms. The overall significance of construction stage impacts was therefore considered to be very low.

Similarly, given the predicted increase in gull species as a result of boat activity associated with the operation of the wind farm, the significance of operational stage impacts were also considered to be negligible.

Review of Potential Impacts and Significance in Context of Ecology Ireland Assessment

Given the high tolerance of this species to disturbance from boat traffic and the low number of birds recorded using the banks it is concluded that the magnitude of construction stage impacts on this species will be negligible.

Again given the very low numbers of this species using the banks and their relatively low flight heights as well as their tolerance to disturbance it is concluded that the magnitude of any operational stage impacts on this species will be negligible.

Therefore, on the basis of the above and given Ecology Ireland's conclusion that the likelihood of the Dublin Array wind farm impacting on the very large numbers of wintering Black-headed Gulls using the SPAs in the wider hinterland, it is concluded that the overall significance of the impacts of the Dublin Array on this species is negligible. This is consistent with the conclusions of the original Dublin Array EIS.

4.2.8 Herring Gull

Relevant SPAs identified within 35km study area

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 of these two SPAs.

Summary of dedicated survey data

The 2010 survey recorded a marked increase in the numbers of Herring Gulls using the banks when compared with the 2001 survey. It is speculated that this increase is due in part to an increase in the breeding population of this species on Lambay Island. Peak numbers recorded during the 2010 survey were in October 2010 (298 birds), November 2010 (107 birds) and March 2011 (304 birds) with relatively few numbers occurring during the summer months. Both surveys found that Herring Gulls were distributed throughout the study area, although with some concentration in the northern sections. Newton & Trewby, who undertook the 2010 survey note that their distribution is influenced by the presence of fishing boats, with Herring Gulls being attracted to fishing boats. Flight height studies undertaken as part of the 2010 survey recorded birds flying at up to 70m high although in only two months (September and October 2010) did the mean flight height exceed 30m (i.e. within the rotor sweep of the proposed turbines).

Relevant Information identified in Ecology Ireland Literature Review

The literature review undertaken as part of the Ecology Ireland Assessment identified the following relevant information in relation to the impacts of offshore wind farm developments on these species:

- 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.
- Recent estimates of avoidance rates for many seabirds have been revised upwards recognizing the ability of these species to navigate successfully through wind farms. Scottish Natural Heritage (2012) now recognizes that the basal avoidance rate should be increased from 95% to 98% for species considered to be less capable of avoiding collision and for the majority of species an avoidance rate of in excess of 99% is considered appropriate.
- Petersen *et al.* (2006) conducted a review of two wind farms constructed off the Danish Coast which studied pre- and post-construction populations of birds using the wind farm areas. Herring Gulls were found to be present at both wind farms throughout the year, but with late autumn peaks in abundance. Their study concluded that for both wind farms, there was no effect on the distribution of Herring Gulls following construction.
- Furness & Wade (2012) undertook 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 turbines or meteorological masts as perches.
- 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.

Ecology Ireland Assessment of Impacts on Herring Gull using the banks

Ecology Ireland made the following conclusions with respect the likely impacts of the project on these species:

- The Scottish Natural Heritage (2012) report reflects the growing evidence that actual collision risk is considerably lower than calculated estimates from earlier models and that collision risk for birds of this species occurring on the banks in September and October, when recorded mean flight heights exceeded 30m, will accordingly be lower than the Furness & Wade score suggests.
- Given the timing of the peak numbers of Herring Gulls occurring on the banks, the main period of usage 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 between late July and 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. As noted above, this most often coincides with the time when birds 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 breeding birds present in the SPAs.

- The likelihood of there being a significant impact on Herring Gull, as a key feature of the designated SPAs is low.

Significance of Impacts identified in Dublin Array EIS

Herring Gull was identified as a key species with a high baseline sensitivity in Chapter 9 of the Dublin Array EIS on the basis its red listing on BirdWatch Ireland's list of species of conservation concern.

The magnitude of construction stage impacts including disturbance to feeding sites and indirect effects from changes to food source were considered negligible given the predicted increase in gull activity predicted as a result of the ship activity associated with the construction of the wind farm on the basis of case studies from other offshore wind farms. The overall significance of construction stage impacts was therefore considered to be very low.

Similarly, given the predicted increase in gull species as a result of boat activity associated with the operation of the wind farm, the magnitude of operational stage impacts including habitat loss and disturbance to feeding sites were also considered to be negligible. Operational stage impacts associated with collision risk and disturbance to flight patterns were assessed as low giving an overall significance for operational stage impacts for Herring Gull of low.

Review of Potential Impacts and Significance in Context of Ecology Ireland Assessment

Given the high tolerance of this species to disturbance from boat traffic it is concluded that the magnitude of construction stage impacts on this species will be negligible.

On the basis of the Ecology Ireland Assessment, it is considered that the birds of this species most at risk of collision with the turbines during the operational stage of the project will be passage birds passing through the wind farm in the months of March and October, when birds were most often observed flying at heights which would put them at risk of collision with the rotors, rather than the nationally important breeding colonies associated with the SPAs at Lambay Island, Ireland's Eye and Skerries Island or the wintering numbers at Skerries Islands and the Murrough which are key features of those two SPAs. Therefore, and on the basis of the acknowledged high degree of manoeuvrability of this species, and the most recent evidence regarding collision risk for birds which do fly at rotor height it is considered that the magnitude of the potential impacts associated with collision with the turbine rotors and disturbance to flight patterns overall for this species is low. Similar to the construction stage impacts, it is considered the magnitude of other operational stage impacts including disturbance is negligible.

On the basis of the above and given Ecology Ireland's conclusion that the likelihood of the Dublin Array wind farm impacting on the Herring Gulls using the SPAs in the wider hinterland, it is concluded that the overall significance of the impacts of the Dublin Array on this species is low. This is consistent with the conclusions of the original Dublin Array EIS.

4.2.9 Lesser Black-backed Gull

Relevant SPAs identified within 35km study area

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.

Summary of dedicated survey data

The 2001 and 2010 surveys found very low numbers of birds within 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 banks during the breeding season was also 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. The 2010 survey recorded two flight heights of 4m and 6m.

Relevant Information identified in Ecology Ireland Literature Review

The literature review undertaken as part of the Ecology Ireland Assessment identified the following relevant information in relation to the impacts of offshore wind farm developments on these species:

- The flight heights recorded on the banks are low in comparison with those predicted by Cook *et al.* (2011) whose model gave 25.2% of recorded flights being at a height that would bring them into risk of collision with rotor blades, although it is noted that their study used a minimum rotor height of 20m rather than the 30m proposed for the Dublin Array.
- Furness & Wade (2012) placed this species as third most sensitive to collision risk on the basis of the above Cook *et al.* analysis of the percentage of flights at rotor height.
- This species seems very 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.

Ecology Ireland Assessment of Impacts on Lesser Black-backed Gull using the banks

Ecology Ireland made the following conclusions with respect the likely impacts of the project on these species:

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

Significance of Impacts identified in Dublin Array EIS

Lesser Black-backed Gull was not identified as a key species in Chapter 9 of the Dublin Array EIS on the basis of the relatively low numbers recorded on the banks.

Review of Potential Impacts and Significance in Context of Ecology Ireland Assessment

Given this species high tolerance to disturbance, the magnitude of any potential construction stage impacts on the small number of this species recorded using the banks will be very low.

Similarly, again given the very low numbers of this species recorded using the banks and the low recorded flight heights, it is considered that the magnitude of construction stage impacts including collision risk will also be very low.

On this basis, and given Ecology Irelands conclusions a lack of impact on the Lesser Black-backed Gulls associated with the Lambay Island SPA, it is included that the overall significance of any impacts on this species will be very low. This is consistent with the conclusion in the Dublin Array EIS (i.e. that the likelihood of a significant impact on birds not identified as key species was very low).

4.2.10 Kittiwake

Relevant SPAs identified within 35km study area

Four of the SPAs within the 35km study area 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 pairs in 2001) and Wicklow Head (956 pairs). All of these SPAs are considered to be nationally important for this species.

Summary of dedicated survey data

Kittiwakes were recorded throughout the year during both surveys but with a definite peak in July, August and September when the counts would include adults feeding fledged chicks and presumably birds dispersing from breeding colonies. The September count in 2001 recorded an exceptional 4,382 birds. Recorded flight heights in 2010 show that only in one month, November, did mean flight heights exceed 20m (38.3m), although the figures for August, September, October and December range from 16.9 to 19.8m indicating that some of these birds would have been in excess of 20m. The highest recorded flight was 60m.

Relevant Information identified in Ecology Ireland Literature Review

The literature review undertaken as part of the Ecology Ireland Assessment identified the following relevant information in relation to the impacts of offshore wind farm developments on these species:

- 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 turbines or meteorological masts as perches.
- Furness & Wade (2012) assigned a low score to Kittiwake for disturbance from boat and helicopter traffic.
- Furness & 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 a height where they are at risk of collision with the turbine rotors. However for their model they used a minimum tip height of 20m, while the minimum proposed tip height for the Dublin Array is 30m, which will further reduce the percentage of flights taking place at a height where they are at risk of collision with the turbine rotors.
- Birds are highly capable of avoiding collision and it is worth noting that in generic Collision Risk modeling (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 recognizes 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.
- Large numbers of Kittiwakes had been recorded in the vicinity of the Arklow Bank Unpublished post-construction monitoring reports for the Arklow Bank wind farm (courtesy of SSE Renewables) showed a slight decline in overall numbers between 2001 and 2008 (based on most up to date complete monitoring report available covering the period July 2007 to June 2008).

Ecology Ireland Assessment of Impacts on Kittiwake using the banks

Ecology Ireland made the following conclusions with respect the likely impacts of the project on these species:

- The availability of prey for Kittiwakes, on the basis that construction activities will not significantly impact on fish populations, coupled with their tolerance of disturbance, means that construction activity will not impact Kittiwake populations.
- Kittiwake populations will not be impacted through displacement.
- Although the shallow waters around the banks undoubtedly support high numbers of Kittiwakes, particularly during the post-breeding period, the vast majority of these birds will be flying at heights which are lower than the rotor height of the proposed turbines, greatly reducing the collision risk.
- There will be no adverse impacts on Kittiwake breeding numbers at the SPAs as a consequence of the proposed Dublin Array wind farm.

Significance of Impacts identified in Dublin Array EIS

Kittiwake was identified as a key species with a high baseline sensitivity in Chapter 9 of the Dublin Array EIS on the basis the high numbers recorded on the banks and its amber listing on BirdWatch Ireland's list of species of conservation concern.

The magnitude of construction stage impacts including disturbance to feeding sites and indirect effects from changes to food source were considered negligible given the predicted increase in gull activity predicted as a result of the ship activity associated with the construction of the wind farm on the basis of case studies from other offshore wind farms. The overall significance of construction stage impacts was therefore considered to be very low.

The magnitude of operational stage impacts associated collision risk was considered low on the basis that the majority of flight heights recorded took place below rotor height. Given the predicted increase in gull species as a result of boat activity associated with the operation of the wind farm, the significance of other operational stage impacts were considered to be negligible.

Review of Potential Impacts and Significance in Context of Ecology Ireland Assessment

Given the high tolerance of this species to disturbance from boat traffic it is concluded that the magnitude of construction stage impacts on this species will be negligible.

Although Gull species, including Kittiwake are identified as a species with a higher degree of collision risk due to the proportion of flights which take place at rotor height, given the high degree of manoeuvrability of this species and the higher minimum rotor height of 30m proposed for the Dublin Array it is considered that the magnitude of impact associated with collision risk will be low.

Therefore, on the basis of the above and given Ecology Ireland's conclusion that the likelihood of the Dublin Array wind farm impacting on the very large numbers of wintering Black-headed Gulls using the SPAs in the wider hinterland, it is concluded that the overall significance of the impacts of the Dublin Array on this species is low. This is consistent with the conclusions of the original Dublin Array EIS.

4.2.11 Tern Species (Common Tern, Arctic Tern and Roseate Tern)

Relevant SPAs identified within 35km study area

The three Tern species are mentioned as conservation features for three SPAs; Rockabill, Dalkey Islands and South Dublin Bay & 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 varying numbers of Terns breeding, although 11 pairs of Roseate Terns nested there in 2004. South Dublin Bay 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.

Summary of dedicated survey data

Table 4.1 below shows the peak monthly numbers of the three Tern species recorded during the boat transect surveys in 2001/2002 and 2010/2011.

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 4.1 clearly illustrates 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 grounds for these bird species during the breeding period but that the birds are using the study area post-fledging when adults and young birds are to be found. It was noted during the 2010/2011 survey 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.

Flight heights were recorded for all three Tern species during the 2010/2011 survey, none of which had mean flight heights that exceeded 20m. The highest mean flight height recorded was for Roseate Tern at 12.8m with the maximum recorded height for this species at 16m. Arctic Tern had a peak mean flight height of 10.3m (range 1 to 15m), with Common Tern having a peak mean flight height of 11.9m (range 1 to 20m).

	Roseate Tern		Common Tern		Arctic Tern	
	2001/2	2010/11	2001/2	2010/11	2001/2	2010/11
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						

Table 4.1 Peak monthly Tern counts

Relevant Information identified in Ecology Ireland Literature Review

The literature review undertaken as part of the Ecology Ireland Assessment identified the following relevant information in relation to the impacts of offshore wind farm developments on Tern species:

- 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 Kenntish Flats wind farm reports that no changes in Common Tern numbers have been recorded but that there is some indication of changes to a flight line to a regularly used foraging area although this change is considered to be insignificant.
- Everaert & Stienen (2007) report high levels of mortality in Common Tern, Sandwich tern and Little Terns in a colony in Zeebrugge. It should however be noted that in this case the Terns were nesting on an artificial peninsula developed immediately adjacent to a wind farm. No other studies have reported issues with collision risk for Tern species and Ecology Ireland 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 off-shore wind farms in the UK to model flight heights and look at collision risk for a variety of species. They have placed all three Tern species in the medium collision risk category.
- 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, Scoup, Eider, Black Guillemot, Slavonian Grebe) should be considered as focal species for concern with regard to 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 respect to displacement effects.
- Lindeboom *et al.* (2011) studied an off-shore wind farm in the Netherlands and noted that '*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.

- Wade & Furness (2012) gives scores for species according to their sensitivity for disturbance (from turbines, boat and helicopter traffic) with a score of 5 being the highest sensitivity. All three Tern species were assigned a score of 2 in terms of sensitivity to disturbance, suggesting that construction activity is likely to have little impact in Tern species.

Ecology Ireland Assessment of Impacts on Tern species using the banks

Ecology Ireland made the following conclusions with respect the likely impacts of the project on Tern species:

- Given the flight heights recorded for each of the species during the 2010/2011 survey it was considered that collision risk for all three Tern species was low for the Dublin Array wind farm.
- Although the assessment acknowledged that construction activity was likely to have little impact on tern species, it was suggested that restrictions on piling activities with the potential to disturb concentrations of roosting terns, particularly in the areas close to the Kish Lighthouse in the north of the construction area would be appropriate. A mitigation measure comprising the exclusion of piling activity from a buffer zone of 3 km of the Kish roosting area during the August/September period when the area is used by post fledging terns was proposed.
- It was considered that displacement and collision effects on Terns using the Kish and Bray banks was very unlikely to have a significant adverse impact on breeding and post fledgling/staging Tern populations within the relevant SPA's.

Significance of Impacts identified in Dublin Array EIS

Common Tern and Arctic Tern were identified as key species with a medium baseline sensitivity in Chapter 9 of the Dublin Array EIS on the basis the numbers recorded on the banks and their amber listing on BirdWatch Ireland's list of species of conservation concern. Roseate Tern was identified also identified as a key species but was assigned a high baseline sensitivity on the basis that the numbers recorded on the banks represented in excess of 1% of the national population.

Construction stage impacts including disturbance to feeding sites and migration routes were considered to be of low magnitude for both the Common Tern and Arctic Tern on the basis that the highest densities of these species were observed in deeper waters outside of the immediate area occupied by the proposed wind farm in which the construction works will take place and given the limited area in which construction will be taking place at any particular time it is unlikely to have significant effects on feeding or the quality and quantity of food available. Construction stage impacts for Roseate Tern were similarly considered to be of low magnitude given the small area affected by construction at any one time compared with the overall area of the banks available to feed. The overall significance of construction stage impacts was therefore considered to be very low for Arctic Tern and Common Tern and low for the Roseate Tern given its slightly higher baseline sensitivity.

Operational stage impacts including disturbance to feeding sites, migration routes and flight patterns were generally considered to be of low magnitude for all three tern species on the basis of evidence from case studies showing little impact from operational turbines on use of areas for foraging. Collision risk was considered to be of very low magnitude for all three species on the basis of recorded flight heights. The overall significance of operational stage impacts was therefore considered to be very low for Arctic Tern and Common Tern and low for the Roseate Tern given its slightly higher baseline sensitivity.

Review of Potential Impacts and Significance in Context of Ecology Ireland Assessment

Given the three tern species relatively low sensitivity to disturbance and the proposal to exclude piling activity within a 3km buffer zone of the Kish roosting area during the August/September period, it is concluded that the magnitude of construction stage impacts on these species is likely to be very low.

Given their relatively low flight heights and evidence of continued use of other offshore wind farm sites for foraging following construction by these species, it is concluded that the magnitude of any operational stage impacts on this species will be very low.

Therefore, on the basis of the above and given Ecology Ireland's conclusion that displacement and collision effects for Terns using the Kish and Bray banks was very unlikely to have a significant adverse impact on breeding and post fledgling/staging Tern populations within the relevant SPA's, it is concluded that the overall significance of the impacts of the Dublin Array on these species is very low. This is consistent with the conclusions of the original Dublin Array EIS.

4.2.12 Auks (Guillemot, Razorbill and Puffin)

Relevant SPAs identified within 35km study area

Only two SPAs within the 35 km study area 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.

Summary of dedicated survey data

Guillemots were recorded year round in both the 2001/2 and 2010/11 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 (3,001 in 2001 and 2,685 in 2011) but timing was different with the 2001 peak occurring in September and the 2010 peak occurring in July. As noted above, 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 number in 2010. Auk species are typically low flying birds and the highest recorded flight height for any of these species during the 2010/11 survey was 8m.

Relevant Information identified in Ecology Ireland Literature Review

The literature review undertaken as part of the Ecology Ireland Assessment identified the following relevant information in relation to the impacts of offshore wind farm developments on Auk species:

- 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, less than 0.4% of Razorbill flights and less than 0.1% of Puffin flights are at collision risk heights. Collision risk impacts for all three auk species are therefore considered insignificant.
- Furness & Wade (2012) give Guillemot and Razorbill a medium score for disturbance from helicopter and boat traffic.
- Research conducted at Danish wind farms (Petersen *et al.*, 2006) has looked at populations of Guillemots and Razorbills pre- and post-construction for two offshore wind farms. The two species did appear to 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 has been recorded.

- Post-construction monitoring at the North Hoyle wind farm (nPower Renewables, 2005) 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.

Ecology Ireland Assessment of Impacts on Auk species using the banks

Ecology Ireland made the following conclusions with respect the likely impacts of the project on Auk species:

- Collision risk impacts for all three auk species are considered insignificant.
- Puffin numbers using the wind farm 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.
- There may be some localized disturbance to Guillemot and Razorbill during construction but the phased approach to construction will minimize these affects.
- Fish populations and distribution are likely to be the influential factors on Guillemot and Razorbill and not the wind farm *per se*. Providing the wind farm does not lead to a significant change in fish species, which is not predicted, the likelihood of a significant impact on these features of the SPAs arising from the wind farm is considered negligible.

Significance of Impacts identified in Dublin Array EIS

Common Guillemot and Razorbill were identified as a key species with a high baseline sensitivity in Chapter 9 of the Dublin Array EIS on the basis of the high numbers of these species recorded on the banks. Black Guillemot was identified as a key species with a medium baseline sensitivity on the basis of the small numbers recorded on the banks and its amber listing on BirdWatch Ireland's list of species of conservation concern. Atlantic Puffin was not identified as a key species on the basis that very few birds of this species were recorded on the banks.

Construction stage impacts on Common Guillemot, Black Guillemot and Razorbill including disturbance to feeding sites and indirect effects from changes to food source were considered to be of low and very low magnitude respectively on the basis of the limited area affected by construction activities at any one time compared to the overall area of foraging habitat available on the banks. On this basis the overall significance of construction stage impacts on these species was considered to be low.

The EIS concluded that the overall significance of the potential impacts on this species during construction stage of the Dublin Array wind farm was very low and was low for the operational stage.

Review of Potential Impacts and Significance in Context of Ecology Ireland Assessment

As identified in the Ecology Ireland Assessment, Guillemot and Razorbill are sensitive to disturbance and there may be some localized displacement of these species during construction of the wind farm. However, given the localized nature of construction activities at any one time, and the overall extent of suitable foraging habitat available on the banks it is considered that the construction of the Dublin Array will not have a significant impact on this species.

Given the insignificant collision risk and evidence of continued use of other offshore wind farm sites for foraging following construction by these species, it is concluded that the magnitude of any operational stage impacts on this species will be very low.

Therefore, on the basis of the above and given Ecology Ireland's conclusion that, providing the wind farm does not lead to a significant change in fish species, which is not predicted, the likelihood of a significant impact on these Auk species as features of the SPAs arising from the wind farm was considered negligible, it is concluded that the construction and operation of the Dublin Array will not have a significant impact on Guillemot and Razorbill species. This is consistent with the conclusions of the original Dublin Array EIS.

Given the very low numbers of Atlantic Puffin recorded on the banks, it is concluded that the construction of the Dublin Array is unlikely to have a significant impact on that species.

4.2.13 Gannet

Relevant SPAs identified within 35km study area

Gannet is not a feature for any of the SPA's within the 35 km study area but are known to breed on Lambay island and Ireland's Eye. Data from the JNCC online seabird register gives counts from 2010 of 138 and 360 Apparently Occupied Nests (AON) respectively. The numbers of birds recorded using the banks, particularly during the 2010/11 survey, are considerably higher than the numbers of birds at both of these colonies and, as noted by Newton & Trewby, who undertook the 2010/11 survey, 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 foraging on the Banks. The colony at 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. The Grassholm colony was considered in 1994 to make up more than 12.5% of the North Atlantic breeding population. Gannets have a long 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.

Summary of dedicated survey data

Gannets were recorded in considerably higher numbers during the 2010/11 survey than the 2001/2 survey. In 2001 the peak number was 107 birds, with a peak of 1,326 in 2011. For all months where Gannets were recorded, the monthly peaks were higher in 2010/11 than 2001/2, except for April when figures were very similar. Flight heights recorded during the 2010/11 survey with the lowest recorded being 0.5m and the highest 75m. The monthly mean heights recorded show that the mean height did not exceed 30m, the proposed minimum rotor height. However, in August the mean height was 29.6m, only just outside the minimum rotor height. During the key months of May and June, the mean flight heights were 3.4 and 5.8 m respectively.

Relevant Information identified in Ecology Ireland Literature Review

The literature review undertaken as part of the Ecology Ireland Assessment identified the following relevant information in relation to the impacts of offshore wind farm developments on Gannet:

- Cook *et al.* (2012), showed that 9.6% of Gannet flights would be at collision risk height, a figure they classed as very high (based on a 20m minimum rotor tip height, rather than the 30m proposed for Dublin Array). They further noted that '*the model for Northern Gannet shows that most, but not all birds tend to fly at low altitudes, below the minimum height of any turbine rotor blades*'.
- Furness & Wade (2012) give Gannet a low score for displacement and comment that this species is unaffected by displacement.
- Gannet is a very important breeding bird in the UK and Ireland with 261,000 nesting pairs (Wanless *et al.* 2005).

- The risk of collision for Gannets is unclear (Langston & Boggio, 2011) but as it lacks manoeuvrability of some 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. Langsten & Boggio, 2011; Lansten & Teuten, 2012; Soanes *et al.*, 2012) using satellite or GPS tags to describe the foraging patterns of this large seabird. Soanes *et al.* found that Gannets did 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 and Wildfowl Trust (2012). This study includes a Population Viability Assessment (PVA) to model various scenarios and assess the impact on population demographics. Their 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, provided other aspects of Gannet ecology do not change drastically.

Ecology Ireland Assessment of Impacts on Northern Gannet using the banks

Given the conclusions of the risk assessment undertaken by the Wetland and Wildlife Trust regarding the robustness of the Gannet population of the British Isles to collision mortality, Ecology Ireland concluded that the Dublin Array wind farm did not have 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.

Significance of Impacts identified in Dublin Array EIS

Northern Gannet was identified as a key species with a medium baseline sensitivity in Chapter 9 of the Dublin Array EIS on the basis the high numbers recorded on the banks and its amber listing on BirdWatch Ireland's list of species of conservation concern.

Construction stage impacts including disturbance to feeding sites were considered to be of low magnitude given to small area impacted by construction as opposed to the overall area of the sandbank available to feed. The significance of construction stage impacts, given the medium baseline sensitivity of this species was therefore considered to be very low.

The magnitude of the impact of collision risk during the operational stage of the project was also considered to be low on the basis that, while their flight and dive heights did put them at some risk of collision, there was little evidence of collisions from other offshore wind farm sites and some evidence that Gannets actively avoid the immediate wind farm area.

Review of Potential Impacts and Significance in Context of Ecology Ireland Assessment

Given the low score for displacement attributed to Gannet by Furness & Wade, 2012 it is concluded that this species will be unaffected by displacement associated with construction of the wind farm. The magnitude of any temporary localized impacts due to changes in food source in the immediate vicinity of piling operations during the course of construction of the wind farm will be negligible given the wide foraging range of this species and the availability of suitable foraging habitat both elsewhere within the banks and over the wider area covered within the range of the species.

Again, given the species tolerance for disturbance, displacement due to operation of the Dublin Array will not be an issue for this species. As identified in the Ecology Ireland Assessment, although this species is considered to be at higher risk of collision given the proportion of flight heights at rotor height and lack of manoeuvrability compared to other

species, the conclusions of the risk assessment undertaken by the Wetland and Wildlife Trust regarding the robustness of the Gannet population of the British Isles to collision mortality would indicate that 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 is very low.

Therefore, on the basis of the above it is concluded that the overall significance of the impacts of the Dublin Array on this species is very low. This is consistent with the conclusions of the original Dublin Array EIS.

4.2.14 Manx Shearwater

Relevant SPAs identified within 35km study area

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 local population, the site synopsis quotes 50 pairs. However, Manx Shearwater has a large foraging range, with a mean of 171 km (Langston,2010) and it considered that the majority of the large numbers of this species recorded on the banks are likely to originate from the Pembrokeshire Islands of Skomer and Skokholm, which form a single SPA and have an overall breeding population in excess of 150,000 pairs, forming more than 50% of the total breeding population for this species.

Summary of dedicated survey data

Peak numbers for Manx Shearwater were recorded in August in both survey years (2001/2 and 2010/11) with maximum counts of 3,764 and 4,513 respectively. The 2001/2 survey recorded higher numbers in the late spring period than in 2010/2011 but thereafter throughout the rest of the summer period, numbers are similar for both surveys.

Relevant Information identified in Ecology Ireland Literature Review

The literature review undertaken as part of the Ecology Ireland Assessment identified the following relevant information in relation to the impacts of offshore wind farm developments on Manx Shearwater:

- Manx Shearwater is a low flying species. Furness & Wade (2012) give it a score of zero in terms of collision risk and Cook *et al.* determined that only 0.04% of flights were at collision risk height.
- Furness & Wade (2012) also give Manx Shearwater a low score for disturbance and displacement.

Significance of Impacts identified in Dublin Array EIS

Manx Shearwater was identified as a key species in with a high baseline sensitivity in Chapter 9 of the Dublin Array EIS on the basis the high numbers recorded on the banks with a local population representing in excess of 1% of the national population for the species.

The magnitude of construction stage impacts associated with disturbance to feeding sites from construction activities were considered to be of low magnitude given the limited extent of construction activities at any one time compared to the widely recorded distribution of the species and availability of suitable foraging habitat within the site. Any indirect effects from changes to food source associated with the construction of the wind farm were considered to be of very low impact on this basis. It was therefore concluded that the overall significance of construction impacts were low for this species.

The magnitude of impacts associated with collision risk during the operational stage of the project were considered to be very low given the recorded flight heights for this species. Other operational stage impacts including disturbance to feeding sites, migration routes and flight patterns were considered to be of low magnitude on the basis of case studies showing little direct impacts on migration routes and flight patterns and reduced sensitivity in breeding birds or rapid habituation during the breeding season. It was therefore concluded that the overall significance of operational stage impacts on this species were low.

Review of Potential Impacts and Significance in Context of Ecology Ireland Assessment

Given the low score for displacement attributed to Gannet by Furness & Wade, 2012 it is concluded that this species will be unaffected by displacement associated with construction of the wind farm. The magnitude of any temporary localized impacts due to changes in food source in the immediate vicinity of piling operations during the course of construction of the wind farm will be negligible given the wide foraging range of this species and the availability of suitable foraging habitat both elsewhere within the banks and over the wider area covered within the range of the species.

Again, given the species tolerance for disturbance, displacement due to operation of the Dublin Array will not be an issue for this species. As identified in the Ecology Ireland Assessment, Manx Shearwater is a low flying species, and collision risk associated with the operation of the Dublin Array will not affect this species.

Therefore, on the basis of the above it is concluded that the overall significance of the impacts of the Dublin Array on this species is very low. This is consistent with the conclusions of the original Dublin Array EIS.

5 Addendum to Chapter 10 of Dublin Array EIS (Marine Mammals and Turtles)

5.1 Introduction

Chapter 10 (Marine Mammals and Turtles) of the Environmental Impact Statement prepared for the Dublin Array addressed the potential impacts of the proposed development on the species of marine mammals and turtle which are known to use the waters on and around the banks.

The impact assessment was informed by two surveys for marine mammals using the Kish and Bray banks and surrounding area undertaken on behalf of the Developers in 2001/2002 and 2010/2011.

Marine mammals common in the Irish Sea include the harbour porpoise, bottle-nosed dolphin, common dolphin and common and grey seal. All Irish waters were declared a sanctuary for whales and dolphins by the Irish government on 7 June 1991. All cetaceans and seals found within Irish waters are afforded national and international protection, and for the purposes of the impact assessment were considered to be of high sensitivity. At the time of preparation of the Dublin Array EIS the only Special Area of Conservation (SAC) designated for marine mammals on the Irish east coast was Lambay Island SAC (site code 000204), which is located approximately 20km from the proposed Dublin Array and for which Grey Seal is a qualifying interest. The Lower Shannon Estuary SAC was designated for the conservation of bottlenose dolphin, while Roaringwater Bay and Islands SAC and the Blasket islands SAC were designated for harbour porpoises. No SACs had been designated for turtles in Irish waters and no turtles were observed during any of the surveys.

It was considered that the main impacts of the development on marine mammals during construction would be from noise and disturbance due to construction activities, particularly from pile driving. However, due to their high degree of mobility and sensory awareness, it was concluded that marine mammals would tend to temporarily avoid the construction area over the period of disturbance and would quickly return following completion of the works. Mitigation measures identified in order to minimise the negative effects of the development on marine mammals included the use of MMOs (marine mammal observers) and a 'soft-start' procedure during piling operations in order to prevent injury through permanent or temporary hearing loss. No other significant potential impacts on marine mammals from the construction and operation of the Dublin Array were identified.

Following completion and submission of the EIS to the Department of Environment, Community & Local Government the Developers engaged Botanical, Environmental & Conservation Consultants Ltd (BEC Consultants) to undertake a further assessment of the potential impacts of the development on marine mammals. The purpose of their assessment was to inform the Appropriate Assessment for the project and it examined the potential for impacts on marine mammals, and any likely significant impacts of the development of the Dublin Array on any Natura 2000 site, where marine mammals are a key conservation feature of interest.

The purpose of this addendum to Chapter 10 of the Environmental Impact Statement is to review the potential impacts of the development and their significance for marine mammals using the Kish and Bray banks identified in the original Environmental Impact Statement in

the context of any additional information presented in the BEC Consultants report entitled **Report on Marine Mammals in relation to the Dublin Array Natura Impact Statement**. A copy of the report is included in Appendix D of this Addendum to the Dublin Array EIS.

5.2 Summary of Information presented in Report by BEC Consultants

The report was prepared by John Brophy M.Sc. MIEEM, of BEC Consultants, an expert ecologist with extensive experience in the assessment of marine and freshwater habitats and species. The report follows the standard prescribed format for an Appropriate Assessment and was prepared with reference to the following guidelines:

- DEHLG (2009). Appropriate Assessment of Plans and Projects in Ireland Guidance for Planning Authorities. Department of the Environment, Heritage and Local Government.
- 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 (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.

In accordance with the above guidelines, the report adopted a staged approach to the assessment, with a conclusion made at the end of each stage as to whether the project should proceed to the next stage.

In carrying out the assessment, Mr. Brophy makes extensive reference to a large portfolio of technical publications relating to marine mammals including impacts of marine noise and associated mitigation measures for offshore wind farm developments. These include several documents published since completion of the EIS for Dublin Array. Of particular relevance are the following publications:

- **Department of Arts Heritage and the Gaeltacht:** *Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters*. (Draft March 2012).
- **Department of Arts Heritage and the Gaeltacht:** *Marine Natura Impact Statements in Irish Special Areas of Conservation*. (A Working Document – April 2012).
- **Bailey et al. (2010).** *Assessing underwater noise levels during pile driving at an offshore windfarm and its potential effects on marine mammals*. (Marine Pollution Bulletin 60: 888-897).
- **Berrow et al. (2011).** *Inshore boat-based surveys for cetaceans – Irish Sea*. (Report for the National Parks and Wildlife Service. Irish whale and Dolphin Group).
- **Brandt et al. (2009).** *Assessing underwater noise levels during pile driving at an offshore windfarm and its potential effects on marine mammals*. (Marine Pollution Bulletin 60: 888-897).
- **IWDG. (2012).** *Data in relation to Cetacean sighting summary summer 2012 and harbour porpoise accessed on IWDG website*.
- **NPWS. (2011).** *Conservation objectives for Lambey Island SAC [000294]*. (Generic Version 3.0 – Department of Arts, Heritage & the Gaeltacht).
- **NPWS. (2012).** *Map of proposed candidate Special Area of Conservation: Rockabill to Dalkey Island SAC [site code 003000]*. (Version 1.0).

- **Ramboll (2012).** *Offshore pile driving – cofferdam: underwater noise measurements.* (Report prepared for Lo-Noise ApS by Ramboll, Kobenhaven, Denmark).

The stage 1 screening assessment undertaken by Mr. Brophy, in order to define the project and to assess the potential for significant effects upon the Natura 2000 network, identified a significant change regarding the presence and proximity of protected sites which need to be considered in relation to the potential impacts of the proposed development on marine mammals. As correctly identified in the Dublin Array EIS, there is currently only one Special Area of Conservation (SAC) designated for marine mammals on the Irish east coast. Grey seal is a Qualifying Interest for the Lambay Island SAC (site code 000204), which is approximately 20 km from the proposed Dublin Array. However, since the completion of the Dublin Array EIS, the Department of Arts, Heritage and the Gaeltacht has proposed the Rockabill to Dalkey Island pcSAC (site code 003000) for designation for the protection of harbour porpoises. Currently, again as identified in the Dublin Array EIS, only Roaringwater Bay cSAC and Blasket islands cSAC have been designated for this species, but as the Rockabill to Dalkey Island pcSAC is now proposed, it assumes the same protection that full designation affords a site. The boundaries of the Rockabill to Dalkey Island pcSAC is presented in Figure 3 of Mr. Brophy's report and is reproduced in Figure 5.1 below. It is approximately 1.6 km west of the proposed Dublin Array site boundary at it's closest point. It's proposed designation for the protection of harbour porpoise clearly justifies a review of the potential impacts of the proposed development on this species in the context the conclusions of the assessment undertaken by Mr. Brophy.

The screening assessment concluded that there would be no other Natura 2000 sites designated for marine mammals adversely affected by the propose development, on the basis that the closest marine mammal SACs, outside those being considered in the report, were UK sites situated well beyond the range at which the noise generated by the installation of the proposed monopiles for the Dublin Array would return to background levels for the relevant marine mammal species being considered.

The potential impacts on marine mammals associated with the construction and operation of the Dublin Array identified in the assessment undertaken by Mr. Brophy are consistent with those identified in the Dublin Array EIS. Construction stage impacts include noise and vibration from construction activities, habitat disturbance, increased suspended sediment/turbidity and pollution. Operation phase impacts include noise and vibration generated by the operation of the wind turbines, loss of habitat, electromagnetic fields and decommissioning. With the exception of construction noise, Mr. Brophy concluded that most of the identified potential impacts were unlikely to have a significant adverse effect on any Annex II marine mammal, which is again consistent with the conclusions of the Dublin Array EIS, or on a Natura 2000 site, whether existing or proposed. The only potential impact identified by the screening assessment as being worthy of more detailed consideration, was construction noise given its potential to have significant adverse effects on the marine mammals associated with the Lambay Island SAC and the Rockabill to Dalkey Island pcSAC. This mainly related to behavioural or aversive effects on harbour porpoise within the Rockabill to Dalkey Island pcSAC given its proximity to the proposed Dublin Array. It was concluded, on the basis that harbour porpoise can show aversive behaviour to piling up to a distance of 15 km, that a significant proportion of the pcSAC could be affected by unmitigated piling operations resulting in reduced harbour porpoise activity in the area in the short term. The maximum area potentially affected by unmitigated piling on this basis was calculated as constituting up to 52% of the Rockabill to Dalkey pcSAC for works occurring towards the north western corner of the proposed wind farm site. This would reduce to 34% and 7% respectively of the pcSAC for unmitigated piling works taking place

at the mid-point of the western boundary of the site and at the south western corner of the site. These are illustrated in Fig. 5.2.

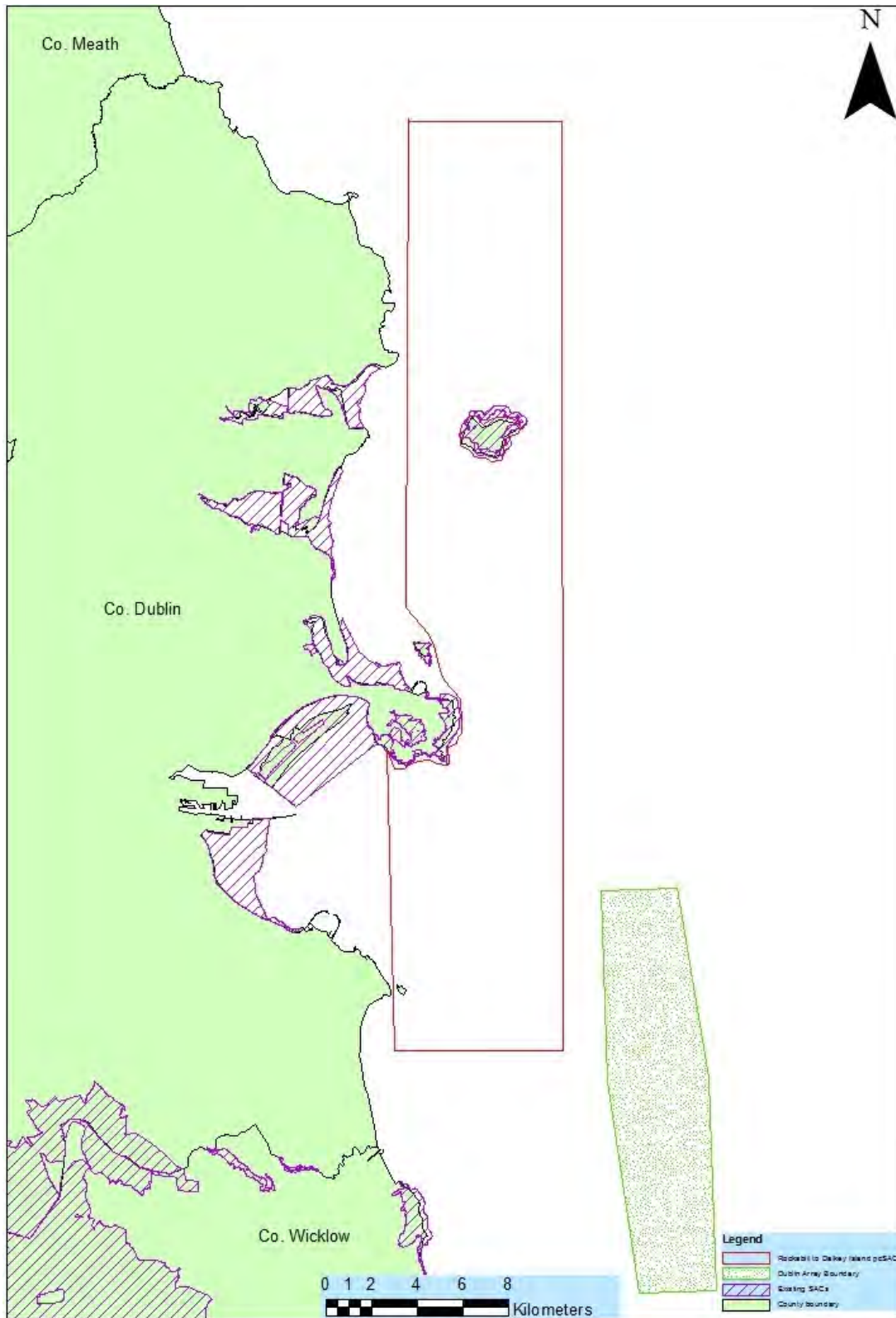


Figure 5.1 Boundary of the Rockabill to Dalkey Island pcSAC

The Stage 2 Appropriate Assessment identifies the necessity to implement mitigation measures to reduce the likely impact of the construction noise on harbour porpoises and grey seal in the vicinity of the Dublin Array. It notes, as also identified in the Dublin Array EIS that unmitigated piling has the potential to pose physical injury to marine mammals at very close ranges (<100m) and to cause aversive effects up to 9 km in the case of grey seals and 15 km in the case of porpoise. It notes that 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 750m from the pile for the protection of harbour porpoise. Mitigation measures identified include:

- Marine Mammals Observers (MMOs) – Employment of MMOs, as proposed in the Dublin Array EIS, to ensure the area around the piling is clear of marine mammals prior to commencement of piling operations in order to minimize the possibility of injury to marine mammals.
- Soft-starts – Use of ‘soft starts’ or ‘ramp-up’ procedures in combination with the MMOs when commencing piling operations in order to reduce the risk of injury to marine mammals, again as proposed in the Dublin Array EIS.
- Cofferdam – The use of a cofferdam system during piling operations in order to reduce the propagation of noise out into the water column. The cofferdam comprises a steel tube of greater diameter than the monopole which is put in place before the pile is installed. Water is pumped out from within the cofferdam before piling commences, thereby reducing the ability of sound to be transmitted to the water column. The report notes that 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 as noted above.
- Consideration of any further improvements in technology that have been proven to a commercial level prior to the commencement of construction.

Mitigation measures identified in the report to minimize the effects of other construction and operational stage impacts are consistent with those identified in the Dublin Array EIS.

The report considers the residual effects from construction noise on marine mammals to be expected following the implementation of the mitigation measures outlined above. It concludes that the implementation of the MMOs and ‘soft-start’ procedures will ensure that there is no direct, physical impact on marine mammals in the area around construction operations and therefore no permanent or temporary hearing loss in harbour porpoises or grey seals from the nearby Lambay Island SAC or the Rockabill to Dalkey Island pcSAC that may present in the Kish and Bray banks area. The lack of physical injury to species listed as qualifying interests of the Lambay Island SAC or the Rockabill to Dalkey Island pcSAC populations prevents any direct impacts on the population dynamics through loss of individuals.

On the basis of the above, with the risk of direct injury to marine mammals greatly reduced by the implementation of MMOs and ‘soft start’ procedures, as proposed in the Dublin Array EIS, the potential for significant adverse effects is limited to disturbance during piling operations. The report notes that while the proposed use of cofferdams during piling operations will significantly reduce underwater noise levels and thereby the area over which aversive behaviour may occur, it does not eliminate it. It concludes that the use of the cofferdam system during the installation of the piles will reduce the range of aversive reactions in harbour porpoise from 15 km to below 10km thereby significantly reducing the extent of the Rockabill to Dalkey Island pcSAC potentially affected compared to the unmitigated piling as illustrated in Figures 5.2 and 5.3. Based on the reduced range, it

calculates that the maximum extent affected by piling operations at the north west corner of the Dublin Array will reduce from 52% to 40% of the Rockabill to Dalkey Island pcSAC, and that it will reduce from 34% to 18% and from 7% to 0% for piling operations at the mid-point of the western boundary and the south west corner respectively of the Dublin Array compared to the unmitigated piling.

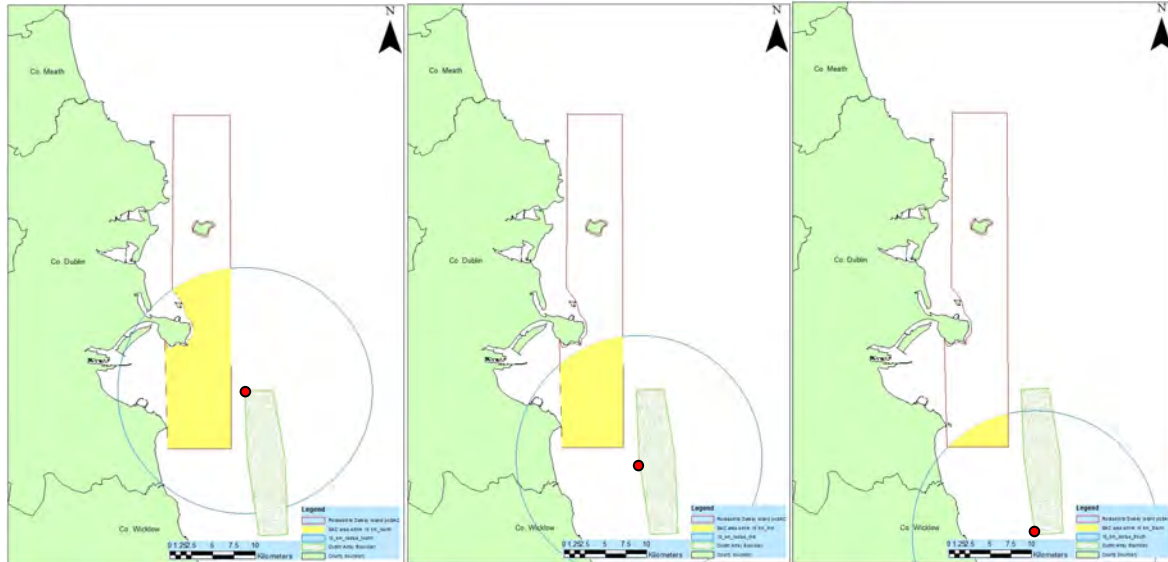


Figure 5.2 Area of Rockabill to Dalkey Island pcSAC within 15km range of piling operations at northwest, mid-west and southwest corners of Dublin Array. *This is area of potential aversive behaviour in harbour porpoise for unmitigated piling.*

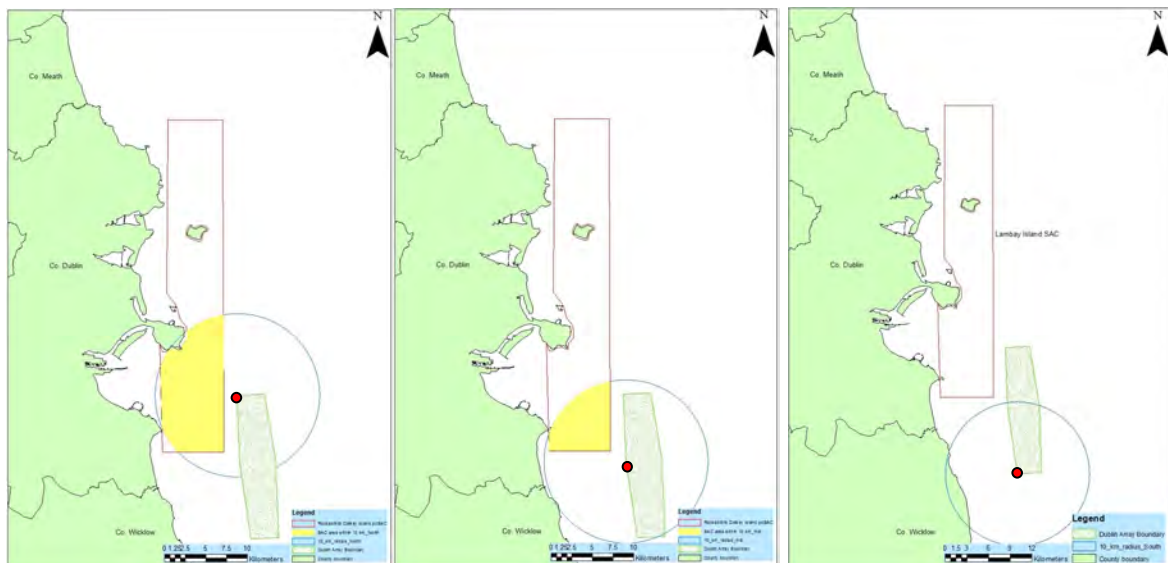


Figure 5.3 Area of Rockabill to Dalkey Island pcSAC within 10km range of piling operations at northwest, mid-west and southwest corners of Dublin Array. *This represents reduced area of potential aversive behaviour in harbour porpoise using cofferdam during piling operations to reduce sound transmission into water column.*

A report prepared by the Irish Whale and Dolphin Group for the National Parks and Wildlife Service on a Harbour Porpoise Survey completed in 2008 (Berrow *et al.*, 2008) identified North County Dublin as being the area with the highest harbour porpoise density in Ireland, also with one of the highest proportion of young and Mr. Brophy notes that this area is

beyond the estimated range for behavioural effects in harbour porpoise. The proposed use of the cofferdam system and the short-term, localized nature of the piling operations (approximately 3 years over less than 5% of the development site at any one time), will mean that a maximum of 40% of the southern part of the Rockabill to Dalkey Island pcSAC will be affected to a level that may cause aversive reaction in harbour porpoise for a limited period. This maximum effect will occur while piling operations are taking place at the northwest corner of the site, and will reduce significantly as piling operations take place further south and east as indicated above.

The report notes that Harbour porpoises are found all along the Irish coast and their distribution varies spatially and temporally so any temporary displacement of harbour porpoises from the Rockabill to Dalkey Island pcSAC can be facilitated by movement of those individuals into surrounding areas. It considers it almost certain that the harbour porpoises that occur within the Rockabill to Dalkey Island pcSAC already exploit a much wider area as suggested by the variability of the results from the IWDG survey in 2008 and other studies on the range of harbour porpoises. It notes that Harbour porpoises have been shown to return to areas where wind farms have been constructed following the cessation of piling works and that in some cases (Egmond ann Zee) this return was rapid and a positive effect was seen once the wind farm was operational, while in other cases (Nysted) the harbour porpoise numbers increased gradually over two years. In the latter case, it was noted that harbour porpoise densities in the immediate area of the works were low to begin with, thus making the effect appear more dramatic. 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.

On the basis of the above, it was concluded that 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 Rockabill to Dalkey Island pcSAC. 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 Rockabill to Dalkey Island pcSAC. 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. 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. On this basis Mr. Brophy concludes that there will be no significant adverse effect on the site causing it not to meet its Conservation Objectives from the construction of the Dublin Array.

5.3 Review of Potential Impacts of Dublin Array and their significance for Marine Mammals in the context of additional information provided in the BEC Consultants Report

The significant changes to the information presented in Chapter 10 (Marine Mammals and Turtles) of the Dublin Array EIS to be considered in reviewing the potential impacts of the development and their significance for marine mammals following the completion of the further assessment by BEC Consultants can be summarized as follows:

- The proposed designation of the Rockabill to Dalkey Island pcSAC for the protection of Harbour porpoise.

- The potential use of coffer-dams during piling operations in order to reduce underwater noise levels.

On the basis of the above, it is considered that the following amendments are appropriate to the Mitigation Measures and Predicted Impacts of the development on Marine Mammals and Turtles presented in Sections 10.5 and 10.6 respectively of the Dublin Array EIS:

Mitigation Measures

Section 10.5.1 of the Dublin Array EIS concluded that adopting a mechanical and acoustic soft start procedure would represent the most effective mitigation measure to reduce the impact of noise from the piling operations for the Dublin Array on marine mammals. It also proposed that marine mammal observers (MMO's) would be used during the initial piling operations to confirm the reliability of the acoustic and acoustic soft start procedures at displacing marine mammals from a predefined area around the works. On the basis of the information presented in the assessment undertaken by BEC Consultants it is now proposed that the use of cofferdams during the piling operations be adopted as an additional mitigation measure in order to reduce the underwater noise levels and the associated range of aversive reactions in harbour porpoise. An Addendum to the Description of Works included in Chapter 3 of the Dublin Array EIS identifying the proposed use of this additional mitigation measure is included in Section B of this Addendum to the EIS accordingly.

Predicted Impacts

Section 10.6.1 of the Dublin Array EIS concluded that the use of acoustic and mechanical soft start to clear the immediate area of marine mammals prior would reduce the significance of effects of physical injury or death, permanent threshold shift in hearing sensitivities and temporary threshold shift in hearing sensitivities to low levels of significance. It is now concluded that the reduction in noise levels associated with the proposed use of cofferdams will further reduce the significance of these effects on marine mammals.

Section 10.6.1 also considered that displacement and behavioural effects were likely to be short term for each piling operation and that animals towards the outer limits of displacement were likely to exhibit fewer behavioural effects. It was concluded therefore that the effects due to displacement were unlikely to be significant and the effects on seals and cetaceans due to sub-lethal noise sources from the pile driving would be low adverse. On the basis of the assessment now undertaken by BEC Consultants and the reduced range of adversarial behaviour associated with the use of cofferdams, that a temporary reduction in the activity of harbour porpoise within a range of 10 km of active piling operations will not be significant and that the overall effects on marine mammals will remain low adverse as per the conclusions of the Dublin Array EIS.

6 Addendum to Chapter 12 of the Dublin Array EIS (Landscape and Visual Impact Assessment)

6.1 Introduction

Chapter 12 of the Dublin Array EIS (Volume 2) submitted to the Department of Environment, Communications and Local Government in February 2012 included a detailed description of the likely visual impacts of the proposed development based on the ZTV Maps and Photomontages (Volumes 4 and 5 of EIS) which had previously been submitted to the Department. Given the time which has elapsed since the preparation of these initial photomontages and ZTV maps in 2004, with changes to landscape context and updates to best practice and technology, as well as minor amendments to the proposed locations of the turbines based on more detailed geotechnical and bathymetric survey data, it was deemed appropriate to update the ZTV Maps and Photomontages as part of the current Addendum to the EIS.

Revised Volumes 4 (ZTV Maps) and 5 (Photomontages) are therefore included with the Addendum documentation being submitted to the Department in February 2013.

Amended Tables 12.1 (Description of Viewshed Reference Points (VRP's)), 12.2 (Assessment of Landscape Sensitivity of Viewshed Reference Points) and 12.3 (Summary of Landscape Impact from each of the VRPs) as well as updated Landscape Impact Assessments from each of the Viewsheds to reflect the revised images are included on the following pages and should be read in place of those previously included on pages 281, 283, 312 and 288 to 307 respectively of Chapter 12 (Volume 2) of the Dublin Array EIS (Rev.1 – January 2012).

Details of the Methodology used by Macro Works Ltd in the preparation of the revised viewsheds and photomontages is included in Appendix E of this Addendum to the Dublin Array EIS.

Viewpoint	Easting	Northing	Description
VRP1	332005	193076	View from scenic car park overlooking Wicklow Town at Corporation Lands, Co. Wicklow
VRP2	331758	203847	View from beach entrance at Six Mile Point, Newcastle, Co. Wicklow
VRP3	328029	205518	View from high bend in the N11 road at Kilmullin, Co. Wicklow
VRP4	329623	212764	View from Greystones Harbour, Co. Wicklow
VRP5	323784	213077	View from the summit of the Sugar Loaf Mountain, Co. Wicklow
VRP6	328206	217516	View from elevated position on walkway around Bray Head, Co. Wicklow
VRP7	327276	218354	View from Bray promenade, Co. Wicklow
VRP8	323130	220068	View from the top of the hill at Carrickgollogan, Co. Dublin
VRP9	326478	225795	View from Vico Road adjacent to Killiney Hill, Co. Dublin
VRP10	326068	225532	View from the obelisk at the top of Killiney Hill, Co. Dublin
VRP11	327229	226615	View from Coliemore harbour, Dalkey, Co. Dublin
VRP12	324753	228536	View close to the entrance to the East Pier, Dun Laoghaire, Co. Dublin
VRP13	319438	232237	View from the road R131 close to Sandymount, Co. Dublin
VRP14	318104	234249	View from the East-Link toll bridge, Ringsend, Co. Dublin
VRP15	318396	236105	View from link road between R131 at Dublin Port and the coast road near Clontarf, Co. Dublin
VRP16	319140	235890	View from pedestrian walkway along the sea wall close to Clontarf Village, Co. Dublin
VRP17	322195	235143	View from a point approximately 300 m from the end of the Bull Wall, North Bull Island, Co. Dublin
VRP18	325139	239246	View from the coast road R105 facing Dublin Bay at Sutton, Co. Dublin
VRP19	329594	237360	View from scenic viewpoint adjacent to car park at The Summit, Howth Head, Co. Dublin
VRP20	326273	250436	View from car park at scenic viewpoint close to the Martello Tower at Portrane, Co. Dublin
VRP21	327226	253805	View facing east / south-east from entrance to new housing estate in Rush, Co. Dublin
VRP22	335426	232535	Offshore view facing southeast from small boat 7 km southeast of Howth Head

Table 12.1 Description of Viewshed Reference Points (VRP's)

Assessment Criterion	Viewshed Reference Point Number																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Sense of awe	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	Y	N	Y	Y	N	Y
Number of viewers	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Likely mental disposition of viewers	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	N	Y	Y	N	Y
Recreational facility	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	N	Y
Provision of highly elevated panoramic views	Y	N	Y	Y	Y	Y	N	Y	Y	Y	N	N	N	N	N	N	N	N	Y	N	N	N
Presence of water (river, lake, sea)	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Strong presence of mountains											N	N	N	N	N	N	Y	Y	Y	N	N	N
Degree of perceived naturalness and sense of remoteness	N	Y	N	N	Y	Y	N	N	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	Y
Ruggedness of landform / exposure of rock outcrops	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	Y	N	N	N	N
Presence of striking or noteworthy features	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y
Integrity of character	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Distinctiveness / memorability	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	Y	N	Y	Y	N	Y
Fragility	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y
Tourist or other income value	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	Y	N	Y	Y	N	Y
Historical, cultural and / or spiritual significance sensed	Y	Y	N	Y	N	N	Y	N	Y	Y	Y	Y	Y	N	N	N	Y	N	Y	Y	N	Y
Rarity or uniqueness	N	Y	N	N	Y	Y	N	N	N	Y	N	N	N	N	N	N	N	N	Y	N	N	N
Summary Sensitivity Assessment	H	VH	M	H	VH	VH	H	M	VH	VH	H	H	H	L	L	M	H	M	VH	H	L	H

Table 12.2 Assessment of Landscape Sensitivity of Viewshed Reference Points

Key: 'N' indicates that the VRP is generally not sensitive with respect to the assessment criterion, while 'Y' implies that it is sensitive

The overall sensitivities are indicated as follows: VL = very low sensitivity; L = low sensitivity; M = medium sensitivity; H = high sensitivity; and VH = very high sensitivity

VRP No.	Location	Summary Impact
6	View from Walkway Around Bray Head, Co. Wicklow	Adverse Major
10	View from the Obelisk at the Top of Killiney Hill, Co. Dublin	Adverse Major
9	View from Vico Road Adjacent to Killiney Hill, Co. Dublin	Adverse Major
19	View from Scenic Viewpoint Adjacent to Car Park at The Summit, Howth Head, Co. Dublin	Adverse Major
1	Scenic Car Park Overlooking Wicklow Town at Corporation Lands, Co. Wicklow	Adverse Moderate
2	View from Beach Entrance at Six Mile Point, Newcastle, Co. Wicklow	Adverse Moderate
4	View from Greystones Harbour, Co. Wicklow	Adverse Moderate
11	View from Coliemore Harbour, Dalkey, Co. Dublin	Adverse Moderate
16	View from Pedestrian Walkway Along Sea Wall Close to Clontarf Village, Co. Dublin	Adverse Moderate
17	View from a Point Approximately 300 m from the End of the Bull Wall, North Bull Island, Co. Dublin	Adverse Moderate
3	View from High Bend in the N11 Road at Kilmullin, Co. Wicklow	Adverse Minor
5	View from Summit of the Sugar Loaf Mountain, Co. Wicklow	Adverse Minor
8	View from the top of the hill at Carrickgollogan, Co. Dublin	Adverse Minor
13	View from the Road R131 close to Sandymount, Co. Dublin	Adverse Minor
15	View from the Link Road Between the R131 at Dublin Port and the Coast Road Near Clontarf, Co. Dublin	Adverse Minor
18	View from the Coast Road R105 Facing Dublin Bay at Sutton, Co. Dublin	Adverse Minor
20	View from Car Park at Scenic Viewpoint Close to Martello Tower at Portrane, Co. Dublin	Neutral
21	View Facing East / Southeast from Entrance to New Housing Estate in Rush, Co. Dublin	Neutral
14	View from the East-Link Toll Bridge, Ringsend, Co. Dublin	No Impact
7	View from Bray Promenade, Co. Wicklow	Positive Minor
12	View Close to the Entrance to the East Pier, Dun Laoghaire, Co. Dublin	Positive Minor
22	Offshore View Facing Southeast from Small Boat 7 km Southeast of Howth Head	Positive Major

Table 12.3 Summary of Landscape Impact from each of the VRPs

6.2 Detailed Landscape Impact Assessment

6.2.1 Landscape Impact Assessment from VRP 1

VRP Location: Scenic Car Park Overlooking Wicklow Town at Corporation Lands, Co. Wicklow

<i>VRP sensitivity</i>	High
<i>Distance to nearest turbine</i>	21.7 km
<i>Number of turbines visible</i>	All visible

Existing View: This viewpoint is from a scenic car park located to the south of Wicklow town. The car park is situated in an elevated position and has panoramic views encompassing Wicklow harbour and bay. The view to the north of the location encompasses the Great Sugar Loaf, the Little Sugar Loaf, Bray Head and distant views of the Wicklow mountains. This viewpoint is set in an urban context with the town centre, harbour and housing estates visible below the car park.

Landscape Impact: The proposed wind farm would be visible from this location with no screening being provided. However there is considerable distance between the turbines and the coast at this point, the closest turbine being located 21.7 km away. While all turbines are visible from this location, the wide panoramic view of the sea from this point reduces the extent of the panorama that is occupied by the wind farm. The layout of the wind farm as viewed from this point consists of a number of groups of turbines that taper to single turbines at the northern and southern edges of the wind farm. This viewpoint is set close to a busy town and working port with a lot of existing human activity, and as such the wind farm may be more accommodated at this location than at other viewpoints.

Cumulative Impact: All turbines in the proposed Codling Bank wind farm would also be visible from this viewpoint. The Codling Bank wind farm is closer to the viewpoint than the Dublin Array (the closest turbine would be located at a distance of approximately 17.9 km). It also occupies a larger extent of the seascape and is more densely clustered than the Dublin Array. The overall cumulative effect of this proposed development at this viewpoint is high. The Arklow Bank wind farm is not visible from this location and so there are no cumulative impacts arising from it.

Summary Impact Assessment: While the entire wind farm would be visible from this popular elevated point, it would be located a long distance from the viewpoint and would not occupy a large extent of the seascape. In addition, since this location is set in the context of a busy working town and port, the overall classification is considered **Adverse Moderate**.

6.2.2 Landscape Impact Assessment from VRP 2

VRP Location: View from Beach Entrance at Six Mile Point, Newcastle, Co. Wicklow

<i>VRP sensitivity</i>	Very High
<i>Distance to nearest turbine</i>	12.17 km
<i>Number of turbines visible</i>	All visible

Existing View: This viewpoint is located on a long shingle beach located on the coast close to Newcastle, Co. Wicklow. It is a popular area for walking, swimming and shore angling. The Dublin – Rosslare railway line runs alongside the beach. The panorama from this viewpoint is dominated by the sea to the east, with inland views being dominated by the Great Sugar Loaf and the Wicklow Mountains to the northwest.

Landscape Impact: All turbines in the proposed wind farm would be visible from this viewpoint, and no screening would be provided (except by neighbouring turbines). The nearest turbine is located 12.17 km from the viewpoint, with all turbines being set against the horizon. Due to the wide extent of seascape that is visible from the viewpoint, the wind farm occupies a relatively small extent of the sea view. There is no visual connection between the wind farm and coast, and so views of the wind farm are not fenced-in. The railway line that runs parallel to the shore along the shingle beach environment sets the wind farm in the context of human development that has already taken place in the area. The layout of the wind farm as viewed from this point consists of a regular line of turbines from the left (northern side of the development), with some avenues of turbines appearing the closer one gets to the right (southern side of the development). The panorama tapers to views of single turbines on the far right of the development.

Cumulative Impact: All turbines in the proposed Codling Bank wind farm would also be visible from this viewpoint. The Codling Bank wind farm occupies a similar extent of the seascape though it appears to be more densely clustered than the Dublin Array. There is no overlap between turbines from the developments from this viewpoint. The Arklow Bank wind farm is also partially visible from this viewpoint. The overall cumulative effect at this viewpoint is significant.

Summary Impact Assessment: While this location is one of high amenity value, the regular layout of the wind farm viewed against the horizon line and the relatively small extent of the seascape occupied by the development compared to at other locations result in an overall impact of the proposed development of **Adverse Moderate**.

6.2.3 Landscape Impact Assessment from VRP 3

VRP Location: View from High Bend in the N11 Road at Kilmullin, Co. Wicklow

<i>VRP sensitivity</i>	Medium
<i>Distance to nearest turbine</i>	13.66 km
<i>Number of turbines visible</i>	All visible

Existing View: This viewpoint is located on an elevated position on the busy national N11 route at Kilmullin, Co. Wicklow. The view towards the sea is dominated by open farmland with the sea in the background. Bray Head is visible to the north along the coast and, inland towards the north are the Great Sugar Loaf and the rolling Wicklow Mountains. Sparse residential housing can be seen along the coast.

Landscape Impact: The entire wind farm would be visible along a large portion of the natural sea views that are visible from this point. The closest turbine is located at a distance of 13.66 km. While some screening is provided by vegetation in the vicinity, no screening is provided from this particular viewpoint location. Turbines to the left of the wind farm appear closely packed, with avenues of turbines visible in the centre and turbines more sparsely laid out to the right. The presence of the N11 road, habitations and other forms of human activity in the area such as telegraph poles set the wind farm in the context of an area that has already seen significant human development.

Cumulative Impact: The full extent of the proposed Codling Bank wind farm would also be visible from this viewpoint, though there is some local screening of turbines provided by vegetation in the area. The Codling Bank wind farm appears as a distinct development, with no overlap between its turbines and the turbines from the Dublin Array. The Codling Bank wind farm occupies a smaller extent of the seascape though it appears to be more densely clustered than the Dublin Array. The Arklow Bank wind farm would not be visible from this location due to screening in the area and so there would be no cumulative impacts arising from it. The overall cumulative effect at this viewpoint is significant.

Summary Impact Assessment: The wind farm is highly visible from this location though local screening effects reduce its visual impact from some points in the vicinity. The wind farm does not dominate the panoramic sea views from this medium sensitivity location. When combined with the sense of the area, which has been developed significantly, the overall classification is considered to be **Adverse Minor**.

6.2.4 Landscape Impact Assessment from VRP 4

VRP Location: View from Greystones Harbour, Co. Wicklow

<i>VRP sensitivity</i>	High
<i>Distance to nearest turbine</i>	9.45 km
<i>Number of turbines visible</i>	All visible

Existing View: This viewpoint is located on the shoreline at the seaside town of Greystones. The view from this location is dominated by the wide panorama of the sea. To the north, along the coast, Bray Head can be seen.

Landscape Impact: All turbines in the proposed development would be visible against the horizon from the viewpoint at Greystones Harbour with no local screening being provided. Given that the wind farm occupies a significant portion of the extent of the seascape and that the nearest turbine is located at a distance of approximately 9.45 km, the visual impact from this point would be one of the most significant of all VRPs. The closest turbines, which are located to the right (southern side) of the development, are regularly spaced. As one moves to the left, a number of avenues of turbines appear and towards the far left (northern side) of the development the turbines gradually taper easing the transition to open sea.

Cumulative Impact: All turbines in the proposed Codling Bank wind farm would also be visible from this viewpoint with the closest turbine being located at a distance of approximately 15 km. Each wind farm appears as a distinct development with no overlap between turbines. The Dublin Array occupies a wider extent of the seascape, while the density of turbines in the Codling Bank is greater than that on the Kish and Bray Banks. The overall cumulative effect at this viewpoint would be significant. While the Arklow Bank wind farm could potentially be seen from this viewpoint, it is over 30 km from the Dublin Array. The EIS for the Codling Bank wind farm concluded that the cumulative impact of the Arklow Bank development was negligible. The cumulative impact is also considered insignificant in this EIS.

Summary Impact Assessment: While the development would be clearly visible along the horizon from this viewpoint, and the closest turbines would be amongst the closest of all viewpoints, the wind farm would be viewed from an area that has a largely urban context. The visual impact from this point is therefore judged to be **Adverse Moderate**.

6.2.5 Landscape Impact Assessment from VRP 5

VRP Location: View from Summit of the Sugar Loaf Mountain, Co. Wicklow

<i>VRP sensitivity</i>	Very High
<i>Distance to nearest turbine</i>	15.26 km
<i>Number of turbines visible</i>	All visible

Existing View: The Great Sugar Loaf mountain, shaped much like a volcano, is located in north Wicklow. The mountain is very popular with walkers due to its close proximity to Dublin, its ease of access and the panoramic views that can be seen from its summit. Extensive views are afforded of the Irish Sea to the east (indeed the mountains of Wales can be seen on a very clear day). Looking northwards, the expanse of Dublin city can be seen in the distance. The Little Sugar Loaf and the Glen of the Downs are situated between the summit and the Irish Sea, though the national N11 route is also clearly visible. Views to the west are dominated by the Wicklow Mountains.

Landscape Impact: This is the first viewpoint from which the turbines appear below the horizon and from which the viewer can appreciate the full depth of the wind farm. The viewer has a more three dimensional view of the wind farm than that afforded from previous VRPs. The turbines are located just below the distant horizon, with the nearest turbine being located at a distance of 15.26 km from this location. There are several avenues of turbines located on the right (southern) end of the development that allow the viewer to appreciate the grid-like geometry of the wind farm. As one moves to the left, the pattern of turbines becomes less regular and increases in density. The presence of the wind farm would introduce a large human development to the area of open sea that is to date only characterised by the presence of the Kish Lighthouse. However, this development would be set against a backdrop that has a lot of other human development; for instance, Bray town and the N11 are clearly visible from the same viewpoint. In addition, the waters around the development provide busy shipping lanes to marine traffic travelling in and out of Dublin Port and Dun Laoghaire Harbour.

Cumulative Impact: All turbines in the proposed Codling Bank wind farm would also be visible from this viewpoint with the closest turbine being located at a distance of approximately 20.7 km. Each wind farm can be distinguished with no overlap between the turbines of each development. The Codling Bank wind farm has a much higher density of turbines, thus occupying a smaller extent of the seascape. Similar to the Dublin Array, there are several regularly ordered avenues of turbines located towards the right of the development. The overall cumulative effect at this viewpoint would be significant. While the Arklow Bank wind farm could theoretically be seen from this viewpoint, it is located at a distance of over 30 km. The EIS for the Codling Bank wind farm concluded that the cumulative impact of the Arklow Bank development was negligible. The cumulative impact is also considered insignificant in this EIS.

Summary Impact Assessment: While the wind farm would be clearly visible from this viewpoint, the ordered appearance of the wind farm and the developed nature of the surrounding landscape result in an impact classification of **Adverse Minor**.

6.2.6 Landscape Impact Assessment from VRP 6

VRP Location: View from Walkway Around Bray Head, Co. Wicklow

<i>VRP sensitivity</i>	Very High
<i>Distance to nearest turbine</i>	10.35 km
<i>Number of turbines visible</i>	All visible

Existing View: A cliff walk runs from Bray town along the coast to Greystones. Good views of the sea and sea cliffs below can be experienced along this route, which is very popular with walkers. Views along the coast extend to Bray in the north and Greystones in the south. A railway line runs parallel to the coast between the route and the sea and trains can be seen at several points along the path. Bray Head has been designated an area of Outstanding Natural Beauty and an Area of Special Amenity by Wicklow County Council.

Landscape Impact: All turbines would be visible from this viewpoint. The turbines appear to be at a closer proximity than at most other viewpoints (the closest turbine would be located approximately 10.35 km from this viewpoint). At distances like this the turbines would be close enough to distinguish clearly the rotation of the blades. The turbines appear regularly spaced in a line along the horizon that occupies a large extent of the panoramic sea view. Towards the right (south) of the development, a number of turbine avenues are visible. The turbines would introduce a change to the predominantly natural character of the views that are to be experienced from this viewpoint.

Cumulative Impact: All turbines from the proposed Codling Bank wind farm would also be visible from this viewpoint with the closest turbine being located at a distance of approximately 17 km. There would be some overlap between the southernmost turbines on the Bray Bank and the northernmost turbines of the Codling Bank, when viewed from this location. This overlap results in a continuous line of turbines running along most of the horizon when viewed from this point. The cumulative impact of the Dublin Array with the Codling development is therefore considered to be very high. The Arklow Bank wind farm would not be visible from this location and so there would be no cumulative impacts resulting from it.

Summary Impact Assessment: Given the highly sensitive nature of this location and the significant visual impact (including cumulative impact) that would result from the development, the overall impact is assessed as **Adverse Major**.

6.2.7 Landscape Impact Assessment from VRP 7

VRP Location: View from Bray Promenade, Co. Wicklow

<i>VRP sensitivity</i>	High
<i>Distance to nearest turbine</i>	10.96 km
<i>Number of turbines visible</i>	All visible

Existing View: This viewpoint is located on the sea front promenade at Bray town, Co. Wicklow. The promenade is located between the sea and Bray town, and there are many hotels, houses and commercial outlets facing it. The promenade is a popular place of amenity for residents of the town, especially since it adjoins the walk along Bray Head to the south. It is also popular with day-trippers from Dublin who have convenient access to the town by DART. The location is urban in character with extensive sea views.

Landscape Impact: All turbines would be visible from this viewpoint, the closest being located at a distance of 10.96 km. At this distance the rotation of the turbine blades would be clearly visible. The turbines are set against the horizon, and occupy a large extent of the panoramic sea view. The distribution of turbines is mostly evenly spaced, though some avenues of turbines appear close to the right (southern end) of the development, and to the left the turbine density reduces, easing the transition from the wind farm to the open sea. The wind farm could be regarded as being in keeping with the character of Bray Promenade where the white turbine towers would reflect the flagpoles and railing posts that are characteristic of the seaside resort.

Cumulative Impact: The northernmost turbines of the proposed Codling Bank wind farm would be visible from the promenade, with the remaining turbines being screened by the landform around Bray Head. Approximately 110 turbines from the Codling Bank would be visible from this viewpoint, should all phases of that wind farm be developed. While there would be overlap of the two developments, it would be possible to distinguish the Codling Bank turbines since the closest of these turbines would be located at a distance of approximately 18 km. The cumulative impact of the Codling Bank would serve to extend the portion of the horizon that is lined with turbines. Since the number of turbines from the Codling Bank development that would be visible would be low in comparison to the Dublin Array, the cumulative impact is considered to be relatively low. The Arklow Bank wind farm would not be visible from this location and so there would be no cumulative impacts resulting from it.

Summary Impact Assessment: The visual presence of the wind farm on the promenade would be significant, though it would add in some respects to the character of the seaside town. The overall impact is assessed as **Positive Minor**.

6.2.8 Landscape Impact Assessment from VRP 8

VRP Location: View from the top of the hill at Carrickgollogan, Co. Dublin

<i>VRP sensitivity</i>	Medium
<i>Distance to nearest turbine</i>	14.96 km
<i>Number of turbines visible</i>	All visible

Existing View: With an elevation of 276 m, the summit of Carrickgollogan hill has a 360 degree panoramic view, taking in the Irish Sea to the east, Dublin to the north, and the Wicklow mountains to the south west. There is extensive deciduous and pine forest on the slopes of the hill which, when coupled with the panoramic view, make this a popular amenity for walkers. To the north can be seen the expanse of Dublin city and Dublin Bay with Ireland's Eye and Killiney Hill in the distance. To the southeast there are good views of Bray town, with Bray Head in the background. While there is open farmland and forestry in the immediate foreground, the location is set in the context of a highly urbanised area overlooking Shankill, Killiney, Bray and Dublin in the distance.

Landscape Impact: The view of the wind farm from this viewpoint is similar to that seen from the summit of the Sugar Loaf mountain in Co. Wicklow in that the depth and width of the wind farm can be appreciated. All turbines are visible just below the horizon line though distant, the closest being at a distance of 14.96 km. The turbines occupy a wide extent of the sea view and are regularly spaced when viewed from this location. A number of turbine avenues are visible just to the right of centre of the development, which reduces the massing effect of the turbines. Moving towards the left (northern) and right (southern) extents of the wind farm the turbine rows taper to individual turbines, thus easing the transition from the wind farm to open sea. The wind farm does not visually connect with the coast and so the wind farm does not seem to fence in the views. The wind farm would not be out of keeping with the landscape viewed from this elevation, which is largely urbanised. Indeed the wind turbines could be regarded as being in keeping with some of the symbolic man-made features that are visible from the viewpoint, such as the obelisk on Killiney Hill and the chimneystacks of the ESB generating station at Ringsend.

Cumulative Impact: The proposed Codling Bank wind farm would be visible in the distance beyond Bray Head. While there would be some slight overlap between the two developments, the Codling Bank turbines would appear small due to their distance from this viewpoint (the closest would be located at a distance of approximately 23 km) and so it would be possible to distinguish between the two wind farms. While the Codling Bank wind farm appears distant, its impact would serve to increase the visual connection between the turbines and the coast, and so the cumulative impact is considered to be moderate. The Arklow Bank wind farm would not be visible from this location and so there would be no cumulative impacts arising from it.

Summary Impact Assessment: The Dublin Array would be highly visible from this viewpoint. However, given the orderly appearance of the wind farm from this location and the context of the foreground in which it is set, which is highly urbanised, the impact of the wind farm at this viewpoint is assessed as **Adverse Minor**.

6.2.9 Landscape Impact Assessment from VRP 9

VRP Location: View from Vico Road adjacent to Killiney Hill, Co. Dublin

<i>VRP sensitivity</i>	Very High
<i>Distance to nearest turbine</i>	10.61 km
<i>Number of turbines visible</i>	All visible

Existing View: The viewpoint on Vico Road is situated to the northeast of Killiney Hill. The road runs along the coast and offers many panoramic viewpoints of Killiney Bay, although there is screening in places due to the presence of houses between the coast and the road. The panorama from this viewpoint is dominated by the sea views over the bay. Dalkey Island with its Martello tower, and Sorrento Terrace can be seen to the north, and to the south Bray Head, the Little Sugar Loaf and the Great Sugar Loaf can be seen in the distance. The Rosslare – Dublin railway line is located between the coast and the road and this can be seen below the road. The area is a popular one for walking, and walkers frequently take the route along the road on their way to Killiney Hill.

Landscape Impact: All turbines would be visible against the horizon from the viewpoint on Vico Road, with the closest turbine being located at a distance of 10.61 km. The turbines appear as regularly spaced except for a number of avenues of turbines which gives a good sense of the grid layout of the wind farm. As viewed from this point, the wind farm appears as a substantial man-made development in the open expanse of sea. The density of turbines tapers towards the left (north) and right (south) of the wind farm thus providing a gradual transition from wind farm to the surrounding open sea.

Cumulative Impact: All turbines of the proposed Codling Bank wind farm would be visible from this vantage point. While the Codling Bank development appears further away than the Dublin Array, the density of turbines on the Codling Bank is much higher. There is some overlap between the turbines of both developments. When both developments are considered, the extent of the seascape covered by turbines is much wider. The visual impact is therefore significant. The Arklow Bank wind farm is located over 40 km from this viewpoint. While it could theoretically be viewed from this distance, it is unlikely to be visible in any weather conditions. If it could be seen, its scale would be so small that cumulative impacts resulting from it would be negligible. The EIS for the Codling Bank wind farm also assessed the cumulative impact of the Arklow Bank wind farm to be negligible at a viewpoint located close to Vico Road.

Summary Impact Assessment: The extent of turbines on the seascape as viewed from this viewpoint and the close proximity of the development to the viewpoint result in a significant visual impact at this highly sensitive location. The impact is assessed as **Adverse Major**.

6.2.10 Landscape Impact Assessment from VRP 10

VRP Location: View from the Obelisk at the Top of Killiney Hill, Co. Dublin

<i>VRP sensitivity</i>	Very High
<i>Distance to nearest turbine</i>	11.06 km
<i>Number of turbines visible</i>	All visible

Existing View: The obelisk on the top of Killiney Hill provides a very popular viewing point for Killiney Bay. A panoramic 360 degree view can be obtained from this location, with views inland of the expanse of Dublin city and views offshore of the Irish Sea. The panoramic sea views are framed at both ends, with Dalkey Island and its Martello tower to the north, and Bray Head to the south. Below the viewpoint, the main Rosslare to Dublin railway line runs parallel to the coast. The Sugar Loaf and other mountains in Wicklow can be seen in the distance to the south and south-east. The immediate area around this viewpoint location is steep and covered by woodland and scrub.

Landscape Impact: All turbines would be visible from the summit of Killiney Hill, and they would be close enough to the viewpoint that the rotation of the turbine blades could be seen (the closest turbine would be located approximately 11.06 km from the obelisk). From the elevated viewpoint the wind farm appears in a well-ordered grid layout with a constant density of turbines and the depth of the wind farm can be appreciated, though not to the same extent as at more elevated viewpoints such as the Sugar Loaf mountain. A number of avenues of turbines appear towards the left (north) of the development. Though the viewpoint is located amid a well-developed area, the elevation of the site results in the view towards the wind farm being dominated by woodland, sea and mountain views. The sensitivity of this location is therefore considered very high. The wind farm would contrast with these surroundings, though a number of man-made features, such as the Martello Tower on Dalkey Island and the obelisk at the viewpoint set a precedent for symbolic developments visible from the viewpoint. The turbines are not visually connected to the mainland, though marine traffic passing to the left of the wind farm would provide a visual link to the coast. As is the case at most other viewpoints, it should be noted that at many lower lying points in the vicinity of Killiney Hill, significant screening would reduce the visual impact of the wind farm.

Cumulative Impact: All turbines from the proposed Codling Bank wind farm would also be visible from this point, though they would appear smaller due to their distance from the viewpoint (the closest would be located at a distance of approximately 23 km). There would be some overlap between the southern part of the Dublin Array and the Codling Bank wind farm. The view of the Codling Bank development would increase the extent of the horizon occupied by turbines, and so the cumulative impact is deemed to be significant. The Arklow Bank wind farm is over 40 km from this viewpoint and so cumulative impacts resulting from it would be negligible.

Summary Impact Assessment: The extent of turbines visible from this site combined with the close proximity of the wind farm to the coast at this point result in a significant visual impact at this highly sensitive location. The cumulative impacts of the proposed Codling Bank wind farm would also be significant. The impact is assessed as being **Adverse Major**.

6.2.11 Landscape Impact Assessment from VRP 11

VRP Location: View from Coliemore Harbour, Dalkey, Co. Dublin

<i>VRP sensitivity</i>	High
<i>Distance to nearest turbine</i>	9.71 km
<i>Number of turbines visible</i>	101

Existing View: The view from Coliemore Harbour looks out over the Dalkey Sound with Dalkey Island and its prominent Martello tower in the foreground. To the north there are views across Dublin Bay to Howth Head. Despite the sea views, the character of the surrounding area is urban residential. The harbour area is popular for fishing and boat trips.

Landscape Impact: This viewpoint is the closest of all onshore viewpoints that have been assessed in this EIS, with the closest turbine being located at a distance of 9.71 km. At this proximity the motion of the turbine blades would be clearly visible. Approximately 100 turbines are visible from this location as Dalkey Island provides screening of the centre of the wind farm. Several avenues of turbines are visible to the left of Dalkey Island. This results in additional screening by neighbouring turbines. The extent of the panorama that is occupied by the wind farm from this viewpoint is not as significant as at other viewpoints, due to these screening effects. Towards the left (north) and right (south) of the development the density of turbines tapers, providing a gradual transition from wind farm to open sea.

Cumulative Impact: Approximately 100 turbines from the proposed Codling Bank wind farm would be visible from this location, though the turbines would be far more distant than those of the Dublin Array (the closest would be located at a distance of approximately 22.5 km). There would be some overlap of the southernmost Dublin Array turbines with the Codling Bank turbines. The extent of the horizon occupied by turbines is increased due to the Codling Bank development and so the visual impact would be quite significant. The Arklow Bank wind farm is over 40 km from this viewpoint and so cumulative impacts resulting from it are considered to be negligible.

Summary Impact Assessment: This viewpoint is one of the closest onshore viewpoints of the wind farm. While the close proximity to the turbines would increase the visual impact, the significant screening provided by Dalkey Island would reduce the number of turbines that would be visible. The cumulative impact of the Codling Bank wind farm is significant. The impact is considered to be **Adverse Moderate**.

6.2.12 Landscape Impact Assessment from VRP 12

VRP Location: View Close to the Entrance to the East Pier, Dun Laoghaire, Co. Dublin

<i>VRP sensitivity</i>	High
<i>Distance to nearest turbine</i>	12.03 km
<i>Number of turbines visible</i>	75

Existing View: Dun Laoghaire harbour is a very busy harbour that sees a number of cross-channel ferry sailings each day. It is also a very popular amenity area for walkers and its large marina is very popular for sailing. The views from Dun Laoghaire are dominated by sea views over Dublin Bay. Howth Head can be seen to the north and the coast to the south runs to Sandycove. There are also distant views of the Wicklow mountains to be seen to the south. The character of the landscape is dominated by manmade developments such as the pier, the marina and the buildings that overlook the harbour.

Landscape Impact: The wind farm would be partially screened by both landform and housing in the area surrounding the 'Forty Foot' in Sandycove. 65 turbines are fully or partially visible from this viewpoint. The turbines are regularly spaced in a line against the horizon. The closest turbine is located at a distance of 12.03 km. As one moves outwards from the coast (to the left) several avenues of turbines come into view. There is thus a progression in the density of visible turbines from constant (close to the coast) to sparse (further out to sea).

Cumulative Impact: The Codling Bank and Arklow Bank wind farms are not visible from this viewpoint and so there are no cumulative impacts resulting from these developments. The Codling Bank wind farm would be visible from other viewpoints located close to this viewpoint on the Dun Laoghaire pier. The closest turbine would be located at a distance of approximately 29 km.

Summary Impact Assessment: There is significant screening provided by the landform around Sandycove, which results in 65 turbines being fully or partially visible. There are no cumulative impacts arising from other developments at this viewpoint, though the Codling Bank wind farm would be visible at points further along the Dun Laoghaire pier. As part of the consultations for the Codling Bank EIS, people commented that the proposed wind farm would resemble a flotilla of sailing boats from a viewpoint on the Pier. The visual impact of the development was deemed to be Positive Minor due to the strong association of the turbines with the sailing atmosphere of the area. The visual impact of The Dublin Array from this viewpoint is also considered to be **Positive Minor**.

6.2.13 Landscape Impact Assessment from VRP 13

VRP Location: View from the Road R131 close to Sandymount, Co. Dublin

<i>VRP sensitivity</i>	High
<i>Distance to nearest turbine</i>	17.56 km
<i>Number of turbines visible</i>	98

Existing View: Sandymount beach is situated on the south side of the city close to the East Link Bridge and Ballsbridge. It has a promenade and car park. The beach itself is long and very wide and it virtually disappears when the tide is in. Stretching for approximately 1 km along the Strand Road, the Promenade is a popular walking place and provides outstanding views over Sandymount Strand. The area is popular with walkers, and swimming and shore angling are also enjoyed. The view from this location is dominated by Dublin Bay, with Howth Head to the north and Dun Laoghaire and Killiney Hill to the south. The location has a strong urban character and the tall twin chimneystacks of the power station at Ringsend are clearly visible across the bay to the north.

Landscape Impact: Most of the wind farm's turbines would be visible from this location in a line against the horizon, although there would be screening provided by Dun Laoghaire West Pier and buildings around Dun Laoghaire and Sandycove. Since this viewpoint location is situated further inland than previous viewpoints (the closest turbine is located at a distance of 17.56 km), the size of the turbines from this location appear smaller. The layout of the turbines appears as being regularly spaced for the most part. As one moves to the left a number of avenues of turbines come into view that reduces the massing effect of turbines and eases the transition from wind farm to open sea.

Cumulative Impact: The Codling Bank and Arklow Bank wind farms are not visible from this viewpoint and so there are no cumulative impacts resulting from these developments.

Summary Impact Assessment: While there is some screening provided by the landform around Sandycove, there is still significant visual impact from the development. There are no cumulative impacts resulting from other developments. While a large number of turbines would be visible, they would be located quite far in the distance. In addition, the development would be set in an urban context alongside other man-made developments. The impact is considered to be **Adverse Minor**.

6.2.14 Landscape Impact Assessment from VRP 14

VRP Location: View from the East-Link Toll Bridge, Ringsend, Co. Dublin

<i>VRP sensitivity</i>	Low
<i>Distance to nearest turbine</i>	19.24 km
<i>Number of turbines visible</i>	None Visible

Existing View: The East-Link Bridge is the final bridge that spans the River Liffey before it enters the sea. The toll bridge is a very busy traffic route that links the Ringsend area with the north quays. This area is of a highly urbanised and slightly industrial nature that sees cargo ships loading and unloading along the quays. The area is dominated by the quays, and views can be seen of merchant ships, cranes and containers. Towards the mouth of the river, the tall twin chimneystacks of the power station at Ringsend dominate the skyline.

Landscape Impact: The wind farm would be completely screened by Dublin Port buildings and by infrastructure on the southern side of the River Liffey. No turbines would be visible from this location.

Cumulative Impact: The Codling Bank and Arklow Bank wind farms are not visible from this viewpoint and so there are no cumulative impacts arising from these developments.

Summary Impact Assessment: Since there would be no turbines visible from this location, the development is assessed as having No Impact.

6.2.15 Landscape Impact Assessment from VRP 15

VRP Location: View from the Link Road Between the R131 at Dublin Port and the Coast Road Near Clontarf, Co. Dublin

<i>VRP sensitivity</i>	Low
<i>Distance to nearest turbine</i>	19.5 km
<i>Number of turbines visible</i>	53 Visible

Existing View: This viewpoint is situated adjacent to a link road between the R131 road from Dublin Port and the Coast Road near Clontarf. The link road is a very busy traffic route, particularly for trucks passing through Dublin Port. The view from this location takes in the waters of Dublin Harbour with the twin chimneystacks of the power station at Ringsend in the background. To the south there is a transition from the Dublin Port infrastructure and buildings to the modern East Point Business Park with distant views of the Wicklow mountains in the background. To the east the Coast Road runs along towards Clontarf, with its numerous commercial and residential buildings. The character of the area is highly urbanised in its transition from Dublin Port, through the East Point Business Park to the residential area of Clontarf.

Landscape Impact: The wind farm would be visible in the distance against the horizon extending from the edge of Dublin Port across the views of Dublin Harbour. The closest turbine is located at a distance of approximately 19.5 km, and so the turbines appear smaller from this location than at some of the previous viewpoints. The southern end of the wind farm is partially screened by buildings and infrastructure around Dublin Port. The northern end of the wind farm, which is completely visible, extends across three-quarters of the sea view from this location. Approximately 53 turbines can be seen in all, although some of these are only partially visible due to screening. Close to the Poolbeg Lighthouse a number of avenues of turbines are visible. Further to the left the density of turbines tapers, easing the transition to the sea. The wind farm does not completely fence-in the view from this location as it does not extend across the entire sea view.

Cumulative Impact: The Codling Bank and Arklow Bank wind farms are not visible from this viewpoint and so there are no cumulative impacts resulting from these developments.

Summary Impact Assessment: While the wind farm is visible in the distance from this viewpoint location, the viewpoint is set in a highly urban context with existing views of developments such as the Ringsend chimney stacks and Dublin Port. The impact is considered to be **Adverse Minor**.

6.2.16 Landscape Impact Assessment from VRP 16

VRP Location: View from Pedestrian Walkway Along Sea Wall Close to Clontarf Village, Co. Dublin

<i>VRP sensitivity</i>	Medium
<i>Distance to nearest turbine</i>	18.7 km
<i>Number of turbines visible</i>	Approx. 70 Visible

Existing View: This viewpoint is situated along a pedestrian walkway that runs between the Coast Road and the sea, close to Clontarf Village. As with the previous viewpoint, the view from this location takes in the waters of Dublin Harbour and the infrastructure around Dublin Port. The twin chimneystacks of the power station at Ringsend are prominent, while in the background the Wicklow mountains can be seen in the distance. To the east the Coast Road runs towards Clontarf, with numerous commercial and residential buildings alongside it. The pedestrian walkway is a very popular amenity for walkers and cyclists. While the waters of Dublin Bay and the green belt around the walkway provide a natural setting for this viewpoint, the character of the area is highly urbanised with its views of Dublin Port and built-up residential and commercial area around Clontarf.

Landscape Impact: Approximately 70 turbines from the northern end of the wind farm would be fully or partially visible from this viewpoint. The southern end of the wind farm would be screened by the buildings and infrastructure around Dublin Port. Those turbines that are visible are located in a line against the horizon, the closest being located at a distance of approximately 18.7 km. There is a visual connection between the wind farm and land with turbines gradually becoming more visible as one progresses from the breakwater at Ringsend towards Poolbeg Lighthouse and on to the open sea. To put the appearance of the turbines in perspective, the hub height of the turbines is just below the height of the Poolbeg Lighthouse. A number of avenues of turbines appear immediately to the left of the lighthouse, and further to the left the density of turbines tapers to individual turbines, easing the transition from wind farm to sea.

Cumulative Impact: The Codling Bank and Arklow Bank wind farms are not visible from this viewpoint and so there are no cumulative impacts resulting from these developments.

Summary Impact Assessment: Approximately 70 turbines from the wind farm are visible in the distance from this viewpoint. However, since this area is already highly urbanised and has a number of tall manmade developments such as the Poolbeg Lighthouse and the chimneystacks at Ringsend visible from it, the wind farm would be in fitting with the character of the area more than if it were located in an area with a more natural environment. The impact of the development from this viewpoint is considered to be **Adverse Moderate**.

6.2.17 Landscape Impact Assessment from VRP 17

VRP Location: View from a Point Approximately 300m from the End of the Bull Wall, North Bull Island, Co. Dublin

<i>VRP sensitivity</i>	High
<i>Distance to nearest turbine</i>	15.6 km
<i>Number of turbines visible</i>	All Visible

Existing View: North Bull Island is a 300 hectare island in Dublin Bay formed from the sandbank that accumulated after the construction of the Bull Wall in the 1820's. It is a Nature Reserve and Bird Sanctuary of international importance and is a proposed Special Protection Area. North Bull Island is a favourite haunt for many Dubliners, who come to walk, jog or cycle. There is also a large golf course and bathing areas off the Bull Wall. Facing southeast along the Bull Wall, one can enjoy a panoramic view of Dublin Bay with Howth Head to the northeast and the Dublin and Wicklow Mountains to the south. Marine traffic can be seen entering and leaving the busy Dublin Port from this viewpoint.

Landscape Impact: All turbines would be visible from this viewpoint with only partial screening of a number of turbines being provided by the North Bull and Poolbeg Lighthouses. The turbines are located in a line against the horizon, the closest being located at a distance of approximately 15.6 km. The turbines are distributed regularly across the horizon, and they provide a visual connection to the land through the Poolbeg Lighthouse. Looking in a straight line along the Bull Wall, a number of avenues of turbines can be seen, which reduces the effective massing of these turbines.

Cumulative Impact: All phases of the proposed Codling Bank wind farm can be seen from this location though in the far distance, the closest turbine being located at a distance of approximately 33 km. There is a small element of screening provided by the Poolbeg Lighthouse. There is overlap between the southern end of the Dublin Array and the Codling Bank wind farm, which increases the density of turbines when viewed from this point. The cumulative impact of all phases of the proposed Codling Bank wind farm would theoretically be significant from this viewpoint though, given the large distance to the Codling Bank, the turbines would not be visible except in clear weather conditions, and so the cumulative impact is reduced. The Arklow Bank wind farm is not visible from this viewpoint and so there are no cumulative impacts arising from it.

Summary Impact Assessment: All turbines of the Dublin Array can be potentially seen in the distance from this viewpoint. While this location is an important nature reserve, the far distance to the wind farm reduces the visual impact of the development. The overall impact is considered to be **Adverse Moderate**.

6.2.18 Landscape Impact Assessment from VRP 18

VRP Location: View from the Coast Road R105 Facing Dublin Bay at Sutton, Co. Dublin

<i>VRP sensitivity</i>	Medium
<i>Distance to nearest turbine</i>	15.0 km
<i>Number of turbines visible</i>	Approx. 70 Visible

Existing View: This coastal viewpoint is located close to Sutton on the narrow isthmus connecting Howth Peninsula to the mainland. The area is urban in character with numerous commercial and residential buildings situated along the coast road. Looking south over Sutton Strand, one can see the flat expanse of North Bull Island with the Dublin and Wicklow Mountains in the background. To the east is Howth Head at the north end of Dublin Bay. There is a popular walk and cycleway that runs along the shoreline between the coast and the road.

Landscape Impact: The southern end of the wind farm would be visible against the horizon at this point with the northern end of the wind farm being screened by the landform around Howth Head. Approximately 70 turbines would be fully or partially visible in total, the closest being located at a distance of approximately 15.0 km. The turbines extend from the Martello tower on Howth Head across most of the sea view towards North Bull Island. The density of turbines as seen from this viewpoint is more irregular than from other viewpoints, though as with other viewpoints the turbine density reduces towards the right (south) of the development, easing the transition from the wind farm to open sea. Also, views from this location are not completely fenced-in as there is a stretch of open sea visible to the south of the development.

Cumulative Impact: The proposed Codling Bank wind farm is visible from this viewpoint. It overlaps with the Dublin Array, and so increases the density of turbines when viewed from this location. The extent of sea occupied by the wind farms does not increase. The Arklow Bank wind farm is not visible from this viewpoint and so there are no cumulative impacts arising from it.

Summary Impact Assessment: While the northern end of the Dublin Array would be screened by the landform at Howth Head from this location, there would be views of the southern turbines in the distance. The proposed Codling Bank wind farm could, theoretically, be seen further away from this point. The visual impact at this viewpoint is considered to be **Adverse Minor**.

6.2.19 Landscape Impact Assessment from VRP 19

VRP Location: View from Scenic Viewpoint Adjacent to Car Park at The Summit, Howth Head, Co. Dublin

<i>VRP sensitivity</i>	Very High
<i>Distance to nearest turbine</i>	10.4 km
<i>Number of turbines visible</i>	All Visible

Existing View: Howth is located on the north side of Dublin Bay and, at its highest point rises to 171 m. There is a cliff walk around Howth Head that extends from Balscadden Bay on the north of the peninsula to the Martello tower in the south. The natural landscape and elevated panoramic views that are to be found along this path make the route a very popular amenity. There is a lighthouse located on the southeastern tip of Howth Head. The viewpoint for this photomontage looks beyond the lighthouse over Dublin Bay. To the east there are extensive views of the Irish Sea with its marine traffic en route to and from Dublin Port and Dun Laoghaire Harbour. To the south, across Dublin Bay, the Wicklow mountains can be seen in the distance. Views of Dublin city to the south cannot be seen from this point, though such views are to be seen around the southern end of Howth Head. The character of this location is natural, though it is set against the highly urbanised backdrop of Dublin city and its suburbs.

Landscape Impact: This is one of the closest of all viewpoints with the closest turbine being located at a distance of 10.4 km. The viewpoint is also located in an elevated position. All turbines would be visible from this viewpoint and they would appear to run in a diagonal line, with hub heights set just below the horizon. The elevated nature of the viewpoint allows the depth of the turbines to be viewed, though not to the same extent as from the Sugar Loaf or Carrickgollogan viewpoints. To the left (north) of the development a number of avenues of turbines can be seen before the density of turbines gradually tapers to a single turbine. The Kish Lighthouse, seen to the left of the northern most turbine, eases the transition of the development to open sea. To the right (south) of the development the turbines appear to be more tightly clustered as they become fainter with distance. The view from this location is still dominated by the open sea and there is no visual connection between the wind farm and the coast.

Cumulative Impact: There would be some overlap of the southernmost Dublin Array turbines with the Codling Bank turbines. The extent of the horizon occupied by turbines would increase due to the Codling Bank development and so the visual impact would increase as a result. The nearest turbine of the Arklow Bank wind farm is located over 50 km from this viewpoint and so, while these turbines would theoretically be visible, in practice they would not be seen from this viewpoint. The cumulative impact of the Arklow Bank wind farm was also assessed from a viewpoint on Howth Head as part of the EIS for the Codling Bank wind farm. This assessment also concluded that the cumulative impact of the Arklow Bank development from this location was negligible.

Summary Impact Assessment: This viewpoint is situated in a highly sensitive area, and all turbines would be visible at close proximity from this location. While the wind farm does occupy a relatively low proportion of the overall seascape in comparison to other viewpoints, the impact is still considered to be **Adverse Major**.

6.2.20 Landscape Impact Assessment from VRP 20

VRP Location: View from Car Park at Scenic Viewpoint Close to Martello Tower at Portrane, Co. Dublin

<i>VRP sensitivity</i>	High
<i>Distance to nearest turbine</i>	23.1 km
<i>Number of turbines visible</i>	All Visible

Existing View: Portrane is situated along the coast in north county Dublin. The viewpoint for this photomontage is situated close to the Martello tower that lies on the coast to the southeast of Portrane. The views from this location are dominated by coastal views of the Irish Sea. Lambay Island can be seen 5 km from the shore in the foreground. To the south there are distant views of Howth Head and Ireland's Eye. Portrane Demesne is located to the west of this viewpoint and there are also a number of golf courses in the area.

Landscape Impact: The Dublin Array would be visible in the distance off Howth Head, the closest turbine being located at a distance of approximately 23.1 km. At this distance the individual turbines appear very small in size against the horizon. Nonetheless the wind farm is visible as a man-made development off the coast. The turbines do not appear to be connected to the mainland, but rather are separated by the sea from Howth Head. Given the broad expanse of sea that commands the view from this location, the relatively low proportion of this view that is occupied by the wind farm results in it having a low visual impact from this location.

Cumulative Impact: Turbines from the proposed Codling Bank wind farm would, theoretically, be visible from this location. The turbines would appear in a cluster behind the Dublin Array. However, in practice, the Codling Bank turbines would be located so far from this viewpoint (the closest turbine would be located at a distance of approximately 43 km) that the cumulative impact arising from them would be negligible. The Arklow Bank wind farm would not be visible from this viewpoint and so there would be no cumulative impacts arising from it.

Summary Impact Assessment: The long distance to the wind farm from this location and the relatively low proportion of the seascape that would be occupied by it would result in a low visual presence overall. The impact is considered to be **Neutral**.

6.2.21 Landscape Impact Assessment from VRP 21

VRP Location: View Facing East / Southeast from Entrance to New Housing Estate in Rush, Co. Dublin

<i>VRP sensitivity</i>	Low
<i>Distance to nearest turbine</i>	25.8 km
<i>Number of turbines visible</i>	All Visible

Existing View: Rush is a seaside town and market gardening centre in North Dublin. Fine beaches are located north and south of the town that have attracted generations of Dubliners. Much of the land in the area is cultivated intensively. The location for this photomontage is situated on the coast to the south of Rush town. Views from this point towards the sea are dominated by Lambay Island to the south and Howth in the distance.

Landscape Impact: The entire wind farm would be visible in the distance off Howth Head, with the closest turbine being located at a distance of approximately 25.8 km. At this distance the individual turbines appear very small in size against the horizon and would not be visible in many weather conditions. Nonetheless the wind farm appears as a man-made development off the coast. The turbines appear to be tightly clustered with the density tapering to individual turbines at the left (north) and right hand side (south) of the development. The turbines do not appear to be connected to the mainland, but rather are separated by the sea from Howth Head. Given the broad expanse of sea that commands the view from this location, the relatively low proportion of this view that is occupied by the wind farm results in it having a low visual impact from this location.

Cumulative Impact: Turbines from the proposed Codling Bank wind farm would, theoretically, be visible from this location. The turbines would appear in a cluster behind the Dublin Array. However, in practice, the Codling Bank turbines would be located so far from this viewpoint (the closest turbine would be located at a distance of approximately 45 km) that the cumulative impact arising from them would be negligible. The Arklow Bank wind farm would be located at such a distance from this viewpoint that visual impacts would also be negligible.

Summary Impact Assessment: The long distance to the wind farm from this location and the relatively low proportion of the seascape that would be occupied by it would result in a low visual presence overall. The impact is considered to be **Neutral**.

6.2.22 Landscape Impact Assessment from VRP 22

VRP Location: Offshore View Facing Southeast from Small Boat 7 km Southeast of Howth Head

<i>VRP sensitivity</i>	High
<i>Distance to nearest turbine</i>	3.0 km
<i>Number of turbines visible</i>	All Visible

Existing View: This photomontage is located at an offshore viewpoint to the northwest of the Kish Bank. The existing view from this location is of open sea looking towards the Kish Lighthouse. There is no visual evidence of the submerged Kish and Bray Banks, apart from the Kish Lighthouse that marks the northern extremity of the Kish Bank. Marine traffic bound for Dublin Port and Dun Laoghaire Harbour can be seen passing to the north of the Kish Bank from here. In particular, a number of passenger ferries that operate between the UK and Dublin pass this point a number of times each day. In the distance, to the east of the Kish and Bray Banks, marine traffic bound for other ports on the east coast of Ireland can be seen.

Landscape Impact: The view of the wind farm afforded from this location is typical of the views that would be seen from offshore locations in the vicinity of the Kish and Bray Banks. All wind turbines can be clearly seen from this location, the closest of which is located at a distance of 3.0 km. At this close proximity the regular layout of the turbine rows is clear and the full breadth and depth of the wind farm can be appreciated. To the right (south) of the development there is overlap between the turbine rows. Moving to the left (north) of the wind farm the turbine avenues can be clearly seen as the density of turbines tends to decrease. The Kish Lighthouse, which can be seen beyond the northern extremity of the wind farm, eases the transition from the wind farm to the open sea.

Cumulative Impact: All turbines from the proposed Codling Bank wind farm would be visible in the distance from this location, the closest turbine being located at a distance of approximately 22 km. The Codling Bank turbines appear in a cluster behind the Dublin Array, their dimensions appearing approximately one third the size of the Dublin Array turbines. The cumulative impact arising from the Codling Bank turbines is therefore not significant. While the Arklow Bank wind farm is theoretically visible from this location, it is situated at such a long distance from this viewpoint that visual impacts arising from it would be negligible.

Summary Impact Assessment: The wind farm would introduce an interesting feature to the open sea views that are visible from this location at present. The views of the turbines would blend in well with the Kish Lighthouse that is the only man-made feature that is currently visible in this area. The impact of the development is considered to be **Positive Major**.