OFFSHORE WIND FARM AT CODLING BANK

Non-Technical Summary

Volume 2 of 3

Produced by natural power for Codling Wind Park

Executive Summary

Development Details

- The Codling Wind Park would be a 220 turbine offshore wind farm at Codling Bank 13 km off the east coast of Ireland between Greystones and Wicklow
- The development would include an anemometer, an offshore substation, and buried cabling between the turbines and the substation, and between the substation and shore
- Turbines would have an installed capacity of at least 2.5MW each and potentially upwards of 5MW, and would have a maximum height between mean sea level and turbine blade tip of 160m. The wind park would cover a total area of 55 square km
- Two alternative cable routes have been identified from the offshore substation to shore: one to the north of Greystones; one to the south of Killiney Bay (north of Bray)
- On-land elements of the cable route and onshore grid connection would form the subject of a separate planning application by ESBNG
- The site would be constructed over 3-7 phases, each phase lasting Spring and Autumn of a single year
- All cables would use expensive solid insulation rather than the usual oil insulation to prevent oil leaks

Economic and Environmental Benefits

- The investment value of the installation of the Codling Wind Park would be around €900 million
- Construction would give Ireland the technical experience to be a significant force in the global offshore wind industry
- This project will stimulate a new hi-tech industry with huge R & D potential
- Up to 200 skilled and non-skilled construction workers would be employed for 3 to 7 years
- 15-25 local technicians and management staff would be employed locally during the lifetime of the wind farm
- Use of renewable energy plays a crucial role in the strategies to reduce the threat of climate change
- The output of the Wind Park would be sufficient to power a minimum of 395,000 average households with clean electricity. This number could reach upwards of 790,000 households for larger turbines.
- The Codling Wind Park would contribute significantly to the Irish Governments challenging international Kyoto target to limit increases in greenhouse gas emissions by 2008-12. The allowed increase has already been exceeded and Ireland could be liable for fines of up to 2.8% of GDP or €1.3 – 4.0 billion.

- During its lifetime the proposal at Codling would achieve savings of at least 32 million tonnes and possibly in excess of 64 million tonnes of carbon dioxide emitted from fossil fuel power stations. Carbon dioxide is the chief climate change gas

Environmental Studies

A series of ongoing comprehensive surveys of the marine, ecological, landscape and human resources of the Codling area and the coastline have been carried out since early 2001 from boreholes drilled down to 35m under the seabed to monthly surveys of the birds flying above the site.

Marine Studies and Potential Impacts

- Construction, operation and decommissioning of this proposal would have an insignificant effect on tidal flows, waves and natural sediment transport
- The volume of water flow through the site is so high that small quantities of hydraulic fluids and other pollutants that could be used during construction would be rapidly diluted should any spillage occur
- Permanent loss of the seabed at foundation locations would cover a total of 0.11km^2 of the wind farm area
- Ecological recovery of the disturbed seabed in the vicinity of cables and foundations during construction would be rapid. The seabed communities are all tolerant to short term smothering
- No effects are predicted for the important reef worm ecosystem in the Wicklow Reef Special Area of Conservation
- Operational noise would have no more than a negligible effect on fish.
- The electric fields on the seabed above buried cables would be below those at which electrosensitive fish would respond. Magnetic fields would be too low to have any effects on migratory fish
- It is likely that fish would be attracted to the new habitat and shelter created by foundation structures
- The wind farm area is of no greater sensitivity for seabirds than surrounding areas
- No significant impact on the Irish Sea populations of any bird species would result from any displacement of birds from the site during construction and operational periods
- The four more important bird species at the site would be at no risk of collision with blades: all were observed to fly well below rotor blade heights.
- The skate/ray fishery has been avoided by the wind park. Effects on fisheries would be limited to the exclusion areas around the construction works. Less than 2% of whelk grounds in the Arklow sector of the fishery would be closed at any time

- No significant effects are predicted for marine mammals from construction or operational noise. A soft start would be used for piling of turbine foundations to avoid impacts on fish and sea mammals
- Historical data shows that the Codling bank is stable with no significant bed movements having taken place over the last 100 years

Other Studies and Potential Impacts

- The Codling bank is the only shallow bank on the east coast that is *not* a long narrow strip parallel to the coast. This allowed a compact turbine layout with much reduced visual impacts when seen from land.
- Despite higher costs turbines will be placed in the deeper areas to the east of the Codling sandbank to increase the closest distance of turbines from shore to 13 km to reduce visual impact onshore
- The wind farm forms a balanced group of turbines which are harmonious in composition when viewed from the shore
- All independent surveys in the UK have show an overwhelmingly positive response by the public to wind farms
- The overall landscape impact of the scheme would be low given the number of turbines involved and the amount of renewable energy that would be produced.
- The closest shipwreck lies 900m from the wind farm area and would be unaffected by construction
- No significant impact is expected onshore from the worst case construction noise. The onshore noise levels from the wind turbines would be well below guideline noise limits for wind farms
- During the operational period leisure and fishing craft would be free to move through the wind park, although no trawling would be allowed. No trawling currently occurs on the site

INTRODUCTION

This documents summarises the proposal to build, operate and decommission a 220 turbine offshore wind farm at Codling Bank off the east coast of Ireland, including the key findings of the environmental assessments carried out for the scheme. A map showing the site location is presented as Map1 at the end of this document.

This Environmental Impact Statement has been compiled to accompany an application to the Department of Communications Marine and Natural Resources for a Foreshore Lease under the Foreshore Acts, 1933 to 1998 which is required for the construction and operation of offshore electricity generating stations in the State-owned foreshore, which extends out to the 12 nautical mile limit.

The Environmental Statement itself is required by European Environmental Impact Assessment Regulations, for wind power developments with more than 5 wind turbines.

The content of the Statement is in accordance with the Statutory Instrument which implements the European Regulations into Irish law. The Statement contains information relating to the construction and operation of 220 wind turbines of a maximum height between mean sea level and turbine blade tip not exceeding 160m, foundations, an anemometry mast, an offshore substation platform, undersea power cables between turbines and the offshore substation, undersea power cables to shore and associated works.

This Environmental Statement has been compiled by Natural Power Consultants Ltd, on behalf of Codling Wind Park Ltd., a company jointly owned by Fred Olsen Renewables Ltd. (FORL) and E.Co Wind Limited. Natural Power, whose staff have worked on over 50 wind farm planning applications, including 11 operating wind farms in the UK, are also lead consultants for the Codling Wind Park.

FORL is part of the Renewable Energy Division of ASA Ganger Rolff and ASA Bonheur. These Norwegian quoted companies have also extensive interests in offshore drilling rigs, production vessels, cruise ships and aviation. FORL commissioned their first onshore wind farm in 1996, a 21.6MW wind farm at Windy Standard, Dumfries and Galloway, Scotland. Since then they have built a 9.6 MW in Cornwall along with National Windpower Ltd. and have permission for a 49 MW wind farm in the Scottish Borders. A further 178 MW of applications for wind energy projects are currently being considered by the Scottish Executive. FORL's first interest in offshore wind energy has been a 45% interest in the 48 turbine Lillgrund project in the sound between Denmark and Sweden which was granted permission for construction in Spring 2001 and is anticipated to commence construction in 2004.

Treasury Holdings Limited ("Treasury") is one of Ireland's largest and most successful property investment companies. In 1994, Treasury perceived that there was significant opportunity to become involved in an industry that it felt was particularly suited to its core skills and that was on the cusp of significant future growth: wind energy. Treasury operates in the wind energy market in Ireland through E.Co Wind Ltd, and other subsidiaries including Windgeneration Ltd and Futuregen. E.Co Wind currently operates three wind farms with a total installed capacity of 15.6MW; holds planning permission for four sites in excess of 40MW and has a number of sites under investigation and being considered for planning permission with capacity of over 300MW. These include sites that are being progressed under joint venture with the manager of Ireland's State-owned forests, Coillte.

Lead engineering consultant for the project is Kirk McClure Morton, a civil engineering consultancy with expertise in marine engineering.

This document represents the Non-Technical Summary of the Environmental Statement. The full Statement, incorporating more detailed technical information about the site, the design of the wind farm and its interaction with the existing environment, can be viewed at the locations listed in the Appendix.

2. SITE LOCATION

The main part of the development including turbines, foundations and the offshore substation, would be located off the east coast of Ireland between Greystones and Wicklow. The turbines would be located to the east of the shallow waters of the Codling sand bank, and would be located 13 kilometres from the shore at the nearest point. Turbines would be placed in water depths of between 9 and 16 m. Greystones would be situated some 14.8 km to the northwest and Wicklow situated 17 km to the southwest respectively of the nearest turbines. See Map1 at the end of this section.

3. THE NEED FOR AND BENEFITS OF THE PROPOSAL

3.1 Environmental Benefits

Renewable energy developments are those which utilise renewable sources of energy, i.e. energy sources which are continually replaced and are inexhaustible. These include direct solar power wind, hydro power, waves, tidal power, biomass and geothermal power. Harnessing of renewable energy sources such as wind leads to little or no emissions of carbon dioxide and other greenhouse gases which cause global climate change.

Use of renewable energy therefore plays an important part in the strategies to reduce the threat of climate change ('global warming') which is widely regarded as the most critical environmental problem of this century. The Irish government have recognised that if positive international action to limit greenhouse gas emissions across the globe are not taken, in the coming century Ireland's climate will be altered giving potentially higher winter rainfall with more severe flooding, lower summer waterfall and water shortages, rising sea levels, accelerated coastal erosion, loss of bogland and threats to agriculture due to additional pests and diseases. According to Noel Dempsey, then Minister for the Environment and Local Government, on launch of the Irish Climate Change Strategy:

'Business as usual is no longer an option for Ireland'

The need to address climate change has been recognised at a global, European and national level, via legally binding targets for the reduction in the emissions of carbon dioxide. The Irish Government has agreed a target for greenhouse gas emissions with the European Union, as part of the EUs commitment to the Framework Convention on Climate Change signed at Kyoto in 1997. Ireland's target is to limit increases in greenhouse gas emissions to 13% above 1990 levels by 2008-2012. If the Russian Federation ratify the Kyoto agreement later this year, as they stated they would at the Summit on Sustainable Development in Johannesburg in early September, this will exceed the ratification target of countries responsible for 55% of global greenhouse gas emissions required in order to bring the Kyoto Protocol into force. At that point, individual national targets will become legally binding and failure to achieve them will result in significant fines being levied on those nations.

If Ireland fails to meet its target, large fines will be imposed. Allowing for the fact that some initiatives have been introduced, estimates indicate that these fines will be in the range of €1.3 billion to €4 billion in 2012, unless a much more comprehensive policy approach is adopted. Fines of this level would equate to about 2.8% of Ireland's GDP. Moreover, these fines are not once off but could be applied annually for each year that Ireland exceeded its target limits.

The Irish Kyoto limit has already been exceeded and significant emission reductions will have to be implemented across all sectors of the Irish economy if these potentially crippling fines are to be avoided.

In addition to the Kyoto targets, the recent EU Renewable Energy Directive sets a target for 12% of gross inland energy consumption to come from renewable sources by 2010 and sets indicative targets for each Member State to ensure this goal is achieved. Ireland's indicative target is set at 13.2%.

The Codling Wind Park is estimated to produce a peak level between 550 MW and upwards of 1100 MW of electricity depending on the final turbine selected for the site (the minimum individual turbine size will be 2.5 MW and could reach upwards of 5 MW). The average output of the wind park, given wind speed variations on the site, would be sufficient to meet the annual electricity demand of at least 395,000 and possibly upwards of 791,000 average Irish households, and could meet 100% of the additional target required to achieve Ireland's EU indicative target of 13.2% of electricity from renewable sources by 2010. The proposed Codling Wind Park would therefore represent a very significant contribution to the Irish renewables and CO2 emissions reduction targets.

Subsidiarity, that is the division of global responsibility down to the national and regional scales, is a key principle of the United Nations Framework Convention on Climate Change. For the aims of the Convention to be met each signatory state and each region within that state needs to meet its share of the overall emissions reduction target. Any development that contributes significantly to the regional renewable energy targets is playing a major role in mitigating against the environmental and social impacts of climate change that would occur under a global do nothing scenario.

Assuming a 20 year design life, the total electricity output over the lifetime of the Codling Wind Park should it be constructed would be at least 36.4 TWh and could reach upwards of 72.8 TWh depending on individual turbine installed capacity (1 TWh = 1 billion kWh). Taking into account the energy use of the wind farm as well as the energy output, the proposal at Codling would achieve the following net pollution savings over the lifetime for the minimum installed capacity of 550 MW and a potential installed capacity of 1100 MW.

Emission Type	**Installed Capacity of 550 (220 x 2.5 MW Turbines)**	**Installed Capacity of 1100 MW+ (220 x 5 MW Turbines)**
Carbon Dioxide	32.04 million tonnes	64.08 million tonnes+
Sulphur Dioxide	401,600 tonnes	803,200 tonnes+
Nitrogen Oxides	73,000 tonnes	146,000 tonnes+

The electricity produced by the Codling Wind Park would displace electricity produced by conventional fossil fuel power stations. The emissions savings are based on the gases that would be emitted by fossil fuel power stations in Ireland should the Codling Wind Park *not* be constructed, and are based on emissions/kWh figures for UK fossil fuel power stations as recommended by UK government Wind Energy planning guidance documents.

3.2 Economic Benefits

Construction – the investment value of the Codling Wind Park through design, construction and commissioning would be around €900 million and would involve a diverse range of businesses including civil engineering design, specialist plant hire, shipping and transportation, rental of port facilities, turbine and electrical components and civil and marine engineering contractors etc. The works will also likely lead to a major investment in the construction port (most likely Dublin or Belfast) and possible additional investment in a local service port(s) (Greystones, Arklow and/or Wicklow) through billeting of construction workers and other services. This period of intensive use of port facilities is expected to last for between 3 and 7 construction seasons. Up to 200 skilled and non-skilled workers will be employed for the construction period both onshore and offshore for the construction season(s). A number of these workers are likely to be sourced locally.

Operation – the operational period would involve direct employment of around 15 – 25 technicians and management staff at a local port (Wicklow, Arklow or Greystones) during the lifetime of the wind farm. During planned maintenance and servicing operations there would be a need for an additional maintenance crew of up to 70 personnel to support the core technical team. In addition there would be investment related to monitoring of the marine environment, including the periodic hire of local boats for seabird surveys and benthic grab surveys during the first few years of the operation of the wind farm.

In the broader picture, the Codling Wind Park would be a sufficiently large and long term construction project to allow Ireland to reshape its offshore construction industry, giving Ireland the potential to be one of the world's major exporters of offshore wind construction expertise.

4. SITE SELECTION AND LAYOUT DESIGN

4.1 Broad Site Selection

Fred Olsen Renewables Ltd. initiated the search for potential offshore sites that would be suitable for wind farm development in 1999 in consultation with the Department of Communications Marine and Natural Resources. The whole of the Irish Coastline was considered in the initial stages of the search.

Chief technical criteria forming a framework for the search were: high wind speeds; continuous areas with water depths less than 20m; and preferably low wave exposure and deep sea bed sediments. Distance to busy shipping lanes, a minimum distance of 5 km from shore, presence

of environmental protected areas and presence of fisheries and mineral, oil and gas resources were all considered in the search for suitable sites.

The west coast proved unsuitable for potential offshore sites for the following reasons: water depths increased rapidly with increasing distance from the shore leading to a need for turbines to be located close to land, wave exposure is high and grid connection potential is extremely limited. Landscape quality is also generally high.

The south coast also had low potential for suitable sites due to lack of suitably shallow water at distance from shore and also the seabed consisting of rock close to the surface rather than preferred deep sediments.

The east coast is subject to a much less severe wave climate to that of the west coast and water depths are much more favourable to wind farm development with a number of sandbanks located beyond 5-10 km from the coastline. In addition potential grid connection extends close to the coast between Dublin and Wexford. Potential sites are extensive and include the Kish and Bray sand banks to the north, the Codling bank, the Arklow bank and the Blackwater bank to the south.

After careful consideration of these banks the Codling bank was considered to have a number of important advantages when compared to the other potential east coast sites. Chief of these were the shape of the bank and its stability. Study of historical hydrographic maps have shown little movement in the Codling bank in the last hundred years. Other banks such as the Arklow bank to the south are considered to be less stable. Regarding shape, of all the east coast extensive areas of shallow water considered, the Codling bank is the only one that is not laid out as a long narrow strip running parallel to the coast. This offers advantages in allowing turbine layouts with both much reduced visual impacts when viewed from the shore through minimising horizontal extent of the wind farm, and maximising wind capture through the design of layouts facing the prevailing wind direction which lies parallel to the shore. The layout of the bank also allows for turbines much further from the shore than would be possible at the other sites, further reducing visual impacts.

Based on this broad initial assessment the Codling site was chosen for more detailed investigation and design.

4.2 Finer Site Selection

Once the Codling area had been selected as a potential site the process of finer site selection was begun, i.e. the identification of the preferred site location for turbines.

The following constraints were key in the site selection process.

Landscape – The coastline in this area is an Area of Outstanding Natural Beauty. Therefore positioning turbines as far from the coast within technical limitations would have environmental advantages although grid connection costs would be increased.

Ecology - The shallower areas of the Codling and India bank towards the western edge are considered to be of most importance for sea birds.

Fishing Areas- The most important fishery in the area is the whelk fishery. It has been suggested that the more productive whelk areas lie on the shallower western areas of the Codling and India bank, rather than the deeper areas towards the east. The northeast corner of the Outer Codling Licence area is trawled for ray and skate. The Howth Fishermen's Association have requested that turbines are not placed in this area.

Water Depths - A maximum water depth of 20 m below Mean Sea Level was considered as being the limit for a potentially viable offshore wind farm. The more shallow waters are preferred where possible for turbine positions since the cost of turbine foundations increases in proportion to water depth. The waters to the west of the Codling area covering the India and Codling banks are shallowest with depths gradually increasing towards the east.

Archaeology – The western shallower banks were considered to have the most potential for ship wrecks of potential archaeological interest.

Despite the increased length of grid connection and the increased costs of turbine foundations due to greater water depths, the less shallow areas to the east of the Codling bank and India bank were selected for the position of turbines. This allowed avoidance of the potentially more important bird areas, potentially more productive part of the whelk fisheries and the area more likely to contain ship wrecks of potential archaeological interest. Avoiding the shallower western areas also increased the distance of closest turbines to shore to approximately 13 km, thus reducing the visual impact of the wind farm. The decision was also made to avoid the north-eastern corner of the original Licence area to avoid the ray and skate fishery in this area.

4.3 The Turbine Layout Design Process

Within the technical constraints of the site, turbine layout design was guided principally by two considerations: wind energy capture and visual and landscape effects. A wind farm design computer model was used to calculate the annual energy yield of draft turbine layouts using wind speed predictions from a proven model called Mesomap.

Since much of the coast closest to the project is designated for its landscape value, it was seen to be of key importance to design a wind farm layout that minimised the visual and landscape impacts when viewed from the coast for a given number of turbines. A significant advance had already been made in minimising visual impact through selecting the most distant part of the shallow water area from the coast. A further dramatic visual advantage was achieved through the decision to place turbines in a block running perpendicular to the coast, as far as possible within the limits of Irish waters, thus significantly reducing the horizontal spread of the wind farm when viewed from the nearest coast.

Beyond these initial key decisions, visual design was approached through the definition of layout characteristics that would give the wind farm an intrinsically balanced and pleasing design regardless of viewing position. A number of viewpoints were selected by the landscape consultant, in consultation with the local councils, from which to assess the relative merits of a number of alternative layouts and to allow principals of good visual design to be determined.

Five alternative layout types were considered. These varied from computer optimised layouts which maximised wind energy yield, but would appear as random patterns of turbines to onlookers, to formal square grids and offset grid pattern layouts. A number of other patterns were used including hexagonal patterns, and grid patterns with gaps in rows parallel to the wind to increase yields of downwind turbines.

The energy optimised layouts were considered not to appear harmonious and were discarded, despite having the highest energy yields.

The offset grid pattern was considered by the landscape consultant after careful consideration, to have distinct visual advantages over the others. This layout, even when compact to reduce horizontal extent of the wind farm yet further, allowed sufficient space between rows of turbines to allow some views through ‘avenues’ of turbines to the horizon when viewed from most perspectives. This was not true for the formal grid based layout or the hexagonal layouts which presented ‘walls’ of turbines from most viewing positions. The offset grid pattern also enjoyed reasonably high energy yields.

A compact offset grid layout laid out in block form with north/south extent reduced as far as possible, to minimise horizontal extent when viewed from the coast, was selected as the preferred layout for the Codling Wind Park. This was felt to minimise landscape and visual impacts as far as possible and allow for positive visual effects, while at the same time having a relatively high energy yield compared to other compact layout types.

5. SITE LAYOUT

Map 2 at the end of this section shows the proposed 220 turbine layout of the wind farm including the routing of undersea cabling, the location of the offshore sub-station, the site of a wind monitoring mast and the maximum exclusion zone for vessels during construction. The layout comprises 13 northwest/southeast lying rows. The turbines are separated by 450 m in the crosswind direction and are separated by 600m in the down wind direction. The layout is compact both in distance between turbines and in overall shape, which was considered to give landscape and visual advantages over more largely spaced turbines. The layout would cover a total area of 55 square km.

6. TURBINE TYPE AND SIZE

The turbines used at Codling would all be of one generic type although, due to construction taking place in a number of phases over 3 to 7 years, the later turbines are expected to be larger than the turbines erected in the first phase. The turbines would be three bladed with a tubular steel tower and a nacelle, which would contain the generator, gearbox and other operating equipment. The transformer for the turbine would either be placed in the turbine tower or on top of the nacelle.

Turbines considered for the site would range in installed capacity from a minimum of 2.5MW to potentially upwards of 5MW. The maximum dimensions for any turbine considered would be 100m from mean sea level to hub-height and 120m rotor diameter, giving a maximum height above mean sea level of 160m. The base of the turbines would be bolted to the platform at the top of the foundation that would be placed above the highest astronomical tide and storm surge and would provide access to maintenance personnel. Once erected the turbines would operate automatically, requiring planned servicing on a periodic basis (normally once or twice a year).

The final choice of turbine model for each phase would be made by competitive tender prior to construction. A photograph of a model of a 2MW production turbine of a type that would be suitable for use at the site is given below. Larger machines of greater than 3 MW are not yet in production, but are expected by the time the Codling Wind Park would be constructed.

2 MW V80 Turbine

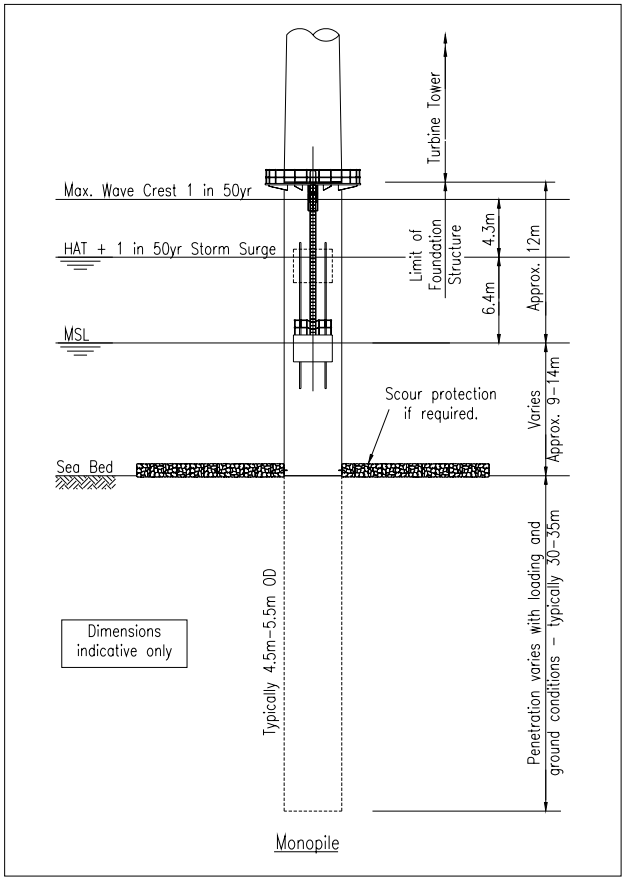
(Courtesy of Vestas wind Systems A/S)

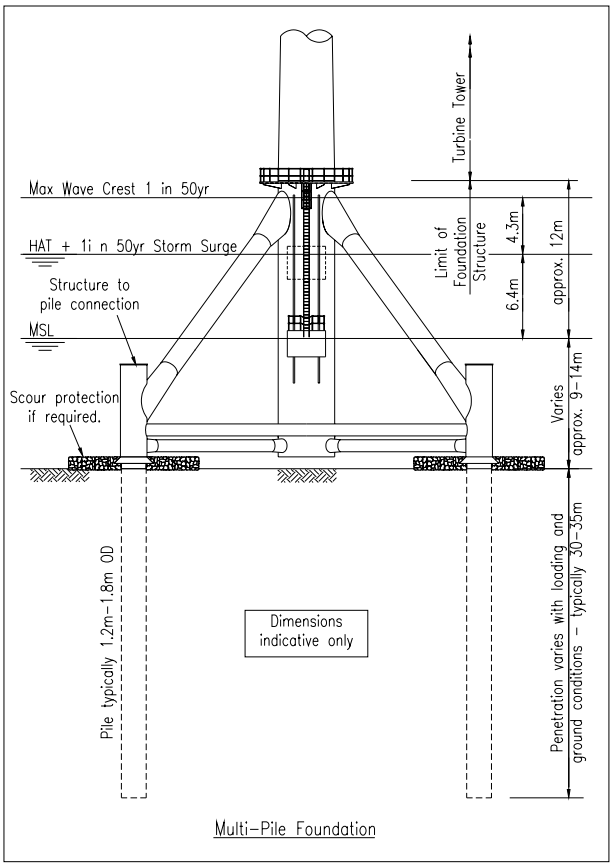
7. TURBINE FOUNDATIONS

A number of foundation types were looked at in the design of this project. These included gravity, monopile, multi-pile and combination designs based around these options. Site investigations have shown that all three types of foundation would be suitable for seabed and hydrographic conditions at the site. No final decision will be made over foundations until the competitive tendering stage and will depend largely on the availability of plant for construction.

7.1 Monopile Foundations

A monopile foundation for a modern multi-mega watt turbine would comprise a large diameter steel cylinder of up to 5.5 m in diameter driven or vibrated up to 35m into the seabed. The mass of a pile would be in the range of 350 to 500 tonnes. Once the pile has been driven into place a sleeve would be introduced over the pile above water level. This would be levelled to provide a horizontal base for the turbine tower and then attached to the pile through an operation called grouting. The turbine tower would be bolted on to a platform on top of the sleeve at a level above the highest possible wave. An access/work platform would be provided at that level.

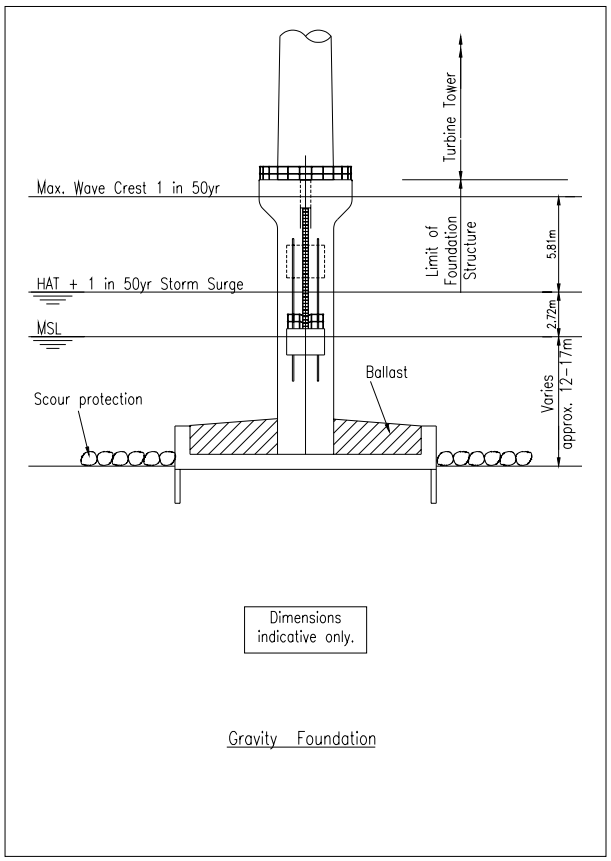




7.2 Multi Pile Foundations

The multi-pile foundation would likely comprise a circular central column, with steel leg structures. The foundation would be supported by piles with diameters in the order of 1.2 m to 1.8 m, which are driven or vibrated up to 35 m into the seabed. The height and width of the structure would depend on site conditions. The central column would be in the range 4.5 – 5.5m in diameter. The elements connecting the piles to the central column leg would be likely to consist of steel tubes. The mass of such a foundation would be between 250 and 350 tonnes. The weight of the piles would be in the order of 20 - 30 tonnes each. The whole foundation structure would take up an area of around 30-35m in diameter on the seabed.

7.3 Gravity Foundations



Gravity-type foundations have been used for the construction of almost all onshore wind farms to date. Such bases may take many different shapes but will generally comprise a base with a large plan area and a central tower. This type of base relies on its weight to resist overturning forces. The foundation will generally comprise a hollow concrete or steel structure which is filled with a high density material once the base has been placed in position.

A gravity foundation for the site in question would likely have a weight in the order of 2300 tonnes. The plan area of the base would likely be in the order of 20 m to 25 m in diameter. At the Codling site, where a relatively thin gravel layer overlays sand, it is anticipated that the base may be placed directly on the bed in order to avoid breaching of the gravel which protects the underlying sands from erosion. In this case a skirt may be provided around the perimeter of the base to achieve a degree of penetration/embedment into the bed.

Gravity foundations would usually be built in dry dock, or at a land location in close proximity to a suitable harbour, and would be floated or transported by barge to the site.

8. SCOUR PROTECTION

Marine structures can be susceptible to erosion of the seabed in the vicinity of their foundations due to the action of waves, currents and tides. This is commonly referred to as scour.

Scour occurs in three types:

Local scour can result from the disturbance of natural flows of water past the seabed by the introduction of a man made structure. Of particular interest is the effect of a single vertical pile

installed in the bed. The presence of a vertical pile leads to an increase in the speed of flow of water past the pile which can cause erosion of the seabed close to the pile.

Global scour is a similar phenomenon that can be experienced over the full area of a multi-piled structure i.e. in the case of the proposed turbines, an area of approximately 30 to 40 m in diameter at each turbine base if multipile foundations are used.

Overall seabed movement can occur over large areas as a result of the action of tides, currents and waves and is not related to the presence of structures on the seabed.

Investigation of historical information on the bathymetry dating from 1874 has shown that the seabed in this area is stable with no significant overall bed movements having taken place because the surface of the seabed is protected by a layer of gravel and cobble sediments. Stability of the sediment layers has been confirmed by borehole samples drilled 35 m down into the sand bank. All possible measures will be taken during design to minimise the likelihood of the protective gravel/cobble layer being damaged. However the possibility of the gravel layer being damaged during installation of the foundations cannot be ruled out and it may be necessary to provide a degree of additional scour protection around the structures. It is expected that such protective measures, if required, would comprise imported rock placed around the base of the foundations. While detailed design of the scour protection is not possible at this stage the diagram indicates possible arrangements.

9. OFFSHORE CABLING AND SUB–STATION.

Turbines would be interconnected on site by 33 kV cables, which would be collected at an offshore sub-station located between the first two most northern turbines on the most western row of the layout (see Map 2 at the end of this document). The on-site cables would be buried on site by ploughing or jetting, from specialist vessels. Depths of embedment vary but in sands and gravels cables are usually embedded at depths in the order of 1m – 2m. At the Codling site depths of embedment will be limited to avoid the protective surface layer of gravel from being breached. The installation of cables by ploughing would initially displace the upper gravel sediments to allow placing of the cable but the material would then be placed back on top of the cable to reinstate the protective layer. Should it be discovered during installation that the full depth of protective layer of gravel is breached or damaged then it may be necessary to provide localised areas of rock dump protection over the damaged sections.

The routes of 33 kV cables between turbines and the on-site substation are shown in Map 2 at the end of this document. Each corridor may contain more than one cable in the same trench particularly the corridors running along the ends of rows since a single 33 kV cable will only have

capacity to take the electricity from at most 10 turbines depending on the size of turbine used. Assuming 10 turbines per cable there would be 220 km of cabling within the site.

At the sub–station the power would be transformed from 33 kV to 110 or 220 kV. The substation would be an enclosed platform supported 10m above mean sea level by a number of single pile foundations. The sub-station would contain switchgear, a number of 33kV/110kV or 33kV/220kV transformers and a diesel backup generator. The cooling oil tank for transformers, the transformers themselves and the diesel tank would all be securely bunded to ensure capture of all oil or diesel that could be released in the unlikely event of a leak.

The substation would have boat mooring and helicopter landing facilities and would act as the base for maintenance operations on the wind farm.

From the substation between three and five 110/220 kV cables would carry the power to shore. Two potential landfall locations have been identified. The first potential landfall location is situated to the north of Greystones and the second to the south of Killiney Bay (north of Bray). The cables would be buried to a depth of up to 1m in the seabed. The depth of burial would be limited to ensure the cables are positioned within the gravel surface and do not penetrate below into the finer sediments. Following ploughing the gravel sediments would be placed back on top of the cable to reinstate the protective layer. Again, should it be discovered following installation that the protective layer of gravel has been damaged then localised areas of additional rock protection would be placed over the damaged sections.

All cabling, both within the wind farm and between the wind farm and shore, would be protected by two layers of galvanised steel wire armouring, with the armouring layer being earthed for safety. All cables would use expensive solid plastic based insulation rather than the usual oil insulation to remove any risk of leaks in the unlikely event of a breach to the cable, thereby protecting water quality.

10. GRID CONNECTION ONSHORE.

The wind farm would be connected to the existing 110 KV or 220 kV transmission systems via underground or overhead cabling onshore. There is a 220kV double circuit line running from Carrickmines substation (south Dublin) to Arklow. The point of connection to the national grid onshore, the final cable route to shore and the route from the landfall point to the point of connection will be the responsibility of ESBNG. On-land elements of the cable route and onshore grid connection would form the subject of separate planning applications.

11. CONSTRUCTION TIMETABLE

The site would be constructed over 3 - 7 phases, each phase completed over a single construction season. Each construction season would last between April and October. Each phase would be fully commissioned and producing electricity by the end of each working season. If all relevant consents are gained in early 2003 construction would be likely to begin in spring of 2005.

Each construction season would comprise the following stages:

- Pre construction design and fabrication
- Preparation of onshore compounds and port facilities.
- Mobilisation onshore.
- Seabed preparation.
- Mobilisation offshore.
- Installation of foundations and scour protection
- Installation of towers, blades and nacelles.
- Laying of cables and scour protection
- Commissioning and testing of turbines.

The following activities would take place during the first construction season

- Installation of the offshore sub-station
- Laying of site to shore cabling
- Building and commissioning of onshore grid connection facilities

12. DECOMMISSIONING

The lifetime for each phase of the project would be 20 years from beginning construction to decommissioning. At the end of each phase's operating life the turbines and their associated infrastructure would be removed in accordance with the Oslo and Paris Convention (OSPAR). A method statement would be drawn up at the time of decommissioning which would be agreed with all the relevant authorities at the time, taking into account standards and equipment available at the time.

13. NAVIGATIONAL RESTRICTIONS

During construction of each phase all vessels not related to the construction of the wind farm, would be excluded from the offshore construction area around the turbines and cabling under construction. This would mean that only the area being worked on in any season would be out of bounds to all shipping. The area of exclusion would extend 300m beyond the outside of the turbine array of each phase, to allow safe manoeuvring of vessels when constructing machines on the edge of the layout.

During the operational lifetime of the wind farm anchoring and trawling would not be permitted within the wind farm for unauthorised vessels. In addition unauthorised vessels would not be permitted to approach within 35m of a turbine nor make fast to the turbines, anemometer masts, or the sub-station. However, vessels of sufficiently small draft for the shallow waters over the sand banks would be free to pass through the wind farm avoiding the 35m exclusion zones.

During decommissioning of each phase, the construction area exclusion would be reinstated for the single season of works.

Following decommissioning of each phase all restrictions would be removed from that area since the area would be clear of all obstructions.

14. NAVIGATION MARKING AND LIGHTING

During the construction period of each phase non-wind farm vessels would be excluded from the construction areas as described above**.** The construction areas for each phase would be marked by the existing navigational buoys with additional temporary buoys marking off the extent of the construction area. Some relocation of the existing buoys would be required during some of the construction phases.

Each buoy would also be fitted with a radar reflector. The markings and light sequences on the buoys would allow vessels to avoid the wind farm construction areas.

During the operational life of the wind farm the buoys would be positioned to mark the full extent of the turbines.

In addition to the buoys carrying navigational markings and lights the base of all turbine foundations would be painted yellow to 11m above the mean high water level at spring tides as determined with the Commissioners of Irish Lights in accordance with IALA conditions. The band

would allow yachtsmen to avoid turbines during periods of low visibility should they decide to navigate through the wind farm.

The wind farm navigation lighting will be established in agreement with the Commissioners of Irish Lights who have responsibility for navigation markings in Irish Territorial waters.

15. CONSTRUCTION PORT

The site would be constructed out of a port or ports where there are large enough lay down areas, strong enough quaysides, large enough dock gates and reasonable access between tides. Possibilities include Dublin or Belfast. Currently the smaller ports along the east coast in the vicinity of the wind farm would be unable to accommodate the vessels transporting the larger components, but could be used to service the site during construction and operation. Servicing requirements are a vital function of the construction process and would include accommodation for up to 200 personnel during construction and up to 70 personnel during planned maintenance operations throughout the operational period of the wind farm. There would also be a requirement for the storage and transportation of supplies required by the larger vessels. It is expected that the majority of materials supplied to the site would be transported to the construction port by sea with minimal road haulage.

16. ENVIRONMENTAL BASELINE STUDIES

A series of detailed studies and surveys have been commissioned by the joint developers and coordinated by Natural Power Consultants Ltd and Kirk McClure Morton. The baseline studies were aimed at building up a detailed picture of the interaction of the physical, ecological and human environment at the site. Surveys have been commissioned to study the area from boreholes drilled to 35m under the seabed to surveying of the birds flying above the site. The findings of these studies shaped the finer detail of site selection and site design as described earlier and allowed the most effective mitigation measures to be selected to reduce the environmental effects of the scheme. Finally, the baseline studies provided the necessary data to allow an assessment of the effects of the construction, operation and decommissioning of the offshore wind farm, on the more important physical, ecological and human elements of the Codling area following the implementation of mitigation measures. Baseline studies were carried out by experts in each field and covered the following areas: -

- ***Bathymetry***: The physical shape of the seabed.
- ***Hydrography***: Wave, tide and currents.
- ***Sedimentology & coastal morphology***: Seabed movement locally and in the wider area

- ***Marine benthos***: Flora and fauna communities living in the upper layer of the seabed.
- ***Fish***: The species and ecology of the fish using the area including commercial, sports, leisure, and migratory fish.
- ***Marine mammals***: Residents and visitors and their ecology.
- ***Ornithological***: Bird species, breeding and overwintering, including observations of flight heights, roosting, migration etc.
- ***Landscape and seascape character assessment*** and identification of the more important viewpoints and types of viewer looking out over the site.
- ***Archaeological***: Shipwrecks and shoreline sites of interest.
- ***Commercial fisheries***: Number of boats, catch, income and fishing methods for the whelk fisheries, mussel seed etc.
- ***Navigation:*** Commercial and leisure sea navigation.
- ***Air traffic and radar interests***
- ***Mineral, oil, gas resources.***
- ***Undersea pipes and cables.***
- ***Military use of the area.***
- ***Telecommunications*** networks and electromagnetic signals.
- ***Tourism***

Studies were begun in early 2001 and are ongoing. Studies involving birds and sea mammals involved monthly surveys to ensure that the picture built up of the environment is not just a snapshot but shows seasonal changes and trends. The baseline studies have been coordinated to allow an understanding of the interaction between for example benthic life and sediment distribution. This then allows the assessment of indirect effects i.e. the knock on effects on sea mammals from any direct impact of the construction of the wind farm on fish for example.

17. SUMMARY FINDINGS OF THE ENVIRONMENTAL IMPACT ASSESSMENT

In carrying out and presenting the results of the specialist assessments within the Environmental Statement (ES), care has been taken to adopt a worst case approach, to ensure that environmental effects are not underestimated.

17.1 Hydrography, Sediments and Coastal Processes

This work was carried out by Kirk McClure Morton who specialise in modelling in the aquatic environment, using the latest computer modelling tools fed with data from detailed sediment, tidal flow and wave height surveys

The effects on sediment during construction would generally be as a result of raising sediments into suspension during operations such as piling of foundations and cable burying.

Sediment suspension levels within the Codling Bank area were modelled for baseline conditions prior to development and for piling and cable laying activities during the construction of the wind farm. It was found that background levels of sediment suspension would only be exceeded within 200 metres of a foundation under construction and even then for very short periods of the tidal cycle. For cable laying, background sediment suspension levels would only be exceeded for 1-2 % of the installation time within 300 m of the construction activity. Typical deposition of sediment on the seafloor would generally not exceed 0.6 mm in the vicinity of construction work, and this would be rapidly dispersed further downstream by subsequent tides.

For an assessment of effects of the presence of the turbine foundations on hydrography and coastal processes during the operational lifetime of the wind farm, wind speeds, wave energy, tidal flows, sediment transport, and coastal erosion processes were modelled with and without the proposed wind farm in place. None showed any more than a negligible difference with the wind farm in place.

It is concluded that the construction operation and decommissioning of this proposal would have an insignificant effect on tidal flows, waves and natural sediment transport both in the wind farm area and in the wider area of the Codling Bank.

17.2 Water Quality.

A full risk assessment would be carried out before construction to ensure that, any risks to water quality are minimised. A preliminary risk assessment has been carried out and a number of mitigation measures have been put in place. All oil filled equipment would be fully bunded to ensure no spillage in the event of a leak or puncture in any vessels or the offshore substation. Power cables would use an alternative non-oil based solid insulator. TBT based anti-fouling paints would not be used on the submerged surfaces of foundations. Instead, barnacles and mussels attached to the foundation would be removed by scraping should this be considered necessary.

To prevent corrosion, sacrificial aluminium based anodes may be placed on foundations. These are designed to slowly break down and would release aluminium gradually into the water. The volume of water flow through the site is so high that the released aluminium would be rapidly diluted causing negligible effects on overall water quality.

17.3 Marine Benthos.

Marenco, a marine biological consultancy were responsible for the site survey work, collecting seabed and seashore samples from the wind farm area and the two alternative cable routes, analysing these for benthic communities living in and on the upper layer of the seabed and providing this data to other consultants to ensure the results were in proper context.

Direct effects on benthic habitats through permanent loss of the seabed at foundation locations would be very small and in a 'worst case' i.e. a gravity foundation, would amount to an area of only 25 m diameter for each turbine, or a total of 0.2 % of the wind farm area. The overall impact to the Bryozoan/hydroid turfs which are the dominant benthic habitat type in the wind farm area is considered to be insignificant. Areas of rock scour protection would provide a hard substratum habitat similar to areas of existing boulder and cobble seabed present throughout the wind farm area and would be likely to be colonised by similar animal and plant species.

There would be some indirect effects on the seabed communities resulting from sediment disturbance and smothering of seabed in the vicinity of wind farm elements during construction. However the benthic communities found in the wind farm area are tolerant of short term smothering. Recovery of the disturbed seabed in the immediate vicinity of cable laying and turbine construction cable laying would be fairly rapid, with recruitment of species from surrounding populations.

During construction and operation of the wind farm the low substance inputs expected following implementation of mitigation measures and good management of substance use, would not have significant impacts to identified benthic communities. Construction noise and vibration should not interfere with the ecological functioning of identified biotopes.

Effects of the presence on the wind farm during its operational life, on sediment movements and other hydrographic processes have already been found to be negligible. Therefore no significant indirect impacts are expected on the benthic communities within the wind farm area or the wider area of the Codlng Bank.

The two cable route options from the wind farm to the shore pass through more variable sets of seabed types and benthic plant and animal communities than in the wind farm area. All of these communities would be impacted by cable ploughing in the immediate area of the cable route (a strip 1 to 2 metres wide) through the removal and possible mortality of species in the community. The most sensitive of these communities may take up to a year to recover, but others such as the brittle star would recover almost immediately. The temporary loss in the context of the extent of these communities generally in the area would be negligible. All the communities along the cable

routes are tolerant of high sediment loadings and would not be indirectly affected by sediment disturbed by cable laying.

At the landfall of both alternative cable routes to shore, the intertidal area consists of shingle and coarse sands with very little benthic life. Therefore no impacts are predicted for intertidal habitats.

No effects are predicted either from construction activities or the operation of the wind farm for the two more important benthic communities in this part of the Irish Sea: an unusual type of horse mussel bed located to the south of Codling Bank; and a honeycomb worm reef north of Wicklow Head which is a candidate Special Protection Area. These habitats lie sufficiently far from the site that any sediment increases or water quality effects would be negligible.

A monitoring programme has been suggested to follow the site through construction and into its operational phase, covering the first 3 years of operation. This would ensure verification of the baseline assessment and provide valuable information on the Codling Bank over a prolonged period.

17.4 Fish

The Centre of Marine and Coastal Studies (CMACS) at Liverpool University have carried out the fish assessments for the Codling Wind Park proposal. Principal sources of fish data for this area of the Irish Sea were trawl surveys carried out by CEFAS, the UK government's fish consultancy, between 1993 and 2001, and trawls undertaken by the Marine Institute's Marine Fisheries Services Division between 1997 and 2001. These surveys provided a general overview of fish communities that are found in this part of the Irish Sea. Flatfish, and other bottom living fish and elasmobranchs (fish in the shark family including ray, skate, tope etc.) were all well represented in the surveys. Migratory fish such as Atlantic salmon and sea trout may also be found in the wind farm area in moderate numbers.

Potential areas of impact examined by CMACS were water quality changes, construction and operational noise and vibration, electric fields, magnetic fields and habitat modification.

During the construction phase, underwater noise and vibration levels resulting from piling hammers could potentially reach up to 236 decibels (dB) if monopile foundations are used. Construction noise would be considerably less for other foundation types and other construction activities. More noise-sensitive fish with swimbladders, such as cod, herring, salmon and trout have hearing thresholds of around 100-120 dB but do not show alarm or avoidance or other behavioural responses until *received* sound levels exceed 170-180 dB. Source noise levels

above this limit would only be generated as the turbine foundations are driven into the top layers of the seabed. Noise levels would decrease as piling continued. During the upper surface piling, hearing-sensitive fish in very close proximity to the foundation may be subject to temporary physiological impacts but these would disappear as the fish moved away from the immediate vicinity of the piling position. A 'soft start-up' of piling would reduce impacts on fish by encouraging fish away from the piling site before the higher noise levels are reached.

Other less sensitive groups of fish, flatfish such as plaice, would only 'hear' the noise from piling close to the piling point (i.e. within 35m – 170m of the piling operation depending on the frequency of the noise). These fish may avoid this small area during the piling operation. Even should the fish avoid these areas, since only one or possibly two foundations would be piled at any one time, it represents such a small proportion of the total area of subtidal bank within the proposed wind farm site that construction noise would have a negligible effect on fish.

During the operational period underwater noise from turbines would be below response levels even in close proximity to a turbine base. Therefore operational noise would have no more than a negligible effect on fish. Benefits of turbine foundations acting as shelter for fish may override any adverse effects of noise. Investigations at the world's first offshore wind turbine, the 'Svante' project in Sweden, for example, have shown numbers of cod in close vicinity to an operating turbine to be greater than in the surrounding open waters.

The small increases in suspended sediment due to construction and decommissioning of the wind farm is not predicted to have any significant impacts. In the worst case some fish species would move away from the immediate area during augering, while sediment levels were above those in the surrounding area, but they would return as soon as the work was completed. With the high volumes of water flowing over the site in the normal tidal sequences and the low use of potentially polluting substances combined with good substance management, any water quality changes during construction and operation of the wind farm would not have a significant impact on fish species on site or in the area as a whole.

Electric fields external to power cables can affect electrosensitive fish while magnetic fields could confuse migratory species such as salmon that use the earth's magnetic field to navigate. All power cables would have earthed armoured shielding around the cores which would reduce electric fields to near zero. While exposed sections of cable could have a very low external electric field in the range where electrosensitive fish such as skates, rays and dogfish might show either an attractive or repulsive reaction, cables at Codling Bank between turbines and from site to shore are all to be buried at depths of 1-2m and scour protection in the form of rocks to be placed on top of cables, where necessary to limit the likelihood of exposure. The fields on the seabed above a buried cable would be well below those at which electrosensitive fish would respond. In the unlikely case where a segment of the cable route to shore is exposed, benthic

elasmobranchs may actively avoid the immediate area. The magnitude of this impact would not be significant considering the small area that elasmobranchs may avoid. Since the depth of water along the cable route to shore reaches 45 m, electric fields around exposed cables would not prevent elasmobranches from crossing the cable route by swimming higher in the water column.

Although some migratory fish including salmon and trout navigate using geomagnetic fields, the localisation and low level of magnetic fields emitted by power cables at the wind farm would be below naturally occurring fields. Moreover any influence on magnetic fields in the immediate vicinity of the cables is unlikely to have any effect on salmon and other migratory species as once in coastal waters they tend to use 'smell/taste' rather than magnetic fields to find their spawning river.

It is likely that fish would be attracted to the new habitat and shelter created by the foundation structures placed in the seabed. Although fish species such as whiting, cod and plaice may benefit from the shelter provided by foundations the overall impact of this change would be a redistribution in population rather than significant increases in fish populations.

A monitoring programme has been proposed to start in the late summer of 2002 to give a firmer indication of fish present and provide a baseline for future anticipated changes

17.5 Birds

This work was managed by Coveney Wildlife Consulting Ltd, who have worked on a number of wind farm ornithological assessments in Ireland.

The Codling Bank area was not considered to be of particular sensitivity for birds. The nearest protected area for breeding or overwintering birds lies on the coast at the Murrough more than 13 km from the wind farm. Nevertheless comprehensive boat and aircraft bird surveys have been carried out over an area of more than 580 km^2 to allow a full picture to be formed of the importance of the Codling Bank and the wider area for bird populations of the Irish Sea.

The entire area has been covered by boat based surveys every month between April 2001 and March 2002. In addition two aerial surveys were undertaken, one on 15 March 2002 and one on 9 April 2002 flying along survey lines totalling 270km in length within the study area to verify the boat counts.

Importance of bird populations using the wider study area and the wind farm area (covering just under 10% of the whole study area) was assessed by calculating the percentage of the total

biogeographical population and the Irish sea population observed using the site. The five most important species in these terms were Manx shearwater, guillemot, razorbill, shag and gannet. In any one monthly survey only the Manx shearwater was observed in numbers within the wider study area representing more than 1% of the biogeographical population. The most important species to use the wind farm area itself was again Manx Shearwater with the highest monthly count representing 0.2% of the total biogeographical population. In terms of proportion of Irish Sea populations, the guillemot was the most important: 7% of the total Irish sea population observed in the wider study area, and 0.75% of the Irish population observed in the wind farm area during the peak month. Bird densities were found to be fairly typical of the Irish east coast and only one bird species, the Herring gull had a higher density within the wind farm area than the wider survey area. This allowed a conclusion to be made that the wind farm area is of no greater sensitivity for birds than surrounding areas of the Irish Sea.

The most important potential impacts were considered to be: disturbance of birds through construction activity and later through movement and noise from wind turbines during the operating period, and subsequent displacement of birds from the wind farm area; and collision risks with turbine blades. Collision risks for migrating birds were considered along with resident species.

The response of many of the seabirds recorded in the wind farm area to wind turbines is not well understood. However, since the wind farm area does not contain higher concentrations of seabirds than surrounding areas of the Irish Sea, in the absolute worst case assumption that all birds using the site would not use it during the construction and operation of the wind farm, and moreover would not find other suitable areas, this would not have a significant effect on the global or Irish Sea population of any species.

Collision risks on birds have been broadly estimated through observation of flight heights. At highest tides the minimum distance of rotor blades over the sea surface would be 30m. Collision risks would be negligible or zero for the four most important species in the Study Area since during the year round monthly surveys 100% of flying Manx shearwaters, guillemot, and shags and 99% of razorbills flew at heights below 7m. More detailed analysis of collision risks for species that were observed flying over 7m (but not necessarily above 30m) in height during surveys, namely kittiwakes and gannets showed that these species were unlikely to be at significant risk of collision with turbine blades.

A recommendation has been made for further ongoing survey work comprising monthly boat surveys until construction started, twice-monthly surveys during construction and monthly surveys for another 3 years post construction. These surveys would cover the same areas as the baseline work to ensure consistent survey results, and confirm the conclusions reached in the assessment.

17.6 Marine Mammals

This impact assessment was done by the Centre for Marine and Coastal Studies (CMACS) at Liverpool University. It establishes the marine mammals that make regular use or visit this part of the Irish Sea and assesses the impacts of the construction, operation and decommissioning of the wind farm on those species.

In order to establish an accurate baseline, Coveney Wildlife Consulting Ltd. recorded sightings of seals and cetaceans concurrently with the boat-based seabird survey between April 2001 and March 2002. This data has been considered together with the results of surveys carried out at Arklow bank to the south and the Earth Watch Foundation Cetacean Distribution Plots and Small Cetacean Abundance in the North Sea (SCANS) data to give a broader context to the numbers observed in the Codling Bank survey area. The Whale and Dolphin Sanctuary, covering Ireland's 200-mile exclusive economic zone, protects all cetaceans (whales and dolphins). For the purposes of this assessment all whales, dolphins and seals found in Irish waters were considered to be of high sensitivity due to the National and International protection afforded to each species.

Three species of cetacean were recorded during the years monthly surveys: the harbour porpoise, Risso's dolphin and the minke whale. Harbour porpoise was by far the most abundant with 84 individuals sighted on 12 out of 16 survey days. However, only three of these sightings were in the wind farm development area. Based on the sighting data collected during the baseline surveys, the Codling Bank area does not appear to be as important for this species as other areas in the south-western Irish Sea for which similar survey data is available.

Two species of seal occur along the coasts of the Irish Sea: the common/harbour seal and the grey seal. Only the grey seal was positively identified during the boat surveys on ten occasions in the wider study area.

Marine mammals forage for food over extensive areas and have highly adapted sensory abilities. Localised effects of changes in water quality or prey availability would be easily detected and avoided with no impact on individuals and populations. The impact assessment therefore looked at the impact of construction and operational noise on sea mammals including behavioural impacts, communication and physiological impacts such as stress reactions.

Small cetaceans such as Harbour Porpoise are not generally sensitive to low frequency noise generated by piling and other construction works. The National Marine Fisheries Service in the USA imposes conservative safety distances for low frequency sound of 180dB for whales and 210 dB for porpoise. The worst case sound power level emitted by construction activity is lower

than the safety limits for harbour porpoise it is unlikely that they would be subject to temporary of permanent physiological effect, even in close proximity to piling operations. The impact of construction work on small cetaceans is likely to be short-term avoidance of the local area of works over the period of sound generation. Cetaceans would only be at risk of physiological effects within a small area close to the location of piling. Within this area, there is a risk that repeated exposure to piling noise could cause short term and minor stress conditions. The 'soft start-up' approach at the beginning of each piling activity period, proposed as mitigation for fish would reduce stress on any cetaceans in the immediate area of piling activity.

Larger whales such as the minke whale are more sensitive to low frequency sound. Using data from an impact assessment of sonar equipment on whales by the US Navy, the occasional mysticete that does pass through the area in the vicinity of the Codling Bank, might avoid an area with a radius of up to 10km around piling works. It is very unlikely that the few individuals excluded from this area each summer during the construction of the wind farm would cause any population level effects.

Operational noise would be significantly lower than construction noise. Operating noise and vibration would not have significant effects on any species of mammal in the Codling area. The worst-case impact could be on seals, which in theory could hear the wind farm from up to 1km away and stay out completely. This is, however, a worse-case-scenario and assumes that a seal would avoid any area where they could hear a turbine. It is much more likely that the area they would avoid would be much smaller, indeed exclusion may not occur at all. Even in the worst case the area of exclusion would represent just over 1% of the average foraging area of a grey seal, which is found more regularly in this part of the Irish Sea than the common seal.

Turbine noise from the proposed Codling Wind Park would only be detected by harbour porpoise within a distance of approximately 50m. Even within this area they are unlikely to respond to the sound. Even if harbour porpoises and other small whales did avoid the area within 50 m, as the closest distance between turbines is 450m, they would be able to move freely through the wind farm, without being adversely affected by noise generated.

Following familiarisation with the physical presence of the wind farm, it is expected that porpoise and other small cetaceans such as the Risso's dolphin may exploit wind farm sites as feeding areas.

No significant effects are therefore predicted for marine mammals during construction, operation or decommissioning of the wind farm. Marine mammals would continue to be monitored during bird surveys during the construction and operating period for up to 3 years to allow the findings of the assessment to be confirmed.

17.7 Landscape

The landscape, seascape and visual assessment for the Codling Wind Park proposal was carried out by MosArt who were also closely involved with the wind farm design process to minimise visual and landscape impacts.

The aim of the impact assessment was to:

- describe the landscape and seascape in the vicinity of the site and identify the most sensitive places from which the proposal would be seen including towns and villages, footpaths, beaches, golf courses, mountain tops etc.
- select a number of viewpoints from which to assess the impact of the scheme in detail. These were also used during the design process of the wind farm as described earlier
- develop a methodology for assessing the overall significance of impact at any viewpoint, through definitions of viewpoint sensitivity, dominance of the wind farm and compatibility or non-compatibility of the wind farm with the existing view
- assess the impact of the wind farm according to the methodology, both alone and in the context of a wind farm proposal, the Arklow Bank wind farm 30 km to the south, assuming that this proposal is realised

A 40km radius study area was chosen for the proposed development at Codling Bank. A zone of visual influence (ZVI) was generated to identify the extent of the proposed wind farm's visibility over the 40km radius study area. The ZVI shows the number of turbines that would be visible from any point at sea or on land assuming a worst case bare ground i.e. no trees, hedges or buildings. A cumulative ZVI, was also generated to identify the extent of the proposed wind farm's visibility in relation to the Arklow offshore wind farm proposal 30km to the south.

A visibility assessment was carried out to describe the general extent of visibility of the proposed wind farm within the study area. The visibility assessment concentrated mainly on publicly accessible areas such as the road and public footpath network, residential and outdoor recreational areas. 21 viewshed reference points (VRPs) were selected for visual representation of the wind farm in the full Environmental Statement in agreement with the Local Authorities. These viewpoints are considered to be representative of the spectrum of receptors in the study area, located at different distances, directions and heights relative to the proposed development.

The landscape, seascape and visual assessment established that the proposed development would change the landscape and visual baseline conditions during the construction and operational phases of the wind farm.

Despite the somewhat lengthy period of construction, the greatest impact would arise during the first year. Furthermore, the construction activities would affect what is a relatively confined area of the overall seascape. For the above reasons, the construction phase of the proposed development was considered to have a minor effect on the seascape generally.

Regarding operational effects, given the number of turbines proposed for Codling Bank, the scheme will occupy a relatively low proportion of the horizon as viewed from land. Considerable attention to landscape, seascape and visual amenity considerations has been given to the layout optimisation process. This has resulted in a wind farm design which is compact and, from nearly all viewpoints, forms a balanced group of turbines which are harmonious in composition, both as an array, and when viewed against the backdrop of land or sea.

The landscape and seascape assessment of the proposed Codling Wind Park, has identified that of the 21 Viewshed Reference Points (VRPs), the impact is deemed to be Adverse Major at just 1 location, namely Bray Head. Impacts are not considered significant at any other VRP.

Designated Areas

In relation to designated areas and in particular, the Area of Outstanding Natural Beauty (AONB), it must be appreciated that the closest distance to any AONB is approximately 13km. The landscape consultants believe that the development will not in any way dominate views. In addition, the overall quality of the landscapes designated as AONB will not be significantly affected by the proposed scheme.

The Wicklow Way and Other Footpaths

The development is located far away from, for example, the Wicklow Way (25km), so the wind farm development would not affect the immediate surrounds of the Wicklow Way and other inland footpaths. That is not to say that the more distant views afforded from walking routes will not change as a result of the Codling Wind Park proposal. However, given the extent of natural resource development in the immediate context of such routes as the Wicklow Way (including large scale commercial conifer forestry), the Codling Wind Park project is unlikely to result in any significant effects.

Residential Areas

Many of the residential areas studied in the landscape report provide views of the seascape off the east coast of Ireland, with little between the viewer and the open sea. The wind farm would present a degree of change to some of these views which would vary with distance, the closest houses being at least 13 km from the nearest turbines. Given the clear results of the public survey carried out in what is the closest large urban centre to the development (Greystones), and the findings of all independent public opinion surveys to date in the UK, which show that a large

majority of the population respond positively to existing wind farms, it appears that the impact upon most residential areas is unlikely to be significant.

Roads (Including Scenic Routes) And Other Communication Links

Along the railway line and out at sea, viewers will be able to fully experience the deliberate and dynamic geometric design layout. They will experience the tall 'avenues' of turbines coming in and out of view as they pass the development and thus can fully appreciate the scale and layout of what will be a major feat of offshore engineering. Road users and other travellers are likely to experience the lower order of impacts in the context of the broader study area.

Tourist Facilities And Attractions

In places such as busy promenades and golf clubs, viewers may be so intent on their pursuit that they pay little attention in the direction of the proposed wind farm. In other locations, such at scenic car parks and beaches, people may be more concentrated on soaking in the view and thus be more aware of the proposed scheme. The level of impact, therefore, can be anticipated to vary from place to place.

Cumulative Effects

Cumulative effects of the Codling Wind Park in the context of a separate offshore wind project at Arklow Bank would be in the lower order of magnitude. The most critical locations are where the viewer would be located in between both schemes. However, where this occurs, the proposed scheme at the Arklow Bank would occupy a much wider section of the horizon and, therefore, would tend to dominate in terms of visual presence over the project proposed for Codling Bank. In summary, the landscape assessors do not feel that cumulative effects of the Codling proposal in the context of the Arklow Bank wind farm already in situ would be significant overall.

The compact block of turbines occupies what is a relatively small length of horizon given the number of turbines involved. The development is also located some 13km from shore thereby greatly reducing apparent scale and potential dominance. In summary, therefore, the landscape assessors feel that the landscape impact of the scheme overall is relatively low given the number of turbines involved and any potential impact must be considered in the context of the amount of renewable energy to be produced.

17.8 Archaeology

The archaeological assessment was carried out by the Archaeological Diving Company one of the most experienced marine archaeological consultancy in the Ireland. The consultancy examined all evidence relating to the presence of shipwrecks in the vicinity of the offshore components of the scheme including the cable routes to shore, and carried out desk top studies of the two alternative landfall sites for the cable to shore to identify any archaeological remains on land that might be affected by the laying of these cables.

The archaeologists examined records of shipwreckings in the vicinity of the Codling bank which were begun in the mid-1700s. While 52 wrecking sites were identified within the wider study area, the closest of these lay some 900m from the wind farm area and therefore out of risk of damage from construction activity. The majority of the wrecking sites lie considerably more distant than this, East and North of the Codling Lightship, itself positioned well to the Southeast of the wind farm area.

While the position of wreckings have been recorded, the current position of any remains from the wreckings could be at some distance from the original site due to the action of tides and waves. Geophysical survey data has therefore been examined in detail by the archaeologists. This data comprises full coverage sidescan sonar recordings for the wind farm area and cable routes to land, that show any objects lying proud of the seabed.

No anomalies were recorded within the wind farm area that had potential to be the remains of wrecks. A number of anomalies were identified along the alternative cable routes to land. Five of these were considered to have some potential to be remains of shipwrecks and have been recommended for avoidance by the final cable route. The laying of cables is a contained construction activity, only affecting the seabed a metre or two to either side of the cable route. Thus it will be easy to avoid any identified potential wrecks along the finally selected route.

Since sidescan sonar surveys only show objects above the seabed, further subsurface seismic and magnetometry surveys are recommended in the immediate vicinity of all elements of the wind farm prior to construction. Magnetometry surveys will identify metal objects both on and below the seabed. Any identified potential wrecks would be avoided or if this were not immediately possible, would be dive surveyed and recorded and avoided if the sensitivity was considered high.

Concerning the landfall sites of the two alternative cable routes, the area of greatest sensitivity is at Greystones, where the cable would be routed directly onto the shore beside a known archaeological site and complex. It is strongly advised that the works programme seeks to avoid any impact in this location with the archaeological site area. Should avoidance not be possible, a

full programme of archaeological work would be recommended to resolve the impact locations in advance of civil works commencing. Archaeological monitoring of the civil works operation during construction should also be undertaken, with the proviso to resolve fully any archaeological material identified at that point.

Provided that these recommendations are followed no significant impacts are expected to result from the scheme on sites of archaeological interest.

17.9 Construction Effects on Land

Due to the large nature of components the majority of haulage to and from the site would be carried out on a port to port basis. Foundation and turbine components would be stored at the construction port. Should any components, such as foundation components, be carried over land to the construction port, of the ports that have been considered as having potential as the construction port (Dublin, Belfast) both are served by both rail and trunk roads. The smaller ports along the east coast in the vicinity of the wind farm would be unable to accommodate the vessels transporting the larger components and would be used to service the site only. No significant traffic impacts would be expected should any of the ports be used.

Noise of unloading, loading and assembly at the construction port is not expected to be greater than the noise from existing port operations at the ports considered as having potential for use, and would not require any special permissions. Impact of construction noise within the port would therefore not be significant.

17.10 Offshore Noise

The only offshore construction operation that would be likely to be heard onshore and would not be part of the ordinary noise environment in the area, would be the noise of piling operations for turbine foundations should piled foundations be used at the site.

The worst case noise impact would be to use monopiles driven, rather than drilled (augered) and vibrated into the sandbank.

The nearest individual housing to the turbine foundations lies just over 13 km from the nearest foundation. The closest community at Greystones lies more than 17 km distant.

The noise assessment predicts that the noise level, for the worst case of driven piles at the closest location to residential properties under down-wind conditions, would be below the most relevant recommended day-time noise limit.

For night-time working, the predicted noise level is below the limit values in both British Standard BS 5228, Noise and Vibration on Construction and Open Sites and MPG11 The Control of Noise at Surface Mineral Workings, which are the most relevant UK guidelines in the absence of Irish statutory limits for construction noise. Therefore no significant impact is expected anywhere onshore from the worst case noise emitted by construction activity at the Codling Wind Park.

During the operational period, the predicted noise levels from the wind turbines would be well below the lower noise limit suggested by the guidelines issued by the Working Group on Noise from Wind Turbines, at even 5 km from the site, and therefore noise from wind turbines is considered to have no significant effects on the amenity of local residences nor on those using amenities such as footpaths, beaches or golf courses on either coast which lie more than 13 km from the nearest turbine.

17.11 Marine Navigation Effects

The only navigation channels in the Codling area run approximately 6 km to the east and west of the site between Wexford and Dublin. The main shipping channels further afield are the Dublin ferry routes running eastwards out of Dublin Bay towards the west coast of Britain. The Codling Bank area where the wind farm is proposed is known for its shallow depths and is not crossed by commercial vessels. Fishing vessels, mainly from the whelk fisheries do use the site, and yachts may cross the site although most sailing in the area is in inshore waters.

All non-construction vessels would be excluded from the active construction area during each construction year which would be marked with navigational buoys. There would therefore be no risk of collision with foundations under construction. The construction exclusions would have no effects on commercial shipping but would have some effect on fisheries as considered later, and would have some impact on the few leisure yachts that may use these outer coastal waters.

During the operational period, there would be no restrictions on the passage of craft through the wind farm, but since commercial vessels do not pass through this area, there would be a very low risk of collision for commercial shipping with any components of the wind farm. Leisure vessels will be free to cross the area during the operational phase although there would be an exclusion area of 35m diameter around each turbine and vessels will be strictly prohibited from making fast to the turbines. These 35 m diameter exclusion zones comprise only 0.4% of the wind farm area. The outer limits of the wind farm area would be marked by light buoys and a foghorn. Each

turbine would be painted with yellow paint up to a height of 11m above high tides to allow leisure sailors to see and avoid turbines even in bad visibility conditions. The minimum distance between blade tip and water at the astronomical high tide would be just over 30m; this will be in excess of the likely height of the top of the mast on a yacht using this area. With the strong currents and tides in the area, there is a small risk of collision if a yacht was becalmed and unable to use an engine to get out of the area, but overall, effects on leisure vessels from the exclusion zone are considered to be minimal.

Local fishermen place pots for catching whelk around the banks and over the proposed wind farm area. This would be not be inhibited by the presence of the wind farm during the operational period. There is therefore a risk of either collision or their gear becoming tangled on foundation structures (especially if multi-pile). Once erected the wind farm would be an exclusion zone for all trawling vessels. No anchoring within the wind farm or tying up to turbines would be permitted. However, no trawling currently occurs on the site and therefore this restriction is thought to have no impact on current activity.

17.12 Aviation and Military Impacts

The Department of Defence have been consulted with regard to the Codling Wind Park proposals. They have confirmed that the Naval Service have no observations or objections to the proposed development.

17.13 Socio-Economic Impacts

Investment and Employment

The Codling Wind Park would bring a series of short and long-term economic benefits to the region. The total investment into the construction of the wind farm would be around €900 million of which the turbines represent approximately 50%, with the remainder going on foundations, cabling, electrical connections, control systems and other engineering works. Construction would take place out of ports on the east coast and would last for three to seven seasons. Typically 20-25% of onshore wind farm construction and material sourcing contracts have gone to local companies based in the region within which the wind farm is constructed and similar proportions are expected for offshore wind.

The ports most likely to be used for construction are Dublin or Belfast. One or more of the smaller ports along the east coast in the vicinity of the wind farm (Wicklow, Arklow and Greystones) could be used to service the site including billeting of construction workers and

mooring of smaller construction vessels. Up to 200 skilled and non-skilled workers would be employed during the 3-7 year construction period, both onshore and offshore. The site would require a number of service vessels during construction. Some of the workers would be specialist contractors brought in to operate large vessels associated with construction. These people would require locally based accommodation.

The operational period for each phase of the wind farm would approximately 20 years. During this time there would be a need for a permanent staff of 5 - 10 equivalent full time technicians and administration staff for the first phase of development increasing to approx 15-25 equivalent full time technicians and administration staff once all construction is complete. The technicians would be stationed onshore in close proximity to the wind farm and close to a harbour. The administration staff would be likely to operate from the same office. Experience elsewhere suggests that the majority of these staff would be recruited locally.

During planned maintenance and servicing operations on the turbines, foundations and offshore substation there would be a need for an additional maintenance crew of up to 70 personnel to support the core technical team. These would be most likely to be brought in from further afield but housed in the vicinity for the planned maintenance periods.

Fisheries

A full fisheries impact assessment was prepared by Paul Johnston Associates and followed consultation with the following bodies:

- the Marine Institute
- the Department of Communications, Marine & Natural Resources (DCMNR)
- Bord Iascaigh Mhara (BIM)
- the Irish Fishermen's Organisation (IFO)
- the Irish Farmers' Association - Aquaculture Committee
- the Central Fisheries Board (CFB)
- the Eastern Regional Fisheries Board (ERFB)
- the Irish Federation of Sea Anglers (IFSA)

The Irish Sea exhibits a diverse fauna in terms of both fin fish and shellfish, many of which are commercially valuable. However, only a limited range of species is exploited at Codling Bank and the surrounding area with the major commercial activity centred on the whelk. The other significant feature in relation to commercial fisheries in the wider area is the occurrence of mussel seed beds which are a valuable source of seed for the expanding bottom mussel culture industry.

The area to the north of Codling Bank is reported to be reasonably productive for ray/skate and is fished by boats based at Howth. This area has been avoided by the developers following consultation with the local fishermen.

In addition to the commercial fisheries angling is very popular in the general area although there is limited activity directly on the bank due to the dangerous tidal currents. Most of the angling activity takes place in the inshore area to the west of the bank from small craft operating out of Greystones, Arklow and Wicklow.

The marine biological consultants assessed the development as having no significant impacts on the benthic nor fish communities in the wind farm area either during the construction or operational period. In addition the development would not adversely affect the migration of salmon, sea trout and other migratory species. The only effects on fisheries resulting from the wind farm would be the general exclusion areas around the construction works during the construction phases and the exclusion for trawling in the whole area of the wind farm during the operational period.

Fishing for whelk generally takes place in shallow waters of less than 20m depth. The development site which is all under 20 m in depth represents an area of less than 10% of the whelk grounds in this sector of the whelk fishery. For a mid-range total construction period of 5 years, 20% of the wind farm area would be closed to fishing at any one time, representing less than 2% of the whelk grounds in this sector. Even if the wind farm area is more productive than other parts of the fishery, for which there is no evidence, this level of disruption would have a low impact on the fishery as a whole. There is some evidence to suggest that the sustainability of the fishery would benefit from the phased short term closure of parts of the whelk grounds during the construction period.

A monitoring programme has been proposed to give a firmer indication of whelk populations present and provide a baseline for future anticipated changes.

Operational restrictions would have no effect on the whelk fishery nor on sports angling as there would be no restrictions on these activities. Since no trawling currently takes place on the Codling bank due to the nature of the seabed and the shallow water depths, the trawling restriction during the operational period would have no effect on fisheries.

Tourism

The main effect of the proposal on tourism on Co. Wicklow would be the indirect effects of changes to the landscape and seascape through the introduction of a new visual feature into the Irish Sea which would be visible from much of the coastline in Co. Wicklow though at some

distance. While the landscape and visual assessment predicted some significant effects on the nearest areas of coast, tourists visiting the chief attractions in Co. Wicklow, the Wicklow Mountains National Park, the Vale of Avoca and Brittas Bay would not experience a significant change in their views looking out from these areas due to the distance from the site and in the case of the Vale of Avoca, intervening topography obscuring the development. Moreover, those tourists on the closest part of the coast to the site are unlikely to view the site negatively. Of the large number of opinion surveys of both residents and tourists collecting their opinions on wind farms operating in the UK, the vast majority have shown that residents and tourists alike view wind farms positively.

There is anecdotal evidence that wind farms attract tourists and visitors to an area rather than discouraging them. The first wind farm in the UK at Delabole in Cornwall is still attracting 14,000 paying customers annually to its visitor centre. A survey of businesses in the vicinity of the North Hoyle offshore wind farm off north Wales, many of which were related to the tourist industry, found that 50% believed that the wind farm would attract more tourists to the area, while only 10% believed that some tourists would be discouraged. As one of the first offshore wind farms in Ireland, the Codling Wind Park would be likely to have an attractive effect for tourists.

Neither the Irish Tourist Board nor the Department of Tourism, Sport and Recreation have any concern that the project would pose a negative impact on tourism in the area.

17.14 Effects on Mineral, Gas and Oil Resources

No live licenses currently exist for dredging the Codling Bank. However, any extraction undertaken during the life of the wind farm would have the potential to undermine the stability of the foundation structures or risk damage to the cables. Therefore, although the wind farm would not have an impact on the sand and gravel reserves, it is likely that these could not be exploited during the lifetime of the wind farm should there be any interest in future license application.

17.15 Undersea Pipes and Cables.

Consultation has confirmed that there are no proposed or operative undersea pipes or cables in the vicinity of the proposed wind farm, including the sub- station and cable routes. The development would have no impacts on undersea cables and pipelines.

17.16 Telecommunications and Electromagnetic Transmission

Microwave Fixed Links

There are no microwave fixed links or other communication links crossing the site that would be affected by the proposal.

Interference to TV and Radio Reception

Consultations has confirmed that the proposed development does not pose an interference risk to the Eircom Microwave Network, also the Frequency Planning Department of RTE Network Division have confirmed that this project would not pose disruption or interference to their service in Ireland. Similarly to television reception, no negative effects are anticipated for radio reception on land.

Mobile Phone Networks

As with radio and television communications, the Office of the Director of Telecommunications Regulation informed all telecommunications operators of any potential impact on our behalf. None of the consultees have raised any objections to the proposals.

APPENDIX

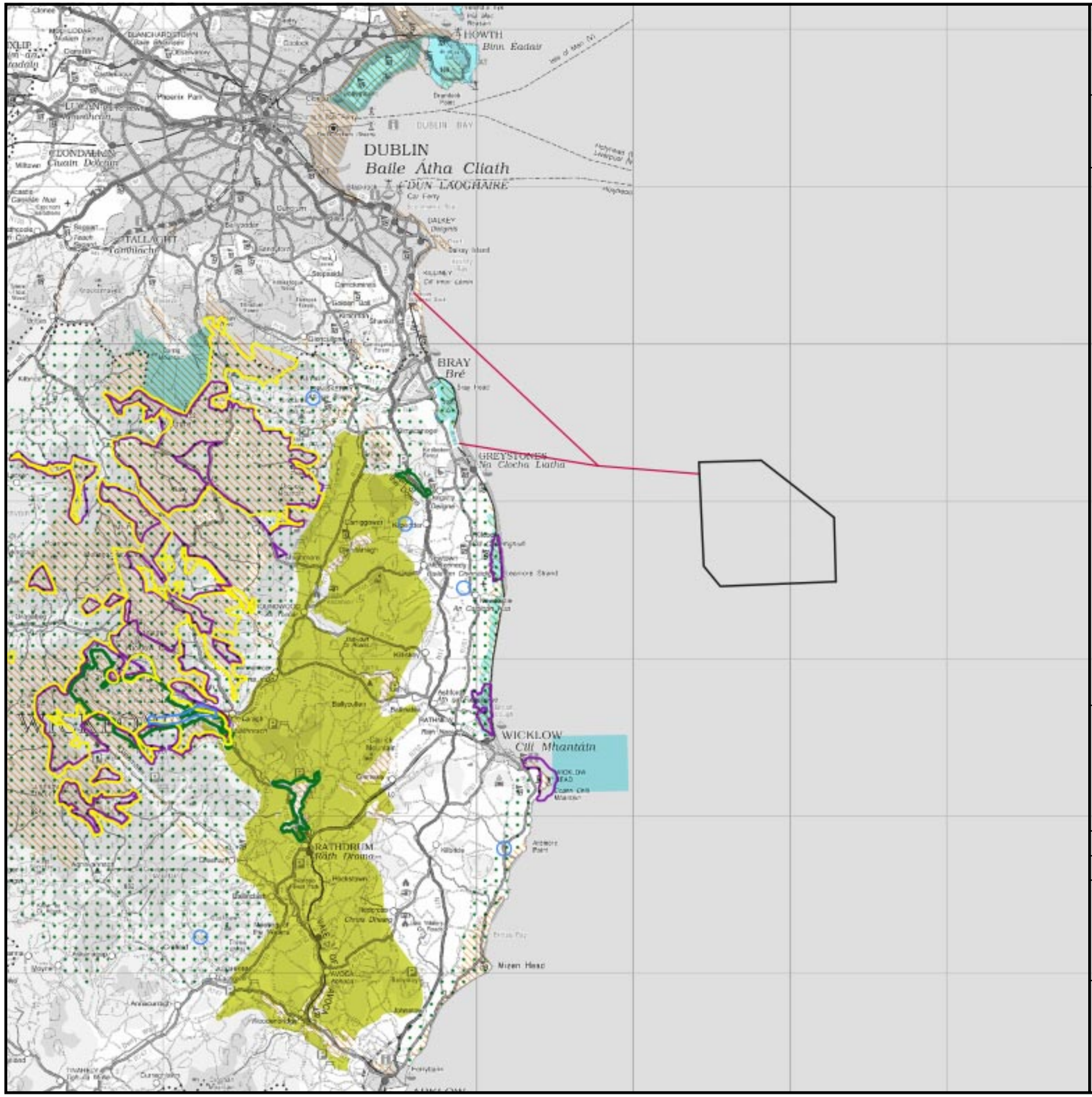
The full Environmental Impact Statement may be viewed at the following addresses:

- Howth Library, Main Street, Howth, Fingal, Co Dublin
- Arklow Branch Library, St Mary's Rd, Arklow, Co Wicklow
- Greystones Library, Mill Rd, Greystones Co Wicklow
- Wicklow Branch Library, Kilmantan Hill, Wicklow, Co. Wicklow

The full Environmental Statement contains the full environmental assessments that have been undertaken including maps, visualisations, diagrams and plates. A volume of appendices accompanies the full Environmental Statement.

Copies of the full Environmental Statement, Non-Technical Summary and Volume of Appendices can be obtained from the Natural Power Offices, *The Green House, Forrest Estate, Dalry, Castle Douglas, DG7 3XS. Tel: (01644) 430008.*

Volume 1:	Environmental Statement	£280
Volume 2:	Non-Technical Summary	Free
Volume 3:	Volume of Appendices	P.O.A



Project:

Codling Wind Park

Map 1: Site Location

Key

- Wind Farm Site Boundary
- Cable Route Options to Shore
- Special Protection Area
- Area of Special Amenity
- Archaelogically Significant Areas
- Proposed Special Area of Conservation
- Nature Reserve
- Area of Outstanding Natural Beauty
- Proposed Natural Heritage Areas
- Wicklow Mountains National Park
- County Boundary

Scale: 1: 250,000 (reduced)

Kilometres

0 — 10

N

Date: 02-09-02	Prepared by: DH
Drawing No: COD_M1.tif	Checked by: NM

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natural power

Client:

Codling Wind Park

Codling Wind Park

Project:
Codling Wind Park

Title:
Map 2: Site Layout

Key:

- Wind Turbine
- 33 kV Cable Route
- 33kV Cable Collection Corridor
- Site to Shore 110/220kV Cable Route Options
- Offshore Mounted Substation & Helipad
- 10 — Depth of Seabed below Chart Datum (Chart datum is 1.69m below MSL)
- Anemometry Mast
- Proposed Location of New Buoy
- Location of Existing Buoys (Arrows indicate repositioning of buoys during wind farm construction)
- Maximum Extent of Construction Period Exclusion Zone

Scale: 1: 33,333 (reduced)

Kilometres
0 0.5 1

N

Date: 15-08-02 | Prepared by: DH

Drawing No: Cod_Layout.tif | Checked by: JS

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