Beatrice

Wind Farm Demonstrator Project Scoping Report

TALISMAN ENERGY

1 NON-TECHNICAL SUMMARY

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PROPOSED DEMONSTRATOR PROJECT

Talisman Energy (UK) Limited and its co-venturer Scottish and Southern Energy are planning to develop an offshore demonstrator wind farm. This Scoping Report describes the potential environmental, socio-economic, and visual impacts that might be caused by building and operating the demonstrator project near the Beatrice field 22 kilometres (12 miles) offshore in the Moray Firth. The demonstrator project would comprise two wind turbine generating units (WTG) each of 5MW capacity located on the seabed about 1.6km and 2.3km from the Beatrice Alpha complex, linked to the Beatrice AP platform by a subsea cable. Lasting for approximately five years, the demonstrator project would be used to examine the feasibility and benefits of creating a commercial deepwater wind farm at this site.

Talisman Energy (UK) is seeking consent for the demonstrator project as a variation of its existing consent for the Beatrice field operations. The proposal will be subject to a full Environmental Impact Assessment (EIA) supported by a formal Environmental Assessment (EA) prepared under the Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999. If the demonstrator project proves successful and the decision is made to proceed with the creation of a commercial wind farm, a second comprehensive EIA, including consultation, would be undertaken for that development.

ENVIRONMENTAL SETTING AND THE HABITATS DIRECTIVE

The Beatrice field lies approximately 22km off the northeast coast of Scotland, and is situated about 24km outside the boundary of the Moray Firth Special Area of Conservation (SAC). The main qualifying interest of the Moray Firth SAC is the resident population of bottlenose dolphins, thought to number between 100 and 174 individuals. In addition to the SAC, the adjacent coasts of Morayshire and Caithness contain numerous sites of ecological or conservation interest, particularly for their nesting seabirds and seals. Offshore, the Smith Bank, on which Beatrice is located, is a site for commercial fishing and includes spawning grounds for several commercially-fished species of fish and shellfish.

POTENTIAL IMPACTS AND THEIR MITIGATION

Initial stakeholder consultation and the results of the scoping exercise identified the following main impacts of the demonstrator project.

UNDERWATER NOISE FROM PILING

If the WTG units were fixed to the seabed by driven piles, the noise from short-term piling operations may disturb marine mammals and fish in the area around the sites. The use of marine mammal observers and the application of a "soft-start" to piling operations may be used to reduce possible effects. Other mitigation measures will be described and reviewed in the EA.

NOISE FROM OPERATIONS OF WTG UNIT

Because of the remote location offshore, no noise is expected on land. The operation of the WTGs will create some noise and vibration that will be transmitted into the water column. Studies being undertaken by the University of Aberdeen will improve our understanding of the noise and its effects on marine mammals.

EFFECTS ON SEABED COMMUNITIES

The two WTGs will cover a very small area of the existing seabed and associated seabed communities. No rare or threatened species or communities will be affected. Installing the WTGs on the steel frames rather than concrete bases is one way this impact may be minimised; others will be reviewed in the EA.

EFFECTS ON BIRDS AT SEA

The presence of the WTGs may affect the movements of birds and the use that they may make of the area, including their feeding activities. There is also a small chance that the WTGs could present a collision hazard for some species, under certain conditions. Studies being undertaken by the University of Aberdeen on bird distribution will help assess the risks.

ELECTROMAGNETIC EFFECTS ON FISH

Electromagnetic fields around the cable linking the WTGs to Beatrice AP may affect some species of fish, such as sharks and rays. The 33KV cable lengths will be relatively short (about 2.8km in total) so the possible effects on fish are likely to be small and localised and will be investigated fully in the EA and appropriate mitigation defined.

INTERACTION WITH COMMERCIAL FISHING AND SHIPPING

The presence of two new structures close to the Beatrice platform may interfere with commercial fishing operations and shipping. It is not yet known if the area around each WTG will be accessible for fishing once the turbines are in place, and consultation with fishing organisations is continuing. The new structures will be marked on charts, and shipping will be notified through the Admiralty's "Notices to Mariners".

VISUAL AND LANDSCAPE IMPACT

Despite their offshore location, parts of the WTG structures will be visible from various locations on the Moray Firth coast. The WTGs will also be seen by vessels in the Moray Firth. Careful choice of colours and reflectivity of surfaces may help mitigate visual impacts.

RESEARCH STUDIES UNDER WAY

As a result of initial consultation, Talisman has identified that noise effects on marine mammals, and disturbance effects on birds at sea, are important potential effects of the demonstrator project. To provide more detailed information on these issues, Talisman has initiated a series of surveys and research programmes with the University of Aberdeen and other organisations. Thses include:

- Assessment of noise effects; through a research programme which will (a) assess activity of marine mammals in the area around the WTGs, and (b) measure the actual noise levels that are created by the operations.
- Gathering new survey data of bottlenose dolphin distribution in the offshore Moray Firth.
- Assessment of the potential effects of the WTGs on birds; Talisman has started a year-long survey to obtain detailed data on the presence of birds around the specific WTG sites and is in the process of commissioning dedicated radar studies of birds around the WTGs.

FUTURE PROGRAMME

A full EIA will be undertaken to assess and quantify in detail all the potential impacts from the demonstrator project. The resulting EA will include the results from the consultation programme, and will reflect the issues, concerns and mitigation measures raised by stakeholders. It is planned that the EA will be completed by the end of 2005, and will support the formal application for consent to the DTI.

CONSULTATION

Talisman will conduct a comprehensive consultation exercise in 2005, during which all interested parties will have an opportunity to learn about the demonstrator project and to voice their concerns and give their comments about the proposed project. Further copies of the Scoping report can be obtained by writing to The Environment Manager, Talisman Energy (UK) Limited, Talisman House, 163 Holburn Street, Aberdeen AB10 6BZ, or downloaded in PDF format from www.beatricewind.co.uk

2 INTRODUCTION

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2.1 BACKGROUND

As the world's demand for energy increases, attention in recent years has focused on two related issues with far-reaching environmental, social and economic consequences for society. Firstly, there is a strong international scientific and societal consensus that the present levels of emissions of carbon dioxide and other gases should be reduced. Under the Kyoto Protocol, which has now been ratified by 146 countries, the UK has set a target that by 2009 CO_2 emissions will have been reduced by 10% in comparison with 1999 levels.The Scottish Executive has set a target of an 18% reduction in this period. Secondly, there is the view that diversity of energy supply should be actively pursued as part of a longer-term sustainable energy policy. The UK government has set a target of 15% energy from renewable sources by 2015.

2.2 UK RENEWABLES PROGRAMMES

The UK has a diverse programme of research and development, and government initiatives and projects, to meet both these goals. At present, the commercial development of onshore and nearshore wind farms is the mainstay of its renewables programme, primarily because technological developments permit the construction and operation of commercially viable wind farms that can supply electricity to the national grid at a competitive price.

The rapid growth in the construction of onshore wind farms has, however, raised concern from stakeholders about the potential social, amenity and environmental impacts of these sites. Onshore wind farms tend to be located in open countryside, and their presence may, among other things, alter the visual and amenity character of a site. The marine environment is increasingly being recognised as a region which offers significant scope for the development of commercial wind farms where distance from the shore has the potential to reduce many of the visual intrusion and societal impacts.

2.3 OFFSHORE WIND FARMS

In the UK at present there are three offshore wind farms at Blyth, North Hoyle and Scroby Sands. Although development offshore does raise additional environmental and socio-economic concerns, the operation of these wind farms suggests that in future the UK may increasingly exploit offshore locations to create large wind farms with larger individual turbine units. Such wind farms are likely to be more efficient than smaller wind farms onshore. The need to expand renewable energy development (including wind farms) into offshore areas has been recognised by the UK Department of Trade and Industry, which has recently produced two key documents, a Strategic Environmental Assessment (SEA)(DTI, 2003) of areas identified as potential licence sites for offshore wind farms, and an Atlas of UK Renewable Energy Resources (i.e. wind, wave and tidal) for the whole of the UK offshore region (DTI, 2004b).

Present offshore wind farms are located in relatively shallow water close to the shore, and are visible from land. Extending the area in which commercial wind farms may be located into deeper waters will have significant benefits. Access to such areas will provide developers and governments with greater choice of locations for large wind farms. Large areas of the coast of northern Europe may be available, and this will encourage development in areas where there are considerable resources (in terms of physical space and wind energy), and, potentially, fewer environmental and societal concerns. In particular, it will allow the development of offshore wind at sites on the UK continental shelf distant from the shore.

2.4 TALISMAN'S INTEREST IN OFFSHORE WIND

Talisman, one of the largest oil and gas operators on the United Kingdom Continental Shelf, became interested in offshore wind in 2001, following a review of the £45 million Beatrice redevelopment. As part of the programme, Talisman screened a range of future options to identify how they could reduce operating costs, increase production, and extend economic life. The studies revealed that finding re-use opportunities for the existing field infrastructure would contribute to these goals, and indicated that there was the potential for wind energy generation at Beatrice. This potential exists because Beatrice has a significant wind resource, is located in relatively shallow water and has a substantial existing infrastructure which could be re-used in a wind farm development.

As a result of the screening study, Talisman conducted a further feasibility study to quantify the development potential. This showed that it could be commercially viable to create a large-scale offshore wind farm at the site using the main Beatrice infrastructure as a hub, but that further detailed evaluation would be required. The development of wind farms at more distant locations in deeper water presents significant additional technical challenges for the design, installation, operation and maintenance of facilities and infrastructure. These must be overcome if the potential for commercial, non-visually intrusive offshore wind energy in northern Europe is to be realised. In the northeast of Scotland, the offshore oil and gas industry is uniquely placed to contribute experience, expertise and resources to further advance the development of commercial wind farms in offshore waters.

The feasibility study also showed that a successful development would require a new range of skills, combining expertise from the offshore oil and gas industry with those of utility businesses. Consequently, Talisman Energy (UK) Limited has partnered with Scottish and Southern Energy, a major UK utility, to examine the potential of creating a deep water wind farm at the Beatrice site in the Moray Firth.

The creation of a commercial offshore wind farm at this location could provide up to 1GW of installed capacity for supply to the National Grid. This would be equivalent to almost 20% of Scotland's present electricity demand.

2.5 THE DEMONSTRATOR PROJECT, ITS PURPOSE, AND POTENTIAL BENEFITS

As part of the long-term planning, investigation and research into the feasibility of creating a wind farm at this site, Talisman proposes to build and run a demonstrator project at the site for a period of 5 years. The demonstrator project consists of 2 wind turbine generating (WTG) units linked by a subsea cable to the nearby Beatrice platform. This initiative has received funding from the Scottish Executive, the UK Department of Trade and Industry, and the European Commission. It has also been incorporated into a pan-European initiative called DOWNVInD (Distant Offshore Wind farms with No Visual Impact iN Deepwater), comprising 15 different organisations from 6 European countries, which has been established as a catalyst for commercialising deepwater wind farm technology.

The purpose of the Beatrice demonstrator project is to:

- Better understand the environmental impact of deepwater wind farms
- Prove the concept of a deepwater wind farm
- Explore the cost-effectiveness of deepwater sites
- Share knowledge and experience across Europe
- Pioneer the development of deepwater wind farms
- Improve and commercialise the technology

In the short term the demonstrator project will have an immediate impact on the future of the Beatrice field. The energy generated by the turbines will be used to power the platform, reducing the use of power from fossil fuels and their associated emissions. This will contribute to Talisman's strategy of reducing its emissions and minimising the environmental impact of its operations. The demonstrator project also aligns with Talisman's programme for the decommissioning of the Beatrice field, which seeks to extend the useful life of the field by finding alternative uses for some of the main facilities and infrastructure (Talisman, 2003). The UK DTI has recently approved this decommissioning programme.

The whole demonstrator programme will cost about £30 million and will bring significant benefits to Scotland and the UK. The design and development, and a substantial part of the research programme, will be undertaken in the UK. The location and management of one of Europe's premier research programmes in the northeast of Scotland will provide a unique opportunity for Scottish companies to demonstrate their technology and capabilities.



2.6 PLANNING AND CONSENT FOR THE DEMONSTRATOR PROJECT

A consent for the building and operation of the demonstrator project is being sought by Talisman Energy (UK) Limited as an addendum to the existing field development consent for the Beatrice field operations. The addendum will be supported by a formal environmental assessment (EA) prepared under the Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999, which will be submitted towards the end of 2005. If the demonstrator project proves successful, and the decision is made to proceed with the creation of a commercial wind farm in the Beatrice field, a second full EA, including consultation, will be undertaken for that development.

2.7 PURPOSE OF THIS SCOPING REPORT

This scoping report has been prepared as part of the planning and consents process for the initial demonstrator project, and as a first stage in preparing the EA. The report:

- Describes the demonstrator project and its context.
- Describes the site of the project and its environmental sensitivities.
- Identifies the impacts that might arise from the project.
- Describes the work being undertaken by the project to gather more information to understand the main environmental impacts better.
- Summarises the further programme of consultation that will be carried out by Talisman during 2005.
- Seeks the views of interested stakeholders and members of the public.

The scoping report is intended to present a review of the main environmental issues as they are presently understood, and to inform the consultation that will be carried out by Talisman during 2005.



3 DESCRIPTION OF PROJECT

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3.1 INTRODUCTION

The demonstrator project encompasses the construction, operation and study of two WTG units in the Beatrice field, Moray Firth. If the project proves successful, the developers may then apply for the development of a commercial wind farm comprising about 200 WTG units, to be located in the general area of the Beatrice field.

3.2 SITE SELECTION

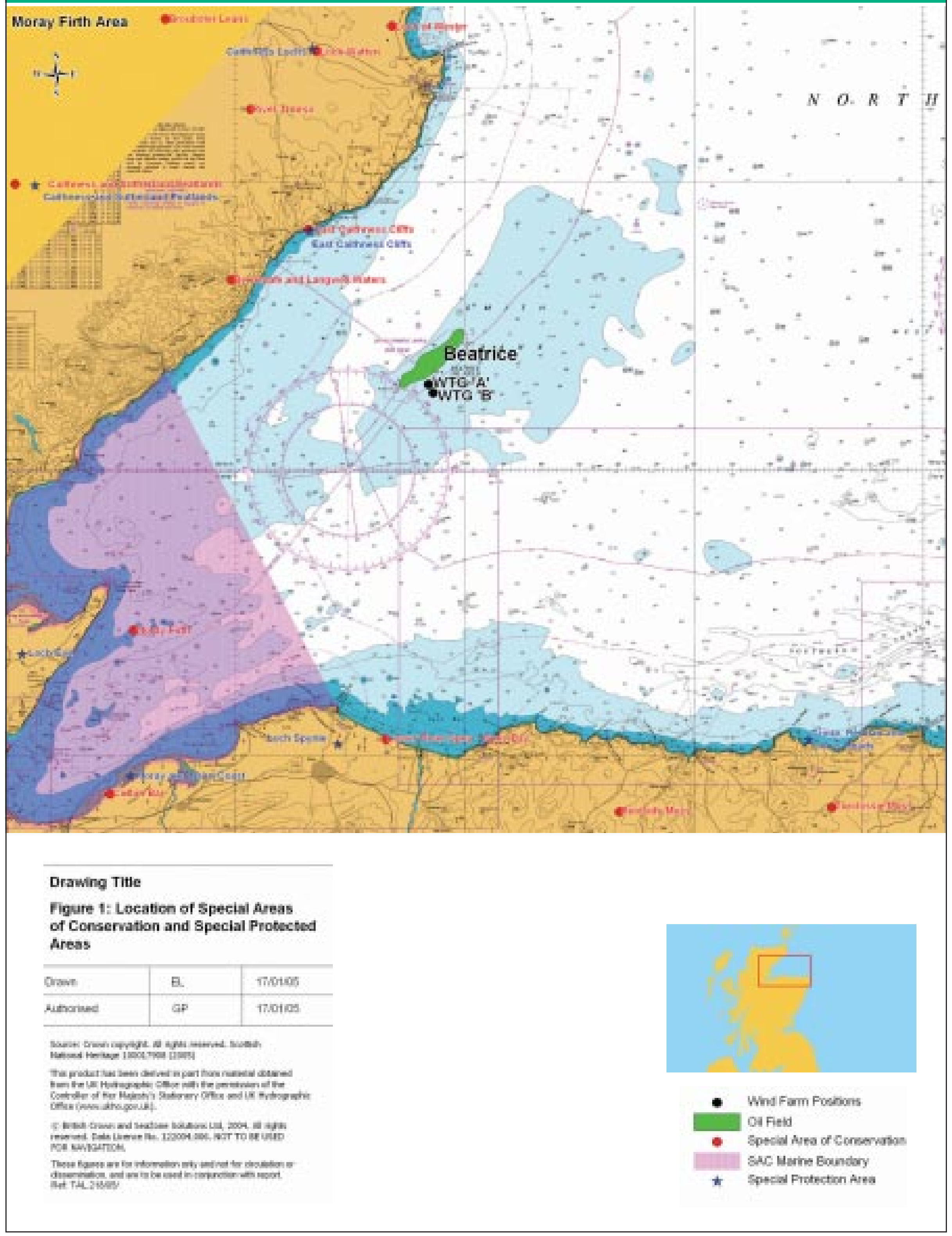
The two WTG units will be installed approximately 1.6km and 2.3km from the platform Beatrice AP in the Beatrice field, in the Moray Firth. The units will thus be located approximately 22km (12 miles) offshore, in a water depth of about 45m; Figure 3-1 shows the location of the field and position of the two units in relation to the existing platforms.

The location of the demonstrator project is dictated by the existing infrastructure of the Beatrice field which provides a site for the offshore electrical substation on Beatrice AP platform.

The other factors that have been taken into account during the selection of exact locations for the two WTG units are:

- the presence of existing oil and gas infrastructure on the seabed around Beatrice;
- the location of shipping routes;
- the topography of the seabed; and
- water depth.

FIGURE 3-1.
MAP OF THE MORAY FIRTH SHOWING THE LOCATION OF THE DEMONSTRATOR WTGS AND THE CLOSEST CONSERVATION SITES.



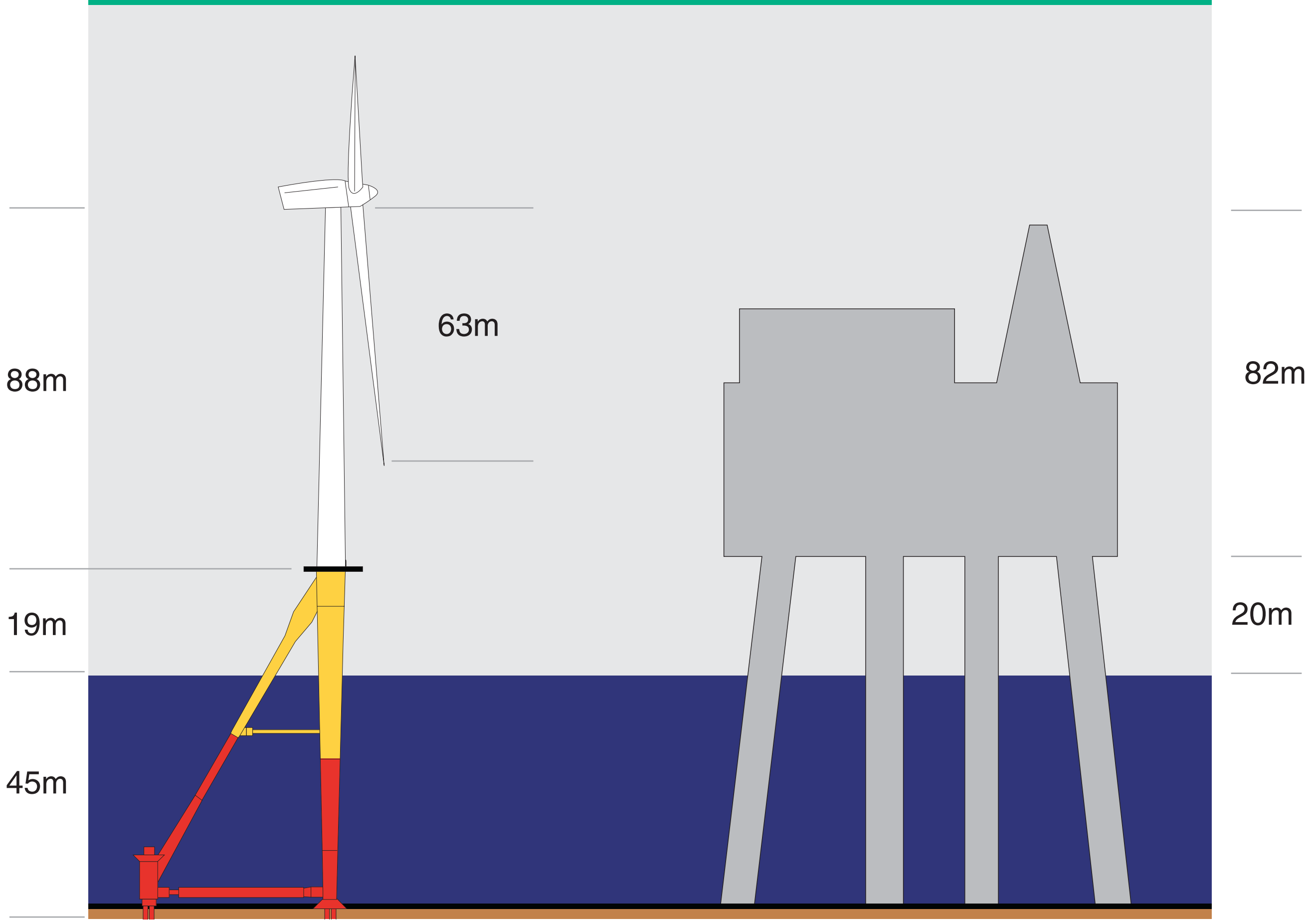
3.3 PROPOSED TURBINE UNITS

Each WTG unit will consist of a 5MW turbine weighing about 410 tonnes, fitted with three blades each 63m long. The turbine will be mounted on a tall tower, which in turn is mounted on a substructure fixed to the seabed; the complete support structure will reach 88m above sea level. The minimum clearance between the blade tips and the surface of the sea (lowest astronomical tide, (LAT)) will therefore be approximately 28m and the height from the surface of the sea to the top of the blades will be 148m (Figure 3-2).

The tower will be a tapered steel column weighing about 210 tonnes, and it will have a diameter of about 6m at 20m above sea level, the point at which the tower is fixed to the subsea structure.

All the subsea components will be protected by a carefully selected paint system and/or a system of sacrificial anodes. Above LAT an appropriate paint system will be used for protection, and its colour will be chosen to minimise visual impact. The turbine blades will rotate in a clockwise direction when viewed from the windward side. The towers will carry warning lights as stipulated and required by present legislation and guidelines.

FIGURE 3-2
DIAGRAM SHOWING SIZE AND STRUCTURE OF A WTG COMPARED WITH BEATRICE AD PLATFORM



3.4 METHOD OF FIXING SUBSTRUCTURE TO THE SEABED

Several designs have been examined for fixing the substructure to the seabed, bearing in mind the total weight of the tower and turbine (about 1,400 tonnes), the water depth, the subsurface conditions for piling, the wave and wind climate in the Beatrice field, and the operations required to transport and erect the substructure at the required location. Two designs are currently being reviewed. The design being considered is the OWEC Jacket Quattropod (OJQ) (Figure 3-3) which weighs about 750 tonnes plus the weight of the piling arrangements. This design gives the required stiffness and fatigue life. The square base of the OJQ has sides 20m long, so will cover about 400m^2 of seabed. An alternative tripod structure also remains under consideration (Figure 3-4). This would have a slightly larger base area (about 600m^2) than the OJQ.

Both types of substructure can be fixed to the seabed either by suction piles or by driven steel piles. In the suction pile method, specially fabricated steel cans 10m or more in diameter are attached to the corners of the subsea structure (i.e. 4 cans in total for the OJQ option, or 3 for the tripod). An example of an offshore structure fitted with suction cans is shown in Figure 3-5.

For installation the structure would be placed on the seabed in a similar manner as for driven piles; once on the seabed, each pile forms a seal with the soil. The seawater inside each can is then pumped out, resulting in a reduction in pressure inside the can. The external pressure of seawater causes the can to penetrate the seabed, and pumping continues until the can has been forced into the seabed to the required depth. (The exact sizes of the suction piles required for the WTGs is dictated by sediment conditions and structural loading, and are presently being assessed as part of the detailed design of the fixing arrangements).

If fixed by driven piling, steel piles 2.1m (84”) in diameter (total weight 502 tonnes) will be driven to a depth of about 39m into the seabed. After pile driving, the subsea substructure would be anchored to the piles by cement grout; the tops of the piles would protrude somewhat above the tops of the pile sleeves, ending about 13m above the seabed. An 8m wide ring of concrete “mudmats” would be placed around each corner of the substructure to protect against seabed scour.

FIGURE 3-3
DIAGRAM SHOWING THE DESIGN OF THE OWEC JACKET QUATTROPOD SUB-STRUCTURE

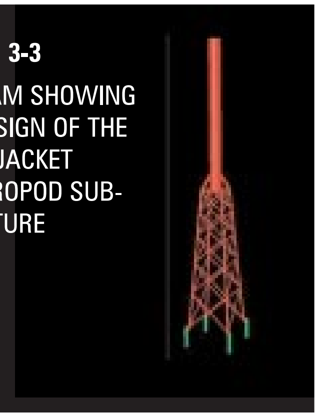


FIGURE 3-4
DIAGRAM SHOWING THE DESIGN OF THE TRIPOD SUB-STRUCTURE

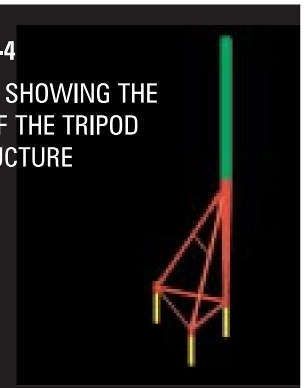


FIGURE 3-5
AN OFFSHORE PLATFORM SHOWING SUCTION CANS ATTACHED TO EACH CORNER LEG.

Installation by the suction pile method is the preferred engineering and environmental solution. It is an efficient and quiet technique that would cause the minimum of disturbance to marine life, and offers the possibility that the fixing arrangements could be completely removed when the WTGs are decommissioned. However, suction piles have the disadvantage that, unlike conventional driven piles, they cannot withstand significant tension loads. In addition, the required size of the cans can be prohibitive.

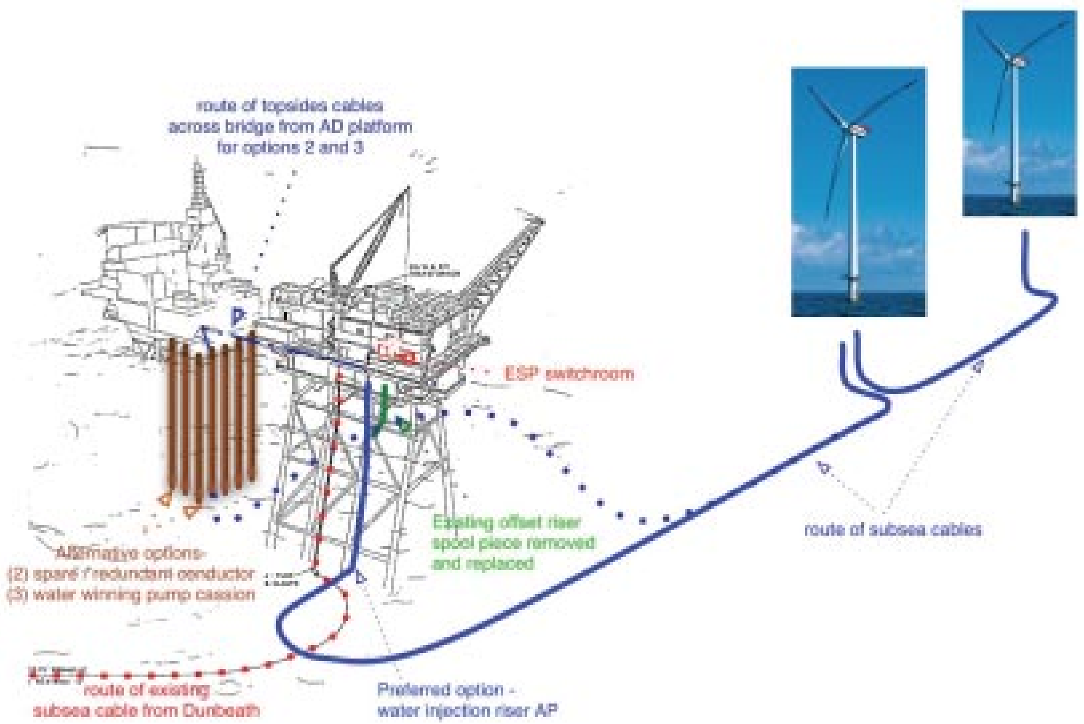
3.5 ELECTRICAL CONNECTION OF UNITS TO BEATRICE FIELD

The two WTG units ('A' and 'B') will be linked by a 900m long 33KV electric cable, about 100mm diameter, depending on the amount of armour protection selected during detailed design. The cable will probably be buried in the seabed sediment to a depth of about 1m, although consideration is also being given to laying the cable on the seabed. A decision on this aspect will be made after due consideration and consultation with regard to fishing and environmental issues.

WTG unit 'A' will be linked to the Beatrice AP platform by 1,900m long 33KV electric cable, which would also be about 100mm in diameter and probably buried. Figure 3-5 shows the planned routes of both cables. Beatrice AP is already linked to the mainland by a 33KV subsea cable that runs to the Scottish and Southern Energy (SSE) substation at Dunbeath. This cable is buried to a depth of about 1m and is used to provide some of the power required on the Beatrice AP, AD and B platforms.

FIGURE 3-6.

SCHEMATIC SHOWING THE GENERAL LOCATIONS OF THE WTGS AND ELECTRICAL CABLES, IN RELATION TO THE BEATRICE AP PLATFORM.



3.6 MODIFICATION TO BEATRICE AP PLATFORM

Modifications to the switchgear and other electrical equipment on Beatrice AP will be required so that the platform can receive and utilise the power generated by the turbines. Some diving work at the Beatrice AP platform will be required to modify a redundant 12" diameter water injection riser so that the electric cable from the turbines can be pulled through it up and into the platform. As far as possible, the need for diving work will be eliminated during the design process.

3.7 FABRICATION AND INSTALLATION

It is planned that construction of the demonstrator project would be carried out during the summer of 2006. There are several possible methods that could be used to install the WTGs, and a decision will be made during the detailed phase of the project in the course of 2005.

A large crane vessel will be utilised offshore at some stage in each of the possible options. Preference will be given to a solution that requires the minimum use of large vessels at the site. The ideal option would be to marry the substructure, the support tower and possibly also the turbine nacelle, and to transport this assembly to site on a suitable vessel for a one or two piece installation on the seabed.

Subsea cables will be laid by a dive support vessel (DSV), starting at the Beatrice AP platform. The vessel will move under its own power using its thrusters and dynamic positioning (DP) capability to maintain station accurately along the planned cable route. As the cable is being laid on the seabed, it may be trenched to a depth of approximately 1m using a jetting tool on a remotely operated vehicle (ROV) deployed from the DSV. This process will be repeated for the electric cable linking units 'A' and 'B'. It is estimated that it will take about 12 hours to trench and lay both cables.

The electric cable will emerge from the seabed trench at each of the facilities to which it is connected (i.e. at Beatrice AP, and at both WTG Units). Assuming that the rest of the cable is trenched, it will therefore still run over the surface of the seabed for short stretches at these locations. At any location where the cable is not trenched it may be protected by a covering of concrete mattresses which may be placed by divers. Concrete mattresses comprise a matrix of 10-30 concrete "tiles", measuring about 6m x 3m x 0.15m, linked by strong rope or steel wire. The mattresses are flexible and can be draped over pipes or cables to anchor them to the seabed and give protection from towed fishing gear or dropped objects.

The electric cable from WTG unit 'A' to Beatrice AP will cross the 16" oil export pipeline that runs from Beatrice AP to Nigg. This crossing will be created by placing one or more concrete mattresses over the buried pipeline, resting the cable on this layer, and then protecting the whole arrangement with another mattress. This crossing is about 200m from Beatrice AP and it may not be practical to trench this short length before the cable starts to bend in towards the platform. The cable between the crossing and Beatrice AP will therefore remain on the seabed and will be protected by mattresses.

3.8 OPERATION, MAINTENANCE AND MONITORING OF PERFORMANCE

The performance of each turbine, and of the electricity generation and export capability of the demonstrator project, will be monitored remotely using sensors and equipment on the turbines, the Beatrice AP platform and the grid connection substation at Dunbeath. The turbines are designed to run remotely and to require minimal planned and reactive maintenance in the course of their designed working life (20 years). It will, however, be possible to gain access to the WTG units for routine maintenance and to effect repairs if necessary. In suitable weather conditions, personnel and light equipment would be transported to the WTG units by sea. There will be a landing stage or stages on the tower at convenient and safe heights above LAT. There will be a staircase and small electric man-riding winch inside the tower. It will also be possible to access the top of the turbine nacelle by helicopter, to transfer equipment and effect emergency rescue. Provision will be made for emergency shelter arrangements and rations within the turbine tower in the event of unexpected and unavoidable overnight stays.

3.9 DECOMMISSIONING

At the end of the demonstration period, it is envisaged that the turbines will either remain in place as part of a commercial wind farm, or be removed entirely and disposed of onshore. Any decommissioning programme would essentially be the reverse of the installation programme. Although the exact scope of work is not known, it is likely that the blades, turbines and towers would be removed and transported to shore for re-use or recycling. If steel piles are used, they would be cut below the level of the seabed to allow the whole of the subsea support structure to be lifted from the seabed and returned to land. If suction piles are used, plans would be made to remove them. Any surface cables would be removed to shore and buried cables would remain *in situ* depending on the outcome of consultations.

4 DESCRIPTION OF THE ENVIRONMENTAL SETTING

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4.1 PHYSICAL AND CHEMICAL ENVIRONMENT

4.1.1 GEOGRAPHICAL LOCATION

The Beatrice field is located within UKCS Block 11/30a on the Smith Bank in the outer Moray Firth, approximately 22km from the Scottish coastline (Figure 3-1).

4.1.2 CLIMATE AND METEOROLOGY

The Moray Firth and adjacent coasts experience a mild maritime climate due to prevailing south-westerly winds and the warming influence of the North Atlantic Current. At sea level, mean air temperatures vary between 6°C (March) and 12.5-13.0°C (July and August) (UKDMAP, 1998). The climate and hydrology of the area is strongly influenced by weather systems and water flow from the North Atlantic (DTI, 2004a). Large-scale westerly air circulation, frequently containing low pressure systems, predominates in the area (DTI, 2004a).

4.1.3 OCEANOGRAPHY AND HYDROLOGY

Water circulation is dominated by significant inflows of Atlantic water which mixes with North Sea and coastal waters (DTI, 2004a). Maximum surface tidal streams, which vary from 0.25 to 0.5m/s over much of the offshore area, are strongest in shallow coastal areas (DTI, 2004a). Temperature stratification is well developed in the summer months, breaking down in autumn due to increased frequency and severity of storms and seasonal cooling at the surface (DTI, 2004a). The seabed of the Moray Firth shows little topographic variation (Chesher and Lawson, 1983) but there are gently undulating banks. The largest of these is the Smith Bank, up to 16km wide and 40km long, which runs south-west to north-east and has a minimum water depth of 33m.

4.1.4 SEABED SEDIMENTS

Sandy sediments are the dominant surface materials in the central and northern parts of the Moray Firth (Chesher and Lawson, 1983). These sediments are generally moderately to well sorted, fine to medium grained, with a small percentage of shell debris. On the Smith Bank, coarsest sediments (sandy gravels) are distributed on the shallower north and east flanks, whereas finer sediments occur in the deeper western area (DTI, 2004a). An interpretation of soil conditions from geophysical survey results and borehole data indicate that sediment at the proposed locations of the turbines is clay of various densities (KBR, 2004).

4.2 BIOLOGICAL ENVIRONMENT

4.2.1 ENVIRONMENTAL SENSITIVITY OF LOCATION

COASTLINE AND CLIFFS

The Moray Firth coastline has significant national and international conservation value, with numerous environmentally sensitive areas and some of the most important breeding sites in the UK for seabird and seal populations. Consequently, extensive stretches of the Moray Firth coastline have been designated as conservation sites. These include Special Protection Areas (SPA), which are areas designated under the Wild Birds Directive (Table 4-1 and Figure 4-1). Examples include the sea cliffs at Duncansby Head which support breeding populations of peregrine and guillemot of European importance. During the breeding season, the area regularly supports 110,000 individual seabirds including puffin, razorbill, kittiwake, fulmar and guillemot (JNCC, 2004). Other notable SPA sites include the tidal flats of the Dornoch Firth, which are of value for breeding osprey and over-wintering bar-tailed godwit; and the Cromarty Firth, which is important for breeding common tern and over-wintering whooper swan (JNCC, 2004).

Special Areas of Conservation (SAC) are areas which support rare, endangered or vulnerable species of plants and animals which have been designated for protection under the EU Habitats Directive (92/43/EEC) (Table 4-1 and Figure 4-1). Sites in the Moray Firth which have been designated as SACs include the Culbin Bar (Moray and Nairn Coast) SAC which is of particular importance for Atlantic salt meadows and embryonic shifting dunes, and Mound Alderwoods SAC which is selected primarily because of its alluvial forests with alder and ash (JNCC, 2004). The nearest designated site, the Berriedale Cliffs, lies approximately 24km from the proposed demonstrator site.

FIGURE 4-1: CONSERVATION AREAS OF THE MORAY FIRTH (TALISMAN, 2002).

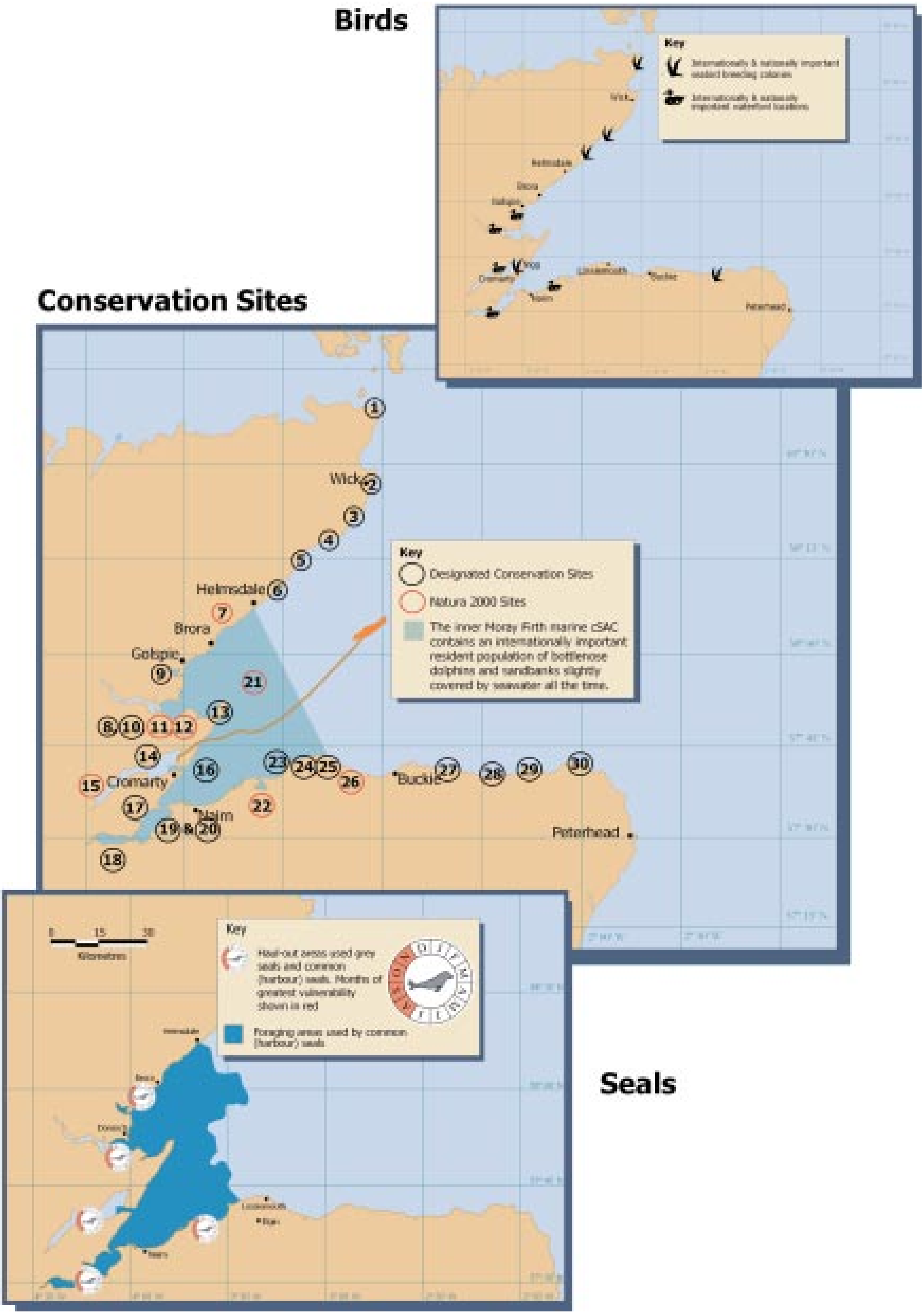


TABLE 4-1: CONSERVATION SITES ALONG THE MORAY FIRTH COASTLINE.

NO.	SITE	DESIGNATION	CONSERVATION INTEREST
1	Duncansby Head	SSSI, SPA, GCR, RLD	Sea cliff, maritime heath and internationally important numbers of breeding seabirds.
2	Lower Wick River	SSSI	Wet grassland/grazing marsh, peatland, fen,Phragmites reedbed, scarce & rare plants, waders & wildfowl breeding.
EAST CAITHNESS CLIFFS SPA, SAC INCLUDES 3-6 BELOW			
3	Castle of Old Wick	SSSI	Sea cliff site internationally important for breeding seabirds and maritime vegetation.
4	Craig Hammel to Scaps Geo	SSSI	Sea cliff site internationally important for breeding seabirds and maritime vegetation.
5	Dunbeath to Sgaps Geo	SSSI	Sea cliff site internationally important for breeding seabirds and maritime vegetation.
6	Berriedale Cliffs	SSSI	Sea cliff site internationally important for breeding seabirds and maritime vegetation.
7	Mound Alderwoods	SSSI, NNR, SAC, SPA, Ramsar, Natura 2000	Coastal lagoon, saltmarsh, woodland, fen, scarce & rare plants alder *(Alnus glutinosa)* and ash *(Fraxinus excelsior)*. Site for internationally important numbers of wintering wildfowl.
8	Kyle of Sutherland Marshes	SSSI	Wet grassland/grazing marsh, dry grassland, woodland, fen, Phragmites reedbed, scarce or rare plants, lower plants, terrestrial invertebrates, mammals, waders breeding & wintering wildfowl.
9	Loch Fleet	SSSI, SPA/Ramsar, NNR	Tidal flats, sand dunes, maritime heath, woodland, scarce & rare plants, lower plants, marine biological interest & marine mammals. Site for nationally important numbers of wintering wildfowl.
10	Easter Fearn	SSSI, NSA	Heath, woodland, fen, flush or seepage line & terrestrial invertebrates.
11	Dornoch Firth	SSSI, SPA, Ramsar, NSA, SAC, Natura 2000	Tidal flats. *Salicornia* and other annuals colonising mud and sand. Atlantic salt meadows *(Glauco-Puccinellietalia maritimae)*. Embryonic shifting dunes. Shifting dunes along the shoreline with *Ammophila arenaria*. Fixed dunes with herbaceous vegetation. Decalcified fixed dunes with *Empetrum nigrum*. Atlantic decalcified fixed dunes *(Calluno-Ulicetea)*. Humid dune slacks. Coastal dunes with *Juniperus spp*.
MARINE BIOLOGICAL INTEREST & MARINE MAMMALS (OTTER, COMMON SEAL). SITE OF INTERNATIONAL IMPORTANCE FOR WINTERING WILDFOWL.			
12	Morrich More	SSSI, SPA, Ramsar, GCR, SAC, NSA, Natura 2000	Geomorphological interest. Tidal flats, saltmarsh, sand dunes, maritime heath, scarce or rare plants, terrestrial invertebrates, wildfowl breeding & wintering wildfowl.
13	Tarbat Ness	SSSI, SPA, Ramsar, GCR	Dry grassland & maritime heath. Site used by other wintering bird species.
14	Cromarty Firth	SSSI, SPA, Ramsar, NNR, RLD (part), RSPB	Tidal flats, saltmarshes, vegetated shingle, mammals, wildfowl & seabirds breeding. Site qualifies for SPA designation for the species common tern *(Sterna hirundo)* and osprey *(Pandion haliaetus)* during the breeding season and for over wintering bar-tailed godwit *(Limosa lapponica)*, whooper swan *(Cygnus cygnus)* and greylag goose *(Anser anser)*.
15	Lower River Conon	SSSI, SPA, Ramsar, SAC, Natura 2000	Saltmarsh, woodland, fen, terrestrial invertebrates, waders & wildfowl breeding. Site used for locally important numbers of wintering wildfowl.

TABLE 4-1 CONTINUED: CONSERVATION SITES ALONG THE MORAY FIRTH COASTLINE.

NO.	SITE	DESIGNATION	CONSERVATION INTEREST
16	Rosemarkie to Shandwick Coast	SSSI, Ramsar, GCR, RLD (part), RSPB	Geological interest. Sand dunes, sea cliffs, dry grassland, woodland, scarce or rare plants, lower plants, marine biological rest, terrestrial invertebrates & birds breeding.
17	Munlochy Bay	SSSI, SPA, Ramsar, GCR	Tidal flats, saltmarsh, flush or seepage line, Phragmites reedbed & terrestrial invertebrates. Site used for nationally important numbers of wintering wildfowl.
18	Beauly Firth	SSSI, SPA, Ramsar	Tidal flats, coastal lagoon, saltmarsh, woodland, fen, Phragmites reedbed, fish & wildfowl breeding. Site used for internationally important numbers of wintering wildfowl.
19	Longman & Castle Stuart Bays	SSSI, SPA	Tidal flats & waterfowl.
20	Whiteness Head	SSSI, SPA, Ramsar, GCR	Geomorphological interest. Tidal flats, saltmarsh, sand dunes, vegetated shingle, waders, wildfowl & seabirds breeding. Important feeding & roosting area.
21	Moray Firth	SAC, Natura 2000	Inner Moray Firth contains an internationally important population of bottlenose dolphins. Sandbanks slightly covered by seawater all the time.
22	Moray & Narin Coast	SSSI, SPA, Ramsar (part of Moray coast), SAC, GCR, RLD, (part), RSPB, Natura 2000	Site is comprised of two areas: the intertidal flats, saltmarsh and sand dunes of Findhorn Bay and Culbin Bar, and the alluvial deposits and associated woodland of the Lower River Spey and Spey Bay. Outstanding importance for coastal and riverine habitats; and for migrating geese and overwintering waders.
23	Masonhaugh	SSSI, GCR	Geological interest.
24	Clashach-Covesea	SSSI-GCR	Geological interest.
25	Lossiemouth Shore	SSSI, GCR	Geological interest.
26	Spey Bay (includes River Spey)	SSSI, SAC, GCR, SPA, Ramsar, Natura 2000	Geomorphological interest. Saltmarsh, vegetated shingle, woodland, fen, terrestrial invertebrates, waders & wildfowl breeding & wintering wildfowl. Largest shingle complex in Scotland.
27	Cullen to Stakeness Coast	SSSI, GCR, RLD (part)	Saltmarsh, sand dunes, sea cliff, dry grassland, maritime heath & flush or seepage line.
28	Whitehills to Melrose Coast	SSSI, GCR	Geological interest.
29	Gamrie to Pennan Coast	SSSI, SPA (part)	Sea cliff, dry grassland, maritime heath, montane heath, woodland, flush or seepage line & seabirds breeding.
30	Rosehearty to Fraserburgh Coast	SSSI, GCR	Geological interest. Tidal flats, coastal lagoon, saltmarsh, sand dunes & sea cliff. Site used for internationally important numbers of wintering wildfowl. Also important for turnstone, sandpipers & wildfowl.

TABLE 4-2: ANNEX I AND II HABITATS AND SPECIES OCCURRING IN UK OFFSHORE WATERS (SOURCE: JNCC, 2002).

ANNEX I HABITATS CONSIDERED FOR SAC SELECTION IN UK OFFSHORE WATERS	SPECIES LISTED IN ANNEX II KNOWN TO OCCUR IN UK OFFSHORE WATERS
• Sandbanks which are slightly covered by seawater all the time • Reefs (bedrock, biogenic and stony) - **Bedrock reefs** – made from continuous outcroppings of bedrock which may be of various topographical shape; - **Stony reefs** – these consist of aggregations of boulders and cobbles which may have some finer sediments in interstitial spaces; and - **Biogenic reefs** – formed by cold water corals (e.g. Lophelia pertusa) and Sabellaria spinulosa. • Submarine structures made by leaking gases • Submerged or partially submerged sea caves	• Grey seal • Common seal • Bottlenose dolphin • Harbour porpoise

OFFSHORE WATERS

Table 4-2 indicates habitats and species from Annex I and II of the EU Habitats Directive (92/43/EEC) which are currently under consideration for identification as possible SACs in the UK offshore waters (JNCC, 2002). At a European level, marine species including all cetacean species and otters, a number of fish species and a range of marine invertebrates are listed on Annex IV (Animal and Plant Species of Community Interest in Need of Strict Protection) of the Habitats Directive (DTI, 2004a). Several marine species are also protected in UK waters under Schedule 5 of The Wildlife and Countryside Act, 1981; these include all cetacean species, otters, all turtle species, a range of fish and a number of marine invertebrates (DTI, 2004a).

ANNEX I HABITATS

The inner Moray Firth (Figure 4-1) has been designated as a marine SAC because of its sandbanks which are slightly covered by seawater all the time (Table 4-2). No qualifying subtidal sandbanks have been identified in the region of the Beatrice field or export pipeline (Talisman 2003). Although an Appropriate Assessment will not therefore be necessary for the demonstrator project, sufficient environmental information will be presented to enable potential impacts to be identified.

ANNEX II SPECIES

All of the Annex II species listed in Table 4-2 have been sighted within the vicinity of the Beatrice field. In 1994, the inner Moray Firth was one of the first areas in Europe to be identified as a marine candidate SAC to protect the population of bottlenose dolphins in the area. Marine mammals occurring in the vicinity of Beatrice are discussed in more detail in Section 4.2.5.

4.2.2 PLANKTON

The key determinants of the character and extent of plankton communities in the northern and central North Sea are climatic and hydrographic variability, in particular the extent of Atlantic inflow (DTI, 2004a). Plankton species composition and productivity is strongly influenced by seasonal variability. In the North Atlantic, a phytoplankton bloom occurs in the spring, usually followed by a smaller peak in the autumn (DTI, 2004a).

Phytoplankton standing stocks in the Moray Firth are strongly related to seabed topography, with highest concentrations over the Smith Bank (Heath *et al*., 1989). Populations over the Smith Bank are typical of temperate coastal shelf areas (Heath *et al*., 1989) and have been identified as a mixed diatom/dinoflagellate assemblage of the species *Rhizosolenia shrubsoli, Stephanopyxis turris, Lauderia borealis, Ceratium* spp. and *Peredimium* spp. The most frequently recorded taxa are dinoflagellates *(Ceratium)*, and this is in line with the rest of the North Sea where there is an increasing trend of dinoflagellate dominance (DTI, 2004a).

Zooplankton communities in the Moray Firth are dominated by copepods, including *Centropages hamatus, Temora longicornis*, (Adams and Martin, 1986), *Acartia clause, Pseudocalanus elongatus* (Heath *et al.,* 1989), *Calanus helgolandicus* and *C. finmarchicus* (DTI, 2004a).

4.2.3 SEABED FAUNA

INFAUNA

With the exception of the Smith Bank (McIntyre, 1958; Hartley & Bishop, 1986) and the Beatrice field (Hartley & Bishop, 1986), offshore benthic habitats of the Moray Firth are surprisingly little studied. Hartley and Bishop (1986) described the benthic fauna of the Beatrice area from surveys undertaken in 1977, 1980 and 1981, and from previously published information. Variations in the water depth (33m to >60m) over the area were mirrored by sedimentary and faunal gradients. Sediments ranged from very fine, through fine to medium sands and were inhabited by faunal communities characterised by mollusc species such as *Thyasira flexuosa, Fabulina fabula* and *Moerella pygmaea*, respectively. Two fine-sand communities were distinguished, typified by the abundance of *Thyasira flexuosa* in muddier sediments and *Crenella decussata* in coarser deposits. Localised patches of shell gravel were characterised by reduced densities of *Fabulina fabula* with elevated numbers of polychaete worm species such as *Scoloplos armiger* and *Lumbrineris gracilis* in medium depths. Comparison of these data with earlier reports (McIntyre, 1958) suggested a degree of long-term persistence of the fauna in qualitative and quantitative terms.

Development drilling at Beatrice AD commenced in 1978 and was completed in 1990. In total, 13 wells were drilled with water-based mud and 18 with low toxicity oil-based mud (Hartley Anderson, 2000) and it is estimated that this resulted in the discharge of 21,000 tonnes of cuttings with approximately 913 tonnes of oil (Watson, 1995). Contamination of the seabed sediment can result in the presence of a modified benthic invertebrate community, composed of high densities of disturbance-tolerant species such as the polychaete *Capitella capitata*. The existence of a rich, diverse benthic fauna, however, suggests that major sediment disturbance at the Beatrice field is infrequent (Hartley and Bishop, 1986).

A seabed survey conducted at the Beatrice field for BP Exploration in 1992 (AURIS, 1992) indicated that undisturbed communities were dominated numerically by the polychaete worms *Spiophanes bombyx* and *Scoloplos armiger*. On behalf of Shell, other biological surveys have been undertaken at exploration sites north of Beatrice in Block 11/25 (Hartley Anderson, 2000). The infaunal communities described from these surveys were similar to that of Beatrice and Smith Bank described by Hartley and Bishop (1986), being characterised by the bivalves *Thyasira* spp., *Crenella decussata* and *Goodallia triangularis*.

EPIFAUNA

Basford *et al.,* (1989; 1990) distinguished the epifauna of this area as being characterised by sponges, the bryozoan *Flustra foliacea*, the anemone *Bolocera tuediae*, and the crab *Hyas coarctatus*. Boulder "islands" on sand or gravel are found within the Smith Bank and the inner Moray Firth, and are known to have a diverse hydroid fauna. The horse mussel *Modiolus modiolus* is common throughout the Moray Firth, and various hydroids, bryozoans and barnacles are associated with the substrate provided by living and dead *Modiolus* shells.

The cold water coral *Lophelia pertusa* has been recorded as a dead fragment from the south-eastern Moray Firth (Wilson, 1979), possibly as fishing discard. Live samples have been recorded on fixed installations (Bell and Smith, 1999; BMT Cordah, 2004) and may occur on suitable substrates in the outer Moray Firth and the northern North Sea. At present, however, there is no evidence to suggest that this species has established colonies of conservational interest in the area of the Moray Firth (DTI, 2004a).

4.2.4 FINFISH AND SHELLFISH

The most common commercially-fished demersal fish in the Moray Firth are sandeels, haddock, cod, whiting, lemon sole, plaice and dab. The Smith Bank is an important spawning ground for plaice (December-March) and cod (January-April). The outer Moray Firth is also an important spawning ground for lemon sole (April-September). Sandeels, a key prey species for a number of seabird and marine mammal species, are abundant throughout this area, being closely associated with well-oxygenated, medium to coarse sand (DTI, 2004a). In addition, juvenile haddock, saithe and whiting use the shallow water areas of the Firth as nursery grounds.

Sprat, herring and mackerel are the most abundant pelagic species in the Moray Firth. Herring and sprat have spawning grounds within the Moray Firth, but these are not coincident with the Beatrice field.

Commercially exploited crustacean species within the Moray Firth include *Nephrops* (Norway lobster), scallops, pink shrimp, European lobster, edible crab, velvet crab and shore crab (DTI, 2004a). *Nephrops* are abundant in the mud and muddy sands of the Moray Firth and are by far the most important shellfishery in the area.

4.2.5 MARINE MAMMALS

CETACEANS

The most common species of marine mammal in the Moray Firth are white-beaked dolphins (*Lagenorhynchus albirostris*), harbour porpoises (*Phocoena phocoena*), bottlenose dolphins (*Tursiops truncatus*) and minke whales (*Balaenoptera acutorostrata*). Most of these species occur all year round, but are most numerous in the summer months (Evans *et al.*, 1992; Wilson *et al.,* 1997; UKDMAP, 1998; Reid *et al.,* 2003). The designation of the Moray Firth as a SAC is based on the internationally important population of bottlenose dolphins, which is one of only two resident inshore populations in the UK and the only population in the North Sea. The harbour porpoise is also a protected species and is included on the OSPAR *Initial List of Threatened and/or Declining Species and Habitats* (DTI, 2004a).

Several other cetacean species are sighted less frequently because they use the Moray Firth seasonally and occasionally. These are the common dolphin (*Delphinus delphis*), striped dolphin (*Stenella coruleoaba*), Atlantic white-sided dolphin (*Lagenorthynchus acutus*), Risso's dolphins (*Grampus griseus*), pilot whale (*Globicephala melas*), killer whale (*Orcinus orca*), fin whale (*Balaenoptera physalus*), sei whale (*Balaenoptera borealis*) and humpback whale (*Megaptera novaeangliae*) (CRRU, 2004).

PINNIPEDS

British populations of grey seal (*Halichoerus grypus*) and common seal (*Phoca vitulina*) represent 40% (Scottish Executive, 2004) and 7% (Environment Agency, 2004), respectively of world populations of these species. The Dornoch Firth supports a significant proportion of the inner Moray Firth population of the common seal and represents almost 2% of the UK population (JNCC, 2004). Common seals utilise sand-bars and shores at the mouth of the estuary as haul-out and breeding sites (JNCC, 2004). Grey seals spend most of the year at sea but come ashore in autumn to form breeding colonies on rocky shores, beaches and in caves in areas such as the Moray Firth, and on small, largely uninhabited, islands (JNCC, 2004).

4.2.6 SEABIRDS

There is a substantial body of baseline data on the broad distribution of birds in the Moray Firth; a synopsis of this is provided in SEA 5 (DTI, 2004a). In view of this existing body of baseline information Talisman, in conjunction with the University of Aberdeen, have defined studies looking at the small-scale effects on bird species which will provide useful additional data to aid our understanding of potential risk from the development.

The Moray Firth's coastal and offshore waters are internationally important for seabird, seaduck, wader and wildfowl populations. The area has been notified as a Special Protection Area (SPA) under the EU Birds Directive (Kalejta-Summers, 2004).

SEABIRDS AND SEADUCKS

Numerous cliff-nesting colonies along the coastal stretch of the Moray Firth (Duncansby Head to Rattray Head) support internationally and nationally important breeding populations of kittiwake, guillemot, razorbill, fulmar, cormorant and puffin (Table 4-3). Dean *et al.* (2003) identified a number of species listed in Annex I of the EC Birds Directive in the Moray Firth including the rRed-throated diver (*Gavia stellata*), black-throated diver (*Gavia arctica*) and great northern diver (*Gavia immer*). The Moray Firth lies within a larger area of the North Sea, which includes Orkney and Shetland, which was part of the UK Department of Trade and Industry (DTI) 5th Strategic Environmental Assessment (SEA) for oil and gas activities. The SEA 5 area is of importance to several species of breeding seabird, all of which are present in numbers equal to or exceeding 1% of their European population; other species exceed nationally important levels (Table 4-3).

During the breeding season (April to June) high numbers of seabirds are concentrated at breeding sites and in the coastal waters of the Moray Firth. Following the breeding season, many seabirds disperse offshore to feed. The sandeel population of the Smith Bank has particular importance for feeding, especially for auks (guillemots, razorbills and puffins).

Seaducks, including eider, goldeneye, long tailed duck, common scoter and velvet scoter over-winter in the inner Moray Firth in large flocks; the Moray Firth regularly holds in excess of 20,000 birds (Lloyd *et al.,* 1991).

TABLE 4-3: SEABIRD SPECIES WHICH OCCUR IN IMPORTANT NUMBERS IN THE DTI SEA 5 AREA [Source: Tasker, 1996; Tasker, 1997a, b and c].

EQUAL TO OR EXCEEDING 1% OF EUROPEAN POPULATION	
Gannet *(Sula bassana)*	Common tern *(Sterna hirundo)*
Fulmar *(Fulmarus glacialis)*	Roseate tern *(Sterna dougalli)*
Cormorant *(Phalacrocorax carbo)*	Guillemot *(Uria aalge)*
Shag *(Phalacrocorax aristotelis)*	Black guillemot *(Cepphus grille)*
Lesser black-backed gull *(Larus fuscus)*	Razorbill *(Alca torda)*
Greater black-backed gull *(Larus marinus)*	Puffin *(Fratercula arctica)*
Herring gull *(Larus argentatus)*	Arctic skua *(Stercorarius parasiticus)*
Kittiwake *(Rissa tridactyla)*	Great skua *(Stercorarius skua)*
NATIONAL IMPORTANCE	
Black-headed gull *(Larus ridibundus)*	Sandwich tern *(Sterna sandvicensis)*
Arctic tern *(Sterna paradisaea)*	Little tern *(Sterna albifrons)*

WADERS AND WILDFOWL

Sheltered firths in this region, and their saltmarsh, mudflat and estuarine habitats, are important for migrating waders and wildfowl in spring and autumn. The Moray basin, firths and bays regularly hold 130,000 wintering and 31,000 passage waterfowl (wildfowl and waders) (Lloyd *et al.*, 1991).

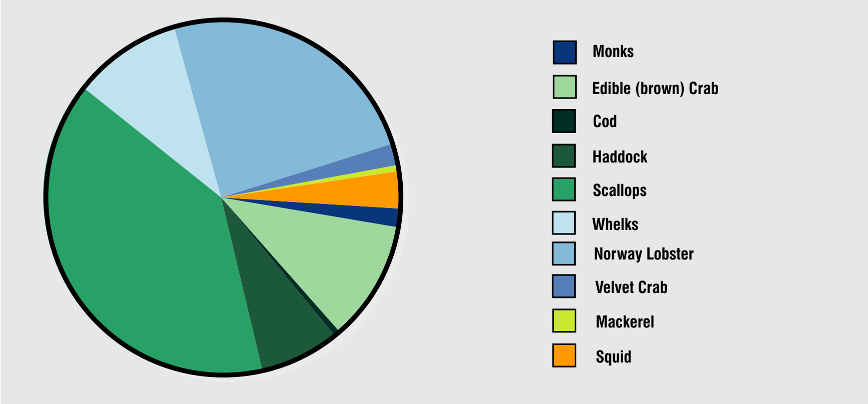
4.2.7 FISHERIES

The Moray Firth has been historically important for the development of Scottish fisheries. One of the most important fisheries in the northern North Sea is the mixed demersal fishery that targets cod, haddock and whiting; the fishery also takes a number of important by-catch species including saithe and monkfish (ICES 2003). The significant decline in the mixed demersal fishery (e.g. haddock and cod) over recent years, however, has led to the increasing importance of monkfish and *Nephrops* landings (DTI, 2004a).

Commercial fishing effort (hours spent fishing) and overall economic productivity in the area around Beatrice (ICES Statistical Rectangles 45E6 and 44E6) are high in comparison to areas of the North Sea, and in 2001, fishing effort in ICES Rectangles 45E6 and 44E6 equated to over 65,000 hours fishing time which resulted in total annual landings by UK vessels of 2,126 tonnes. Landings were dominated by shellfish such as *Nephrops*, whelk, scallop and crabs; the remaining landings were primarily demersal species including, cod, haddock, whiting, plaice and monkfish (Figure 4-2). Pelagic species contributed a very small percentage (<0.5%) and comprised predominantly herring (Talisman 2002).

FIGURE 4-2.

MAIN SPECIES LANDED BY WEIGHT (TONNES) FROM ICES RECTANGLES 45E6 AND 44E6 [SOURCE: FRS, 2002].



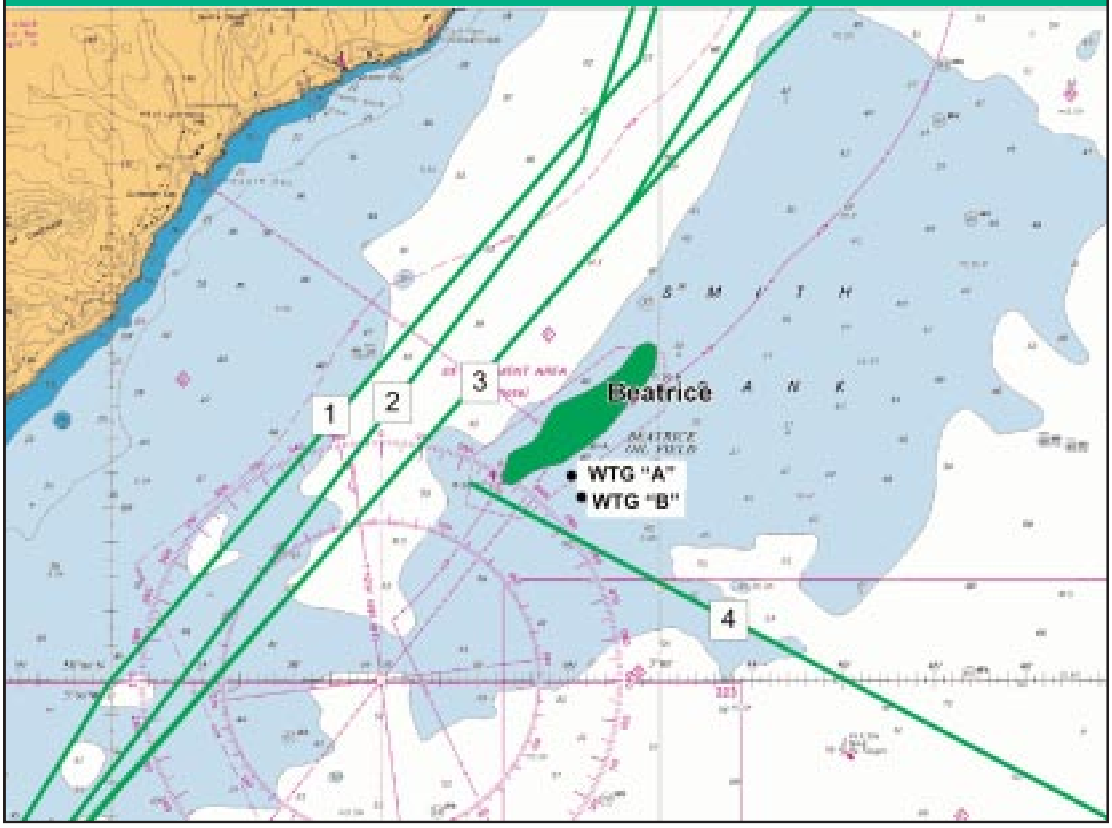
4.2.8 SHIPPING ACTIVITY

The Moray Firth has a high level of shipping activity, dominated by vessels associated with the fishing industry and the oil service industry. Fifteen routes pass through the Moray Firth and the 4 routes considered to be in closest proximity to the Beatrice field (Talisman, 2002)(Figure 4-3) are as follows:

- Route 1 is a merchant shipping vessel route, passing about 10.5km from the nearest WTG; estimated traffic is 624 vessels per annum.
- Route 2 consists of merchant (86 vessels per annum) and tanker traffic (15 tankers per annum) and passes about 9.3km from the nearest WTG.
- Route 3 is used by small numbers (27 vessels) of merchant and tanker traffic throughout the year and passes about 6km from the nearest WTG.
- Route 4 consists of supply/standby vessels transiting between Peterhead and the Beatrice field.

FIGURE 4-3:

MAIN SHIPPING ROUTES IN CLOSE PROXIMITY TO THE BEATRICE FIELD AND PIPELINE [Source: redrawn from Talisman, 2002]



5 POTENTIAL IMPACTS FROM THE BEATRICE WIND FARM DEMONSTRATOR PROJECT

5 POTENTIAL IMPACTS FROM THE BEATRICE WIND FARM DEMONSTRATOR PROJECT

5.1 INTRODUCTION

This section provides:

- a summary of the concerns already expressed by stakeholders during preliminary consultation; and
- a matrix which identifies the main impacts associated with the Beatrice demonstrator project itself.

PROJECT-SPECIFIC ISSUES IDENTIFIED BY STAKEHOLDERS

Talisman Energy has completed preliminary consultation with the following organisations:

- The Joint Nature Conservation Committee
- Scottish Natural Heritage
- The Department of Trade and Industry
- The Royal Society for the Protection of Birds
- Fisheries Research Service
- The Moray Firth Partnership's Fisheries Advisory Group

These organisations have identified several environmental issues (Table 5-1) that should be addressed in the EIA process, and that may have to be studied in more detail. These were the key concerns identified for the demonstrator project, but other issues – including effects on fishing and visual impacts - could also be significant for a commercial development. As indicated in the scoping matrix (Table 5-2) and Sections 6 to 10, these issues are being addressed in the research programmes that Talisman has initiated.

TABLE 5-1MAJOR ENVIRONMENTAL CONCERNS RAISED IN PRELIMINARY STAKEHOLDER CONSULTATION

ENVIRONMENTAL ASPECT	AREAS OF CONCERN
Marine mammals	• Effect of noise from pile driving during installation • Effect of noise from vessels during installation • Effect of operational noise
Birds	• Effect of operational wind farm on bird migration • Disturbance effect of operational wind farm on birds • Effect of operational wind farm on wintering wildfowl species • Effect of operational wind farm on seabirds foraging from local breeding sites
Fish	• Effect on sandeels during installation and operation of commercial development (see below) • Effect on elasmobranchs (sharks and rays) of electromagnetic fields from commercial wind farm
Benthic communities	• Destruction of benthic habitat during installation, and modification of habitat. Area of habitat destroyed/modified.

SCOPING OF POTENTIAL IMPACTS ARISING FROM UNDERTAKING THE DEMONSTRATOR PROJECT

The impacts that might arise during the four stages of the demonstrator project were identified by:

- Reviewing the comments and concerns expressed by stakeholders during preliminary consultation.
- Examining the proposed programme for constructing, installing, operating and decommissioning the two WTG units.
- Assessing the characteristics and sensitivities of the offshore environment in which the demonstrator turbines would be sited, and making an initial appraisal as to whether the demonstrator project would be likely to have an effect on those characteristics and sensitivities.

The **initial appraisal** was informed by:

- the considerable body of knowledge that already exists about the Beatrice field and the wider Moray Firth;
- Talisman's present appreciation of the effects that the ongoing operations at the Beatrice field may be having on the local environment;
- the effects that past operations in and around the Beatrice field (for example the Beatrice pipeline replacement project and drilling the Marcel and Bravo wells), appear to have had;
- the growing body of evidence available from other offshore wind farms. This material provides both additional predictive or modelling information and actual data from measuring the effects of operational sites; and, in particular
- the possibility that one or more of the "qualifying interests" of a Special Area of Conservation (SAC) or a Special Protection Area (SPA) may be affected by the proposed development. These potential impacts are marked ■ in Table 5-2.

5.2 INTRODUCTION TO SECTIONS 6 – 10

In Sections 6-10 of this scoping report the following information is presented for each aspect of the environment that might be impacted by the four stages of the project:

- A description of the effects that might arise from the demonstrator project.
- A description of how the effects would be assessed in the EA, with an assessment of the adequacy of existing knowledge and whether more information is required.
- A description of the mitigation that is in place, or will be incorporated in the design or operation of the project.
- A description of the work being undertaken by the project to gather more information to understand the issue better.

TABLE 5-2 SCREENING MATRIX FOR BEATRICE WIND FARM DEMONSTRATOR PROJECT

Phase and aspect of the demonstrator project	Physical Environment				Biological Environment				Human Environment												Visual		Initial appraisal of potential effects
	Currents & tidal streams	Seabed sediments	Water column	Atmosphere	Benthos	Fish & shellfish	Sea mammals	Birds	Historical sites	Commercial fishing	Shipping	MOD activities	Oil & Gas operations	Cables & pipelines	Conservation sites	Communities	Socio-economic	Amenity, leisure	Telecommunication	Air traffic	Seascape	Landscape	
ASSEMBLY AT COASTAL SITE PRIOR TO DEPLOYMENT																							
• Transportation by sea											●				●								Risk from accidental spillage or loss of materials near sensitive coastal sites.
• Assembly operations onshore																●	●						Possibly some local disturbance, but also possibility of local employment at assembly site.
CONSTRUCTION AT OFFSHORE SITE																							
• Presence of vessels offshore				●			◆			●	●		●										Possible effects of noise on marine mammals. Possible short-term interference to fishing.
• Deployment of anchors		●	●		●				●														Deployment and use of anchors may affect seabed, and any historic sites if present.
• Installation of Base Unit	●	●	●		●	●	◆		●														Piling operations will generate underwater noise that may affect marine mammals and fish.
• Installation of tower		●	●			●																	Possible short-term disturbance in the marine environment mainly caused by the presence of vessels.
• Installation of turbine and blades						●																	Possible short-term disturbance in the marine environment mainly caused by the presence of vessels.
• Trenching and installation of cable		●	●		●	●	◆		●	●	●		●	●									Possible effects of noise on marine mammals. Disruption to benthic communities along the cable route.
• Subsea work at WTG and Beatrice AP		●	●		●	●	◆																Possible effects of noise on marine mammals. Local disruption to benthos at WTG sites & Beatrice AP.
• Placement of concrete mattresses	●	●	●		●	●																	Disruption to sediments and benthic communities along route between WTG and Beatrice AP.
• Modifications to topsides of Beatrice AP				●									●										Possible atmospheric emissions and short-term disruption to normal operations on AP.
OPERATION AT OFFSHORE SITE																							
• Physical presence of WTG in sea	●	●	●		●	●	◆	◆		●	●	●							●	●			Disruption to bird migration and movement; strike risk to resident and over-wintering species.
• Physical presence of buried cable to Beatrice AP		●			●	●				●													Disruption to sediments and potential hazard to bottom-towed fishing gear.
• Visual impact of WTG																●	●	●			●	●	Impact on landscape and seascape of the Moray Firth, with loss of amenity to residents and visitors.
• WTG noise created in air						●		◆								●							Impact on birds and possible impact to adjacent settlements and communities.
• WTG noise created underwater						●	◆																Impacts of underwater noise on marine mammals.
• Periodic maintenance/intervention by sea										●			●				●						Possible short-term inconvenience for commercial shipping and fishing operations.
• Emergency maintenance by helicopter							◆	◆															Possible increased risk of disturbance to birds and marine mammals.
• Cumulative impacts in the Beatrice field	●	●	●		●	●	◆	◆		●	●	●	●	●	◆	●	●	●	●	●	●	●	Increase in number of offshore facilities leads to increased effects on birds, marine mammals, fishing.
DECOMMISSIONING AND DISPOSAL ONSHORE																							
• Presence of vessels offshore		●		●			◆			●	●		●										Possible effects of noise on marine mammals. Possible local interference with fishing and shipping.
• Offshore dismantling of blades, turbine, tower				●													●						Possible short-term disturbance in the marine environment.
• Cutting piles and removing base		●	●		●	●	◆			●	●						●						Possible effects of noise on marine mammals. Disruption to sediments and benthic communities.
• Exposing and removing cables		●	●			●	◆			●	●		●	●			●						Possible effects of noise on marine mammals; disruption to benthos; inconvenience to fishing.
• Transportation of material to shore site(s)											●				◆	●							Risk from accidental spillage or loss of materials near sensitive coastal sites.
• Recycling and/or disposal of material onshore				●											●	●	●						Local deterioration in amenity at recycling site(s) caused by noise, light, dust, or fumes.

● This aspect of the demonstrator project may affect this receptor.

◆ This aspect of the demonstrator project may directly or indirectly affect the qualifying interests of a SAC or SPA.

6 EFFECTS OF ASSEMBLY AT ONSHORE LOCATION

6 EFFECTS OF ASSEMBLY AT ONSHORE LOCATION

6.1 INTRODUCTION

The elements of each WTG unit will be transported to a port or other facility for final preparation, assembly into larger components and load-out. This site has not yet been determined.

6.2 POTENTIAL IMPACTS AND MAIN RECEPTORS

The *transportation of elements* by land or by sea might impact other users of the site, the local road infrastructure, local communities adjacent to roads, or shipping activity close to any port or harbour that is used. The *assembly of components and their storage* at the site might cause local short-term visual impacts. The main elements or components that are likely to be stored are the turbine nacelle, fitted with 2 of the 3 blades (an example of such a unit is shown Figure 6-1), the tower, and the complete support structure.

All of these potential impacts will be assessed in the EA, and further information about the key issues is provided below.

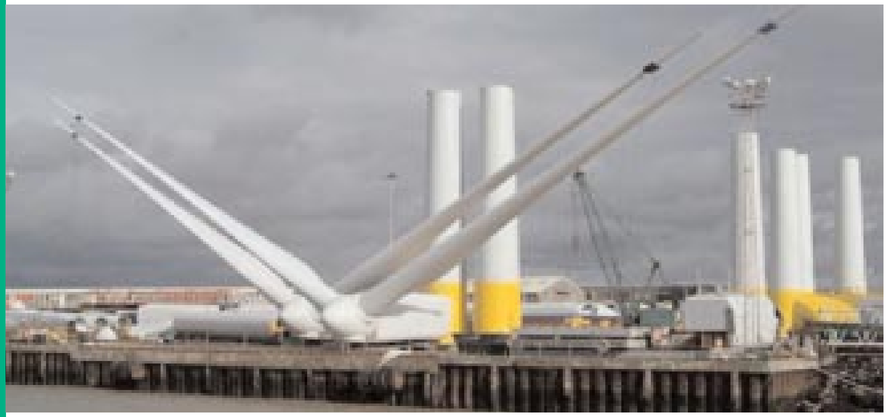


FIGURE 6-1.

WIND FARM TOWERS AND PARTIALLY ASSEMBLED TURBINES ("BUNNY EARS") STORED ONSHORE AWAITING TRANSPORTATION TO OFFSHORE SITE.

PHOTO COURTESY OF SLP ENGINEERING LTD

6.3 EFFECTS ON PORT AND LOCAL INFRASTRUCTURE

DESCRIPTION OF IMPACT

The various elements and components of each WTG unit, of various sizes, will be transported to a port where they will be assembled into larger components before being transported offshore (Figure 6-2). Items may be delivered by sea and by land, and although there will only be a small number of deliveries some of the loads may be large or unusual. This may result in local, temporary inconvenience to or disruption of local infrastructure and amenity. Once delivered the items will be stored at the site, where cranes and other equipment will be used to manipulate them and construct larger components. These activities may result in transient inconvenience to people living in close proximity to the site.

There would also be positive effects for the assembly location, as a result of the additional commercial activities necessary for the handling and further construction of the WTGs.

ASSESSING THESE EFFECTS IN THE EA

The assembly location will be a port or other similar site at which commercial or industrial activity is being undertaken. It is therefore likely that the effects of this aspect of the demonstrator project would be similar to those already experienced from time to time at the site. The characteristics of the onshore site will be obtained when a site has been selected. All the potential impacts will be fully evaluated in the EA.

MITIGATION PROPOSED

The site selected for assembly will be suitably equipped to handle the different components, and the vessels required to take them offshore. Talisman will make site visits to assess environmental issues associated with using a particular site. Activities at the assembly site would be controlled by the existing regulations, practices, and emergency procedures, and would be subject to inspection by regulatory agencies.

FURTHER STUDIES UNDER WAY

Talisman will identify suitable sites and make a selection based on several factors including capacity to deal with the WTG components, accessibility, distance from the Beatrice field, management and technical capability, socio-economic benefits and commercial proposal.

FIGURE 6-2.

AN EXAMPLE OF PARTIALLY ASSEMBLED TURBINES AND TOWERS BEING TAKEN FROM ASSEMBLY SITE TO OFFSHORE LOCATION.

PHOTO COURTESY OF SLP ENGINEERING LTD

7 IMPACTS OF CONSTRUCTION AT OFFSHORE SITE

7 IMPACTS OF CONSTRUCTION AT OFFSHORE SITE

7.1 INTRODUCTION

Subject to approval, it is intended to install the WTG units in the Beatrice field 2006. Several vessels may be required during this operation, including a DSV, a cargo barge and a crane vessel. It is likely that this operation will take place during the summer months, when weather and sea conditions are most favourable.

7.2 POTENTIAL IMPACTS AND MAIN RECEPTORS

The *use of vessels* in the Beatrice field to construct the WTG units may cause local and short-term impacts to commercial fishing operations, shipping, and oil and gas operations. *Piling operations on the base unit* will create underwater noises that may affect marine mammals and fish. *Trenching and burying the subsea cable* will disrupt the existing benthic community. The *placement of concrete mattresses* and other *subsea work at Beatrice and the WTG units* may disrupt seabed sediments and cause local transient effects in the water column and pelagic environment, and impact the benthos and fish and shellfish in the immediate area. The *presence of the base units* will cover an area of seabed for the duration of the project, and could also affect natural sediment movement.

All of these potential impacts will be assessed in the EA, and further information about the key issues is provided below.

7.3 EFFECT OF UNDERWATER NOISE ON MARINE MAMMALS

7.3.1 DESCRIPTION OF IMPACT

The main impact that might arise during the installation of the WTG units offshore is the effect of underwater noise on marine mammals as a result of:

- the presence and use of vessels;
- the piling of the base unit, if driven piles are used;
- operations to trench the subsea cable; and
- subsea work at the WTG units and Beatrice AP.

Stakeholders have expressed concern that pile driving operations would create underwater noise that would affect marine mammals, in particular the three species most likely to be encountered in the Moray Firth (Section 4.2.5). One of the "qualifying interests" of the Moray Firth SAC is the presence of the bottlenose dolphin *Tursiops truncatus*.

Given the limited duration of offshore operations to install the WTG units, and the sandy-muddy nature of the seabed at the site, the other potential sources of noise are likely to be less important, and this agrees with recent reviews of data from offshore wind farms (Nedwell & Howell, 2004; Nedwell *et al.*, 2004a).

NOISE FROM PILING

Piling operations create underwater noises of a frequency and level that are audible to seals, toothed and baleen whales, and fish (Richardson *et al.,* 1995; Nedwell & Howell, 2004; Nedwell *et al.,* 2004a). Noise from piling can enter the marine environment by four pathways, but the most significant one is thought to be by transmission of vibration through the pile itself directly into the water column. The noise produced during piling is dependent on the several factors including the type of equipment used, the water depth, and the characteristics of the seabed.

Nedwell and Howell (2004) reviewed data from offshore piling operations, including two recent wind farm sites – North Hoyle off the north coast of Wales and Scroby Sands off the coast of Norfolk. At North Hoyle the water depth was 6-7m, the substratum below the surface seabed layers required some drilling, and the pile was 4m in diameter. At Scroby Sands the water depth was 1-5m, and although the topography was much more complex than at North Hoyle, the seabed was sandy and no drilling was required. The piles were 2m in diameter, very similar in size to those that would be used in the Beatrice demonstrator project.

Field measurements from North Hoyle showed that the sound Source Levels were 260db re 1μPa @ 1m at a depth of 5m in the water column and 262db re 1μPa @ 1m at a depth of 10m. Most of the energy was in the frequency range 40Hz to 1kHz. At Scroby Sands the Source Level was estimated to be 297db re 1μPa @ 1m, but this was thought to be unrealistically high, possibly as a result of the very shallow water and local topography. At the Horns Rev site in Denmark, piling in water 4-6m deep produced peak Source Levels of at least 215db re 1μPa @ 1m (Tougaard *et al.,* 2003; Nedwell and Howell, 2004). Finally, piling in a water depth of 180m at the Magnus platform in the northern North Sea was found to produce an effective Source Level of 246db re 1μPa @ 1m (Nedwell *et al.,* 2001).

NOISE FROM TRENCHING CABLES

The noises produced by subsea trenching operations depend on the equipment used and, in particular, the nature of the seabed sediments. Data reported by Nedwell *et al.,* 2004 showed a calculated source level of 178db re 1μPa @ 1m.

EFFECTS OF NOISE ON MARINE MAMMALS AND FISH

For an underwater noise (as opposed to a gross pressure wave) to have an effect on an animal it must have a frequency spectrum that is detectable by the particular species, and loud enough to be audible. Table 7-1 shows the audible frequency ranges for some fish and mammals, and indicates the threshold value at the peak frequency (i.e. the frequency at which their hearing is "keenest"). It also shows the frequency range and Source Levels from recorded offshore piling and the operation of the turbine. Table 7-1 indicates that offshore piling operations are likely to produce noises that will be detected by both fish and mammals.

TABLE 7-1.HEARING RANGES, MOST SENSITIVE FREQUENCY AND MINIMUM THRESHOLDS FOR SOME SPECIES OF FISH LIKELY TO BE PRESENT AT DEMONSTRATOR SITE, AND COMPARISON WITH SOUNDS PRODUCED BY WIND FARM ACTIVITIES. (Source Nedwell et al., 2004b; Nedwell and Howell, 2004.)

SPECIES	HEARING RANGE (HZ)	APPROXIMATE PEAK FREQUENCY (HZ)	THRESHOLD AT PEAK DB RE 1μPA @ 1m
Cod	10 - 800	20 - 100	63.4 - 94.8
Dab	20 - 300	110	89.0
Haddock	30 - 500	100 - 300	80.4 - 84.9
Herring	20 – 4,000	50 - 200	75
Ling	40 - 600	200	80.8
Pollack	40 - 500	200 - 300	91.6 - 91.9
Atlantic salmon	30 - 400	160	95.2
Little skate	100 - 1000	200	123
Bottlenose dolphin	100 – 300,000	50,000 – 80,000	40 - 50
Harbour porpoise	200 – 200,000	100,000 – 200,000	30 - 60
Grey seal	200 – 200,000	20,000 – 30,000	61 - 70
Harbour seal	100 – 200,000	7,000 – 30,000	63 - 67
Killer whale	500 – 200,000	10,000 – 30,000	30 - 45
Risso's dolphin	2,000 – 110,000	8,000 – 30,000	63.7 – 66.5
	SOURCE FREQUENCY RANGE	**SOURCE PEAK FREQUENCY**	**SOURCE LEVEL DB RE 1μPA @ 1M**
Piling operations	1 – 10,000	100 – 1,000	215
Operation of turbines	10 – 10,000	16	153

Nedwell and Howell have examined the potential for underwater sound to cause effect in fish and marine mammals. They propose the use of a weighted measure dB_{ht}(species) (where *ht* refers to the "hearing threshold" of the species) which reflects that particular species' ability to detect sounds at different frequencies. The application of this measure, it is argued, permits proper examination of the true likely effect of external noises on fish and marine mammals. This is illustrated in Figure 7-1 which shows the measured sound from piling operations in Southampton water, and the sound that is perceived by a particular species, the salmon. The sound level perceived by the salmon is significantly lower than that produced at the source, and this reflects the fact that salmon, like many species of fish, are relatively insensitive to noise.

Similar patterns of perceived noise can be determined for other species on the basis of their audiograms; audiograms show the response of a species to sounds of different frequency and indicate (a) the range of frequencies that a species can detect and (b) the frequency range over which the species' hearing is most acute.

Nedwell and Howell also suggest that a behavioural response in an animal would be elicited if the dBht (species) noise perceived was greater than 90dB (Nedwell *et al.,* 2004a). About 75% of the readings obtained at North Hoyle were in excess of 90dBht, indicating that avoidance reactions would be expected in various species up to certain distances from the piling operations. Table 7-2 shows, for several species, the calculated ranges within which significant avoidance reaction would be expected to occur as a result of piling at North Hoyle (Nedwell *et al.,* 2004a).

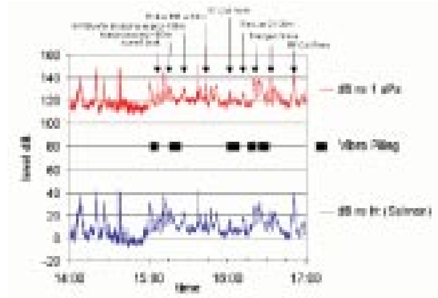


FIGURE 7-1

AN EXAMPLE OF THE MONITORING APPROACH TO NOISE MEASUREMENTS FROM NEDWELL, *ET AL.*, (2003), SHOWING BOTH UNWEIGHTED LEVELS AND DBHT FOR SALMON.

TABLE 7-2.CALCULATED RANGES FOR SIGNIFICANT AVOIDANCE REACTION FOR DIFFERENT SPECIES

SPECIES	RANGE FOR AVOIDANCE REACTION (m)
Salmon	1,400
Cod	5,500
Dab	1,600
Bottlenose dolphin	4,600
Harbour porpoise	7,400
Harbour seal	2,000

These estimated ranges seem to agree with the limited observational data on the response of fish and marine mammals to piling noise (reviewed in Nedwell & Howell, 2004). At least one study has looked at the behavioural responses of harbour porpoise to noise from piling (Horns Rev, Denmark) but no such study has been carried out for the bottlenose dolphin. The Horns Rev study indicated that pile driving had a short-term (3-4 hours) effect on acoustic activity in both the development area and the control area, i.e. over the entire Horns Rev location. It is also likely that pile driving was partially responsible for displacing animals from the piling area, although acoustic deterrents were also in use at the time to drive animals away. There were also more general effects on the abundance and behaviour of porpoises in the development and control areas but it is not clear if these effects are related to overall temporal variation or piling and other construction activity. More results are expected.

Fish may also be affected by piling noise although effects may be restricted to avoidance at close range amongst fish with swimbladders, such as cod, haddock and whiting. Fish without swimbladders (including sandeels) are not likely to be significantly adversely affected (El Samprojekt A/S, 2000, Rødsand EIA Technical report).

7.3.2 ASSESSING THIS EFFECT IN THE EA

An assessment will be made of the potential zones of acoustic effect from the installation operations, and in particular for the piling operations. This assessment will utilise published information on noise source levels from piling and vessels to compute and predict the received noise levels at various distances from the offshore operations. These data will then be reviewed in the light of data concerning the distribution and abundance of marine mammals in the area to estimate the likelihood that they may be exposed to noise levels that are likely to result in behavioural or physical impacts.

In particular, the EA will use the most up-to-date information on the numbers of marine mammals that might be exposed to noise levels above the threshold response level. This assessment will be informed by the site-specific data gathered during the monitoring programme that is being undertaken by the University of Aberdeen. This monitoring programme is informed by, and builds on, existing information about the distribution of marine mammals in the Moray Firth and the use that the bottlenose dolphins make of the area.

Knowledge about the coarse distribution of bottlenose dolphins in the Moray Firth is fair but effort is skewed to certain areas, in particular the inner Moray Firth and the Beauly, Cromarty and Dornoch Firths (Talisman, 2000). Much less is known about the distribution of bottlenose dolphins in the outer Moray Firth. The area of the proposed development has not been as thoroughly studied, although a short survey was recently carried during the Beatrice Pipeline Replacement Project (Talisman, 2000).

The available distribution data indicate that the area of the development is not important to the bottlenose dolphin population although low numbers of animals are sometimes recorded there. Sightings are more frequent and population densities apparently higher in the inner firths and the coastal areas to the south of the Firth (Wilson *et al.*, 1997, Reid *et al.*, 2003, Hastie *et al.*, 2001). There are occasional sightings in other parts of the Firth, and animals are also recorded in significant numbers off the coast of Aberdeenshire. The Moray Firth's dolphin population is estimated to consist of 129 individuals, with 95% confidence limits of 100 to 174 (Wilson *et al.,* 1999). Sanders-Reed *et al.,* (1999) predicted that the population may be declining at 5% per annum but more recent survey data do not support this (Thompson *et al.,* 2005).

Several other species of toothed cetaceans have been recorded in the Firth, in particular white-beaked dolphin, Risso's dolphin and killer whale. None of these species has as wide a distribution or such high population densities as that observed for harbour porpoise. Minke whale occur in the Firth at moderate to low densities; some animals could be expected at the development location. Grey and common seals use the Moray Firth and there is a SAC for common seals.

7.3.3 MITIGATION PROPOSED

The key mitigation is to complete our present ongoing technical evaluation of the feasibility of using suction piles. This involves a thorough assessment of the performance of this method of fixing. As stated in Section 3.4, suction piles would be the preferred option, conferring environmental benefit as well as greater efficiency during installation.

Should the driven pile option be selected, piling operations will be conducted with a so-called "soft start". This means that piling will begin with several less intensive strikes of the piling hammer, spaced at intervals of several minutes. The intention of such a practice is to create underwater noise levels that are detectable by marine mammals but not so loud that they are distressing or damaging. The well-spaced noise gives any marine mammals (and fish) in the area time to move away from the source of sound, and to be well away from the zone in which high levels of noise would be perceived when full piling begins.

A marine mammal observer (MMO) will be present on the piling barge throughout operations, and operations will only commence if mammals are absent from the area of operations. In daylight hours with good visibility, MMOs can see mammals up to distances of 500m. Passive Acoustic Monitoring (PAM) will also be used.

7.3.4 FURTHER STUDIES UNDER WAY

The available data suggest that piling noise is loud and that it is generated at frequencies audible to marine mammals including bottlenose dolphin, harbour porpoise and minke whales.

Talisman recognises that there are two key issues in relation to the effects of underwater noise during installation of the two demonstrator WTG units – **noise Source Levels**, and **marine mammal distribution** in and around the demonstrator site. These both require further study, and Talisman has embarked on a programme of research and field study comprising the following three Tasks:

1 IDENTIFICATION OF SENSITIVE AREAS FOR MARINE MAMMALS

Whilst there is good information on the distribution of bottlenose dolphins in the inner Moray Firth, there are few data on the offshore distribution patterns of dolphins and porpoises, particularly in those areas where noise levels from the demonstrator project are predicted to be highest. Limited existing data suggest that dolphins are rarely found in these areas, but further work is required to confirm this. Site-specific data are needed on the detailed distribution and presence of marine mammals, including bottlenose dolphins, in the development area. Such data would allow a more accurate prediction of the likelihood that individuals would be present within the zone of acoustic effect during the piling operations.

In 2004, wide-scale boat-based acoustic studies were initiated as part of a PhD project at the University of Aberdeen, and these will be extended in 2005 to cover the outer part of the Moray Firth SAC. These surveys will be complemented by deploying long-term acoustic recording devices (T-PODs, the latest version of POrpoise Detectors) around the demonstrator site to provide more detailed information on temporal variability in cetacean presence in the main area of potential impact.

2 BEHAVIOURAL RESPONSE OF CETACEANS

Cetacean behaviour and movement patterns are inherently difficult to study and vary markedly in time and space. This makes the identification of responses to relatively short-term events such as piling extremely challenging.

Given these problems, and the relatively short duration of the pile driving activity, scientists from the University of Aberdeen will use remote acoustic recording methods to detect changes in the presence of dolphins and porpoises in a series of sample areas. Three main sampling areas will be used for this work (and for studies of foraging seabirds, to make best use of boat time). An "impact" area will be located directly between the two WTG sites, and two other areas will be located at more inshore sites in the inner Moray Firth and southern coast of the Moray Firth which are known to be "hot spots" for bottlenose dolphins.

Acoustic sampling will be carried out using moored T-PODS, as previously used for measuring the cetacean activity in similar impact studies. Initial calibration studies will be carried out in the spring of 2005. T-PODS will then be deployed for a series of 2-month cycles to provide continuous recordings throughout the rest 2005 and 2006.

3 TESTING OF ACOUSTIC PROPAGATION MODELS

Information on ambient noise in the Moray Firth is poor, and this makes it difficult to predict whether new noise sources, such as WTGs, will significantly increase noise levels in areas used by marine mammals.

The EA for the demonstrator project will require acoustic propagation models to be run to predict the received noise levels at different distances from the pile driving activity and the operating WTGs. Scientists from the University of Aberdeen will collect local ambient noise data that will allow these models to be refined, with the intention of testing propagation models in the field during the installation of the WTG units in 2006.

Field studies will be conducted in the summer of 2005 to estimate ambient noise levels at the demonstrator site and at three sample locations in other parts of the Moray Firth (inner Moray Firth; off Helmsdale; and off Lossiemouth). Sites have been selected to be in similar depths of water to the demonstrator project, but cover areas subjected to various levels of anthropogenic activity. It is planned to obtain recordings at each of these sites at different depths on several occasions, and so cover a range of different acoustic conditions.

Project-specific data are needed on the source noise levels of deepwater piling operations. The data from North Hoyle, Scroby Sands and Horns Rev (Section 7.3.1) are from shallow sites and monopiles and may not accurately reflect the noise that would be produced by piling in the Beatrice field. During pile driving at the demonstrator site recordings of sound levels will be made at distances of between 100m and 40km from the demonstrator site to compare recorded and predicted received noise levels.

It is recognised that these studies would provide data that would inform the assessment of the effects of future developments, although some data on distribution may be obtained in time for inclusion in the EA for the demonstrator project.



7.4 EFFECTS ON SEDIMENTS AND BENTHIC COMMUNITIES

7.4.1 DESCRIPTION OF IMPACTS

The base of each WTG unit would cover an area of seabed of about $400m^2$ to $613m^2$ (depending on the design of substructure). Mattresses placed around the ends of the subsea cable, over the pipeline crossing, and around the edges of the base units, would cover an additional small area of seabed. The operations to bury the subsea cable linking the WTG units to Beatrice AP would disturb about $14,400m^2$ of seabed sediment, assuming that an area seabed extending 3m either side of the cable line was disturbed.

7.4.2 ASSESSING THESE EFFECT IN THE EA

The characteristics and status of the benthic communities in and around the Beatrice field have been surveyed and assessed on several occasions, primarily to assess the effects of the permitted discharge of drill cuttings at the site (Talisman, 2003). The characteristics of the seabed sediments in the area of the Beatrice field, where the water depth ranges from 40m to 50m, are relatively uniform, and there are no remarkable, threatened or vulnerable physical features or habitats (Talisman, 2003).

Existing data will be used to inform the assessment of the potential significance of disturbance or local mortality of the benthic communities. The sizes of the areas of seabed that will be covered or disturbed will be estimated accurately once the final layout of the demonstrator facilities has been agreed. An initial assessment, however, indicates that the area of disturbance will be small in relation to the area of similar seabed in the vicinity that will not be disturbed.

7.4.3 MITIGATION PROPOSED

The operations required to install the support structure, mattresses and subsea cable will be carefully designed and executed so as to minimise the area of seabed disturbed. Recolonisation of the clean sediment by fauna typical of the surrounding area should begin as soon as installation has been completed.

7.4.4 FURTHER STUDIES UNDER WAY

Because of the wealth of information that already exists about the benthic communities of the Beatrice field, and the small area of seabed that will be affected by the demonstrator project, no additional studies of seabed effects are planned.

8 IMPACTS OF OPERATION AND MAINTENANCE

8 IMPACTS OF OPERATION AND MAINTENANCE

8.1 INTRODUCTION

The demonstrator turbines would operate in the Beatrice field for approximately 5 years, exporting electricity to the Beatrice platforms. The WTG units are designed to require the minimum of routine maintenance.

8.2 POTENTIAL IMPACTS AND MAIN RECEPTORS TO BE CONSIDERED

The *physical presence* of the WTG units may give rise to a range of impacts, including localised effects on seabed currents and patterns of scouring, resuspension of sediments into the water column, permanent covering of a small area of seabed and benthos, interference with fishing operations and navigation, and effects on telecommunications and radar. The presence of the units may also affect birds, and present a risk of bird strike. Although the units will be located offshore, they will be partially visible from the shore and may thus affect the landscape and seascape.

The *operation* of the turbines will generate noise that may affect marine mammals, and the transmission of electricity along the subsea cable may create electromagnetic fields that affect some species of fish. The *maintenance* of the WTG units by sea may create local nuisance to fishing and shipping.

Finally, the presence of new hard structures in the sea may be beneficial in creating *artificial habitats for marine organisms and fish*.

All of these potential impacts will be assessed in the EA, and further information about the key issues is provided below.

8.3 EFFECT OF WTG UNITS ON BIRDS

8.3.1 DESCRIPTION OF IMPACTS

Birds may be subject to a variety of possible impacts from the long-term operation of wind farms. These are discussed in more detail in the following sections.

8.3.1.1 BIRD STRIKE

Wind turbines can pose a potential collision risk in relation to several types of bird movements (Noer *et al.,* 2000; Christensen *et al.,* 2003) including:

- annual migration between breeding and wintering areas;
- daily flights between roosting sites and foraging areas;
- evasion or avoidance flights following disturbance by humans (e.g. as a result of turbine maintenance activities);
- flights towards turbines, as a result of attraction to the wind farm area; and
- active foraging flights.

Overall, it is clear that birds are generally able to avoid collisions (Percival, 2003) and the majority of studies to date have demonstrated low rates of collision mortality per turbine (Percival, 2001; BirdLife International, 2002). The risk of collision, however, will vary considerably depending on several factors such as bird species, flock size, normal flight behaviour (speed, direction, altitude), migration and local inter-site routes, weather conditions, population of birds adjacent to the wind farm, feeding habitats and seasonal variability in flight capability (as affected by, for example, moulting) (Noer *et al.,* 2000; Christensen *et al.,* 2003).

Studies of bird collisions at coastal wind farms have generally reported higher numbers of collisions than in upland areas, probably reflecting the higher bird densities in those areas (Percival, 2003). Studies at Blyth Harbour (Still *et al.,* 1995; Painter *et al.,* 1999) and at Zeebrugge Harbour (Everaert *et al.,* 2002) both found collision rates in excess of one bird per turbine per year, with most casualties at both sites being gulls. In some cases, collision rates are considerably lower, such as at the offshore wind farm at Utgrunden where over 500,000 eider flights have been observed without a single collision being noted (Petterson and Stalin, 2003). It should be noted that care must be taken when interpreting the results of these studies since there are considerable problems in ensuring that any casualties are detected and quantified (Percival, 2003).

Studies using radar tracking have helped to provide further information on the general ability of birds to avoid collisions. Dirksen *et al.* (1998), for example, showed that pochard and tufted duck flew through a wind farm in the Netherlands at night under moonlight, but flew around the turbines at greater distance from them when it was dark and foggy. Reports by Pedersen and Poulsen (1991) and Christensen *et al.* (2003), however, indicated that birds migrating at night may experience an increased risk of collision compared to those migrating by day. It is clear that the risk of collision can be a particular problem under some circumstances, for example:

- at sites where large birds of prey regularly fly within the wind farm at the same height as rotor blades (Orloff and Flannery 1992 and 1996); and
- at sites where very high densities of birds fly at rotor height (Percival, 2003).

The potential impact of the increase in mortality caused by collision will vary with the population dynamics of the species (Noer *et al.,* 2000). Species with a high reproductive output and a correspondingly low annual survival rate will be less sensitive to additional mortality than species with a high annual survival rate and a low reproductive output (Noer *et al.,* 2000).

8.3.1.2 EXCLUSION

In the offshore marine environment, exclusion of birds can potentially occur as a consequence of the following:

- displacement from a location by pre-construction, construction, operation and decommissioning activities;
- loss of feeding habitat because of the footprint of the turbine foundations, scouring (or scour protection), power cables, and zones of avoidance about each turbine;
- the areas around WTGs that birds would avoid because of the presence of the WTGs;
- smothering of food sources by the settlement of sediment re-suspended into the water column by construction activities or scouring; and
- barrier effects, preventing birds from moving in a chosen direction.

8.3.1.3 DISPLACEMENT AS A RESULT OF DISTURBANCE

Generally speaking, birds will be sensitive to disturbance from activities on the water during all phases of the wind farm life-cycle. Birds will depart from the area of influence to avoid the source of disturbance and consequently will be excluded from that location for the duration of the disturbance. The risk of a potentially significant impact from displacement is dependent on:

- the availability of alternative localities, such as other feeding areas;
- the scale of the disturbance including the distance from the disturbance within which the bird reacts to the disturbance;
- the frequency and duration of the disturbance;
- the sensitivity of the species to the disturbance; and
- the degree to which each species might habituate to the disturbance.

8.3.1.4 LOSS OF, AND CHANGES TO, FEEDING HABITATS

Habitat loss occurs mainly through displacement of birds from an area around the wind turbines and includes reduced access to feeding areas and other important locations for specific activities, such as moulting. Physical changes to the habitat include the loss of the area of seabed covered by the turbine foundations, and the creation of new underwater substrate, in the form of the submerged parts of the WTGs, for the settlement of marine organisms (Noer *et al.,* 2000).

Existing studies (e.g. ABPmer, 2002) on the effects on bird populations of the loss of feeding habitat through the physical loss of seabed habitat indicate that changes to sediment character and physical processes are of small scale and restricted to the wind farm site. It is important that any proposed site should avoid important areas of suitable feeding habitat for particular species of interest.

In addition to the physical loss of habitat, there is also a potential 'zone of avoidance' around turbines and wind farms where foraging birds are displaced. The probability of this effect occurring is high for at least some species which are sensitive to disturbance (DTI, 2003). Research carried out in Denmark, albeit on small wind farm developments, and reviewed by Percival (2001), however, noted that both eider and common scoter were more abundant in the wind farm area immediately after construction was completed. It was concluded that their distribution was more strongly mediated by food availability than any turbine avoidance behaviour. This suggests that exclusion may not affect all bird species, and some species and individuals are likely to forage amongst turbines. The consequence of exclusion on bird populations would be dependent on the extent of the exclusion and the availability of an alternative habitat. One of the important issues associated with the loss of, or change to, habitat is that of cumulative impacts, in particular those that potentially affect limited habitats that are important feeding areas (DTI, 2003).

A range of prey species for seabirds and sea ducks may be attracted to turbine structures following colonisation by shellfish (DTI, 2003). Increased abundance of fish species around the structures may potentially attract divers, auks, terns and gulls (DTI, 2003).

8.3.1.5 BARRIER EFFECTS

There is some indication that wind turbines may act as offshore barriers to bird movement (BirdLife International, 2002; Percival, 2001; OSPAR 2003), with birds flying around groups of turbine rather than through them. Several studies have shown that some bird species alter their flight routes to avoid flying through wind farms (e.g. tufted duck and pochard at Lely in the Netherlands (Dirksen *et al.*, 1998), eiders at Tuno Knob in the Danish Baltic (Tulp *et al.,* 1999) and eiders at Utgrunden in the Swedish Baltic (Petterson and Stalin, 2003). The extent to which birds avoid turbines has variously been estimated as ranging from 100m to 1,500m, with a typical range of 400-800m (Percival, 2001, Guillemette *et al.,* 1998, Painter *et al.,* 1999). There is generally more evidence of displacement of birds around wind farms located in coastal habitats; most of the examples of such disturbance relate to waterfowl (Percival, 2003). In general, it is believed that birds will tend to avoid passing through wind farms, even when the total number of turbines is only 20 or 30 (Percival, 2001).

The consequence of such a response by birds will be dependent on the species in question, the physical condition of the individuals and the magnitude of the displacement that the wind farm causes. Issues of spacing between individual turbines and between clusters of turbines may be important and may offer the potential for mitigation. Generally, the closer turbines are sited to the shore, the greater the potential for interception of bird movements associated with feeding, roosting, breeding and migration. Locally collected, site-specific knowledge is essential when determining the potential for a proposed site to lead to bird strike or act as a barrier to movement.

8.3.2 ASSESSING THESE EFFECTS IN THE EA

In order to assess the impact of the WTG units on bird populations in the Moray Firth, an assessment will be made of the presence of different species of birds in the development area. This will be based on published data, any observations that have been reported from the Beatrice installations themselves, and any available data from the ongoing bird survey research programme (Section 8.3.4). A literature review will be undertaken to determine the likely response of these species to the WTG units.

Available data on bird densities, flight paths and flying heights will be used to estimate the likelihood that particular species would collide with the operating units, assuming that the birds either did not detect, or did not respond to the WTG units. In addition, published data on strike risk will be reviewed and presented to quantify the potential for the Beatrice demonstrator WTG units to impact birds.

The coastline and waters of the Moray Firth together represent an internationally important area for several bird species (Sections 4.2.1 and 4.2.6); there are resident populations, over-wintering populations, and birds on passage. The coast provides sites for breeding, and the coastal and offshore areas offer important feeding grounds. With respect to the two demonstrator turbines that will be located in the Beatrice field, it is likely that the species that might be affected to the greatest extent would include those that:

- use the area for feeding;
- congregate in the area during moulting; or
- traverse the area at relatively low level on feeding excursions or during passage.

The Smith Bank, on which the demonstrator turbines are located, is an important feeding ground for seabirds (Mudge and Crooke, 1986). This area is particularly important in spring and autumn for guillemots, razorbills, kittiwakes, gannets and sooty shearwaters, but bird numbers are low in winter. Data for the Moray Firth indicate a predominantly coastal distribution for sea duck and coastal waterfowl (Dean *et al.*, 2003), with nationally important numbers of common scoter, long-tailed duck and eider.

There is concern that offshore wind farms may have a significant effect on sea ducks and waterfowl through collision and habitat exclusion. While swans and geese are present in this region and migrate to nearby locations (Barton and Pollock, 2004), reports have shown that these birds are generally able to detect the presence of turbines and avoid them (Larsen and Madsen, 2000; Percival 1998; Koop, 1997 reported in BirdLife International, 2002). Though the Moray Firth is an important area for sea ducks (Lloyd *et al.,* 1991), eiders and common scoters are generally confined to areas within 5km of the shore, and are therefore unlikely to be influenced by the demonstrator project.

Razorbills forage up to 55km from the coast, although most are likely to forage much closer to colonies and the highest densities occur close to coasts (Leaper *et al.,* 1988; Stone *et al.,* 1995). Webb *et al.* (unpublished) studied auks off Bempton Cliffs and reported few breeding adults foraging beyond 30km but noted important concentrations of guillemots between 26-30km from Bempton. With respect to collision risk, guillemots and razorbills are thought generally to fly below the level of turbine blades, but are likely to fly higher when arriving and exiting breeding sites on cliffs, and in conditions of tail wind (A. Webb, pers. comm.).

Observations of red throated divers suggest that the frequency of bird strike is low (Cramp and Simmonds, 1977), but the conservation importance of the species means that the effects of any mortality caused by collisions could have an effect on population size at a national scale. Observational data on the average flying heights of cormorants is limited, but studies in the Netherlands by Dirksen *et al.,* 1998 provide some evidence that cormorants may actively avoid turbines when flying between roosts and feeding areas.

8.3.3 MITIGATION PROPOSED

No mitigation for disturbance effects on birds can be proposed. The towers will bear navigation lights, and the lower part of the tower will be painted to make it more visible to shipping. The rest of the tower, and the blades, will be coloured so as to reduce their overall visual impact.

8.3.4 FURTHER STUDIES UNDER WAY

Broad-scale surveys suggest that the Smith Bank is an important feeding area for seabirds. Little is known, however, about the factors influencing the fine-scale distribution of birds within this area, and it is not known if the presence of WTG units will influence foraging distribution or flight behaviour.

The University of Aberdeen will therefore conduct field surveys of the feeding and resting behaviour of marine birds in and around the site of the demonstrator project. The key species of interest around Beatrice are auks. This work will be based on radar observations of seabird movements; radar provides 24-hour data, is not compromised by bad weather, and avoids the logistical difficulties of working offshore in small boats. These data will be validated by direct observations either from the Beatrice platform or from boat surveys conducted in conjunction with the deployment and recovery of T-PODS.

Initially the study will identify suitable sampling techniques and conduct validation studies which will assess the extent to which radar can be used in this location to measure flight paths and feeding aggregations.

In parallel to this, techniques will be developed to estimate the height of flying auks, either using photogrammetry or radar. Once techniques have been developed, studies will be conducted to determine how flight height varies in relation to local conditions such as weather and distance from shore.

8.4 EFFECTS OF OPERATIONAL NOISE ON MARINE MAMMALS

8.4.1 DESCRIPTION OF IMPACT

The underwater noise created by the *operation* of the WTG units may impact marine mammals and fish in and around the site. The main source of underwater noise will be from the working of the gears in the nacelle at the top of the tower (Nedwell and Howell, 2004). This noise/vibration is transmitted into the sea by the structure of the tower itself, and manifests as low frequency noise. Other transmission pathways are via the tower and the seabed, or through the air and air/water interface, but these are unlikely to be as important as the pathway directly through the tower (Nedwell and Howell, 2004).

Early consultation with stakeholders has identified operational noise as a potential effect. In general it is thought that operational noise from wind farms is low. Noise levels in the nacelle are estimated to be in the region of 115-120 dB re 1μPa (Vella *et al.,* 2001). Data from the Svante wind farm in Sweden indicate operational noise levels peaking at 120 dB at 16Hz, about 20 dB above background levels (Westerberg 1994). Overall, received levels are not expected to be significant. The turbines proposed for the Moray Firth are larger than most other wind farm turbines but the noise frequencies produced are expected to be the same and not thought to merit special consideration.

There are some published data on the source noise levels from operating wind farms (reviewed by Nedwell and Howell, 2004), and these indicate that noise generated may have a peak frequency in the range 16 to 25Hz, and that the sound level may be up to 153 dB re μPa @ 1m (Nedwell and Howell, 2004). The available field data showed that although the absolute level of turbine noise increased with increasing wind speed, the noise level relative to background noise (i.e. from wave action, entrained bubbles) remained relatively constant. It should be noted, however, that these data are all for monopole or gravity structures located in relatively shallow water. The character and level of noise generated by operating turbines is dependent not only on the characteristics of the turbine itself, but also on the nature of the support structure and the way in which this may efficiently transmit noise and vibration into the water column.

8.4.2 ASSESSING THIS EFFECT IN THE EA

The potential response of marine mammals depends on the noise level actually perceived by the individual (Section 7.3). The limited published data reviewed by Nedwell and Howell (2004) indicate that harbour seal and harbour porpoise exhibit behavioural reactions to real or simulated “operational” noise, but the potential zone of influence is not given.

In the EA, the effect of operational noise will be assessed using the approach described in Section 7.3.2 for piling.

Data on source noise levels from operating turbines will be reviewed and then used to model the potential zone of acoustic effect. The frequency spectrum of noise transmitted by the support tower will be determined from the literature. The densities of marine mammals in the area at different times of the year will be determined from the literature and from field surveys.

8.4.3 MITIGATION PROPOSED

No mitigation can be proposed for the underwater noise resulting from turbine operations. However, at this early stage in the project it is considered that no mitigation will be necessary.

8.4.4 FURTHER STUDIES UNDER WAY

Given the possibly unique combination of support structure design, and (relatively) deep water at the demonstrator site, emphasis will be placed on obtaining site-specific field measurements of operational noise under different conditions, both to inform the EA for the demonstrator, and, importantly, to provide data relevant to the further understanding of the potential impacts of a commercial wind farm.

The field studies described in Section 7.3.4 for piling operations will be repeated for monitoring the noise levels generated by normal operations. The University of Aberdeen will plan, execute and report on these studies.

8.5 EFFECTS OF ELECTROMAGNETIC FIELDS ON FISH

8.5.1 DESCRIPTION OF IMPACT

The presence of an E-Field around the subsea cable may affect some species of fish, and might interfere with their ability to navigate and/or locate prey. It may act as a deterrent, prompting individuals to move away from the immediate area of the cable, but some E-Fields may also attract certain species of elasmobranchs (cartilaginous fish).

8.5.2 ASSESSING THIS EFFECT IN THE EA

Because the demonstrator WTG units are so close to the existing Beatrice Alpha facility the subsea cable is short, and its rating is lower than that of the export cables for most commercial wind farms. It is therefore likely that the area affected by its E-Field will be relatively small.

Data for this part of the Moray Firth suggest that:

1. there are no resident populations of rare species of electro-perceptive fish (including elasmobranchs) in the area; and
2. the area of habitat that may be affected by the E-Field from the demonstrator cable is likely to be a very small proportion of that available to common and widespread species such as dogfish and common skate.

There is ongoing research on the effects of E-Fields on fish, and published results are equivocal, suggesting a likely behavioural response but one that could be either attraction or repulsion (Gill and Taylor, 2002; CMACS, 2003).

An estimate of the strength and size of the E-Field will be made. Published information will be reviewed to determine the probable response of the most common or commercially important fish species at the demonstrator site.

8.5.3 MITIGATION PROPOSED

A number of mitigation measures could be adopted if the effect was predicted to be significant. The cable will be buried, and the effect of burial on the predicted E-Field will be assessed. The cable coatings could be modified to reduce their permeability, and thus reduce the magnitude and extent of the E-fields. The total length of the subsea cable would be kept to a minimum.

8.5.4 FURTHER STUDIES UNDER WAY

No further studies are proposed at this stage, but the demonstrator project will draw on studies and information obtained from other offshore sites, including some in the DOWNVInD programme.

8.6 POTENTIAL INTERFERENCE WITH FISHING OPERATIONS

8.6.1 DESCRIPTION OF IMPACT

It is possible that the *physical presence* of the 2 WTG units and the subsea cable will represent a source of interference to commercial fishing operations in the area. The support bases and the tops of the driven piles (if selected) may represent a small *snagging risk* to bottom-towed fishing gear, depending on the type of substructure selected.

8.6.2 ASSESSING THIS EFFECT IN THE EA

Commercial fishing effort and overall economic productivity in the area around Beatrice are high (Section 4.2.7). Up to date information on the types of fishing gear employed in the area, the intensity of fishing, and the amount of landings will be obtained and reviewed. These data will be evaluated in the light of the mitigation measures proposed and the views of stakeholders, to determine what effect the presence of the WTG units might have on commercial fishing operations.

8.6.3 MITIGATION PROPOSED

The locations of the WTG units will be notified in Admiralty "Notices to Mariners". The WTG units will be painted and lit in accordance with International Association of Marine Aids to Navigation & Lighthouse Authorities. IALA and Trinity House guidelines and will be visible on ships' radar.

There is a 500m radius safety zone around Beatrice AP to minimise the potential for fishing gear to interact with equipment and pipelines on the seabed. The WTG units will be located outside this zone and it is not known at this stage if they will have safety zones around them; this will be determined by consultation with the authorities and stakeholders.

Where the subsea electric cables are buried, they will be buried to a depth of at least 0.6m to ensure that they would not be affected by bottom-towed fishing gear. Where they are not buried, they will be protected by concrete mattresses. The longest length of mattressed cable will be from the crossing over the 16" oil export line to Beatrice AP, a distance of about 200m, and all of this will lie within the existing 500m safety zone around the platform.

8.6.4 FURTHER STUDIES UNDER WAY

No field studies of this aspect are planned for the demonstrator project. The issue of interference with commercial fishing will be fully discussed with stakeholders. In the event that the demonstrator project is successful and a decision is made to move to future commercial development, the impacts on fishing, and associated consultation, will be fully revisited.

8.7 POTENTIAL COLLISION RISK FOR SHIPPING

8.7.1 DESCRIPTION OF IMPACT

The physical presence of the 2 WTG units at some distance from the present Beatrice AP platform would pose a small additional risk to shipping in the area.

8.7.2 ASSESSING THIS EFFECT IN THE EA

Ship collision data are available for this area and have been used in previous EIAs (for example the Beatrice Pipeline Replacement EIA). The intensity of shipping activity in the area is low (Section 4.2.8).

Up to date data on shipping intensity will be obtained and used to assess collision risk.

8.7.3 MITIGATION PROPOSED

Offshore operations with vessels will be broadcast in Admiralty “Notices to Mariners”. The WTG units will be painted and will carry navigation lights, and will be visible on ships’ radar.

8.7.4 FURTHER STUDIES UNDER WAY

No field studies of this aspect are planned for the demonstrator project. The issue of interference with commercial shipping and navigation will be fully discussed with stakeholders and re-examined in detail if the decision is made to proceed with the commercial wind farm.

8.8 VISUAL AND LANDSCAPE EFFECT OF WTG UNITS

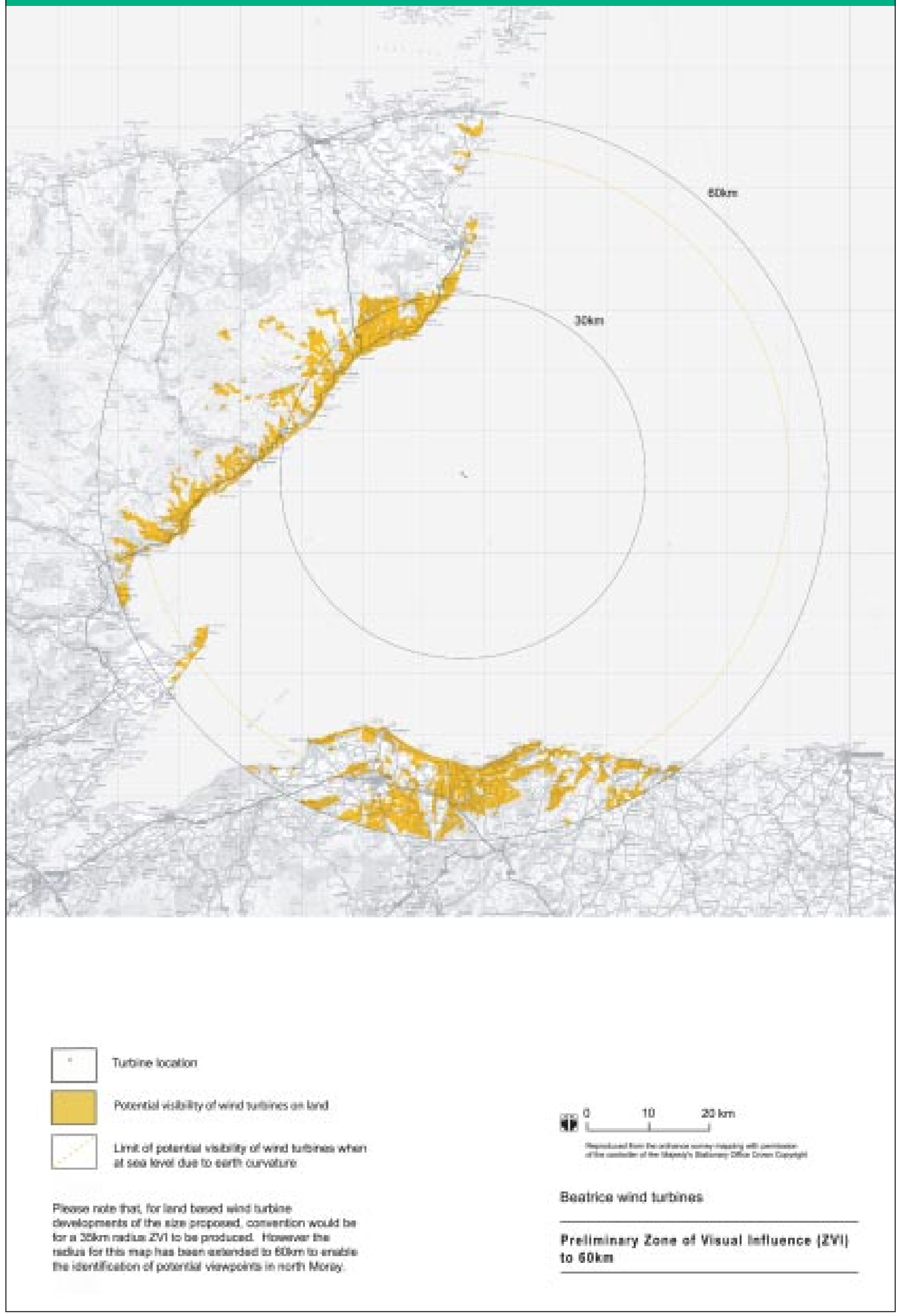
8.8.1 DESCRIPTION OF THE IMPACT

The upper parts of the towers, the turbines, and the blades will be visible from certain locations on the shore. The two WTG units will be an additional feature on the horizon of the seascape when viewed under conditions of good visibility from stretches of both the north and south coasts of the Moray Firth, and from some elevated locations inland.

Figure 8-1 presents a preliminary assessment of the zone of visual influence (ZVI) for the demonstrator project. It identifies an area over which the development could theoretically be seen. The zone extends to a radius predicted to include all areas from which some part of the structure might be observed. The ZVI represents a “worst case scenario”. It is a precautionary and inclusive picture of the likely visibility of the development. For onshore developments a radius of 35km is considered Best Practice, but for the offshore demonstrator project Talisman have considered a 60km radius to be appropriate to assess the potential impacts to nearest settlements.

The ZVI does not represent the nature or magnitude of effects, such as where impacts might occur or how significant they would be. However, it is a useful and necessary first step in undertaking a landscape and visual impact assessment (LVIA) for any development because it gives an indication of the broad area over which the development may be seen. This allows the subsequent identification of potentially important viewpoints that will be assessed in greater detail in the LVIA as part of the EA. However, some indication of the possible visibility of the 2 WTGs can be gained by considering the present visibility of the 3 Beatrice platforms.

FIGURE 8-1.
PRELIMINARY ZONE OF VISUAL INFLUENCE (ZVI) FOR THE BEATRICE WIND FARM DEMONSTRATOR PROJECT, TO 60KM.



8.8.2 ASSESSING THIS EFFECT IN THE EA

An assessment of the visual impact of the two WTG units will be carried out, following the guidelines and good practice described in SNH (2001, 2002), Landscape Institute and Institute of Environmental Assessment, (2002) and CCW (2001). This will assess the impact of the demonstrator project when viewed from the land, with particular emphasis on the appearance of the site when viewed from major settlements or locations where the WTG units and the Beatrice field may present a combined effect.

8.8.3 MITIGATION PROPOSED

The WTG units will be about 0.8km apart and will be coloured so as to minimise visual impact. The WTG units will carry only essential lights to warn shipping and aircraft.

8.8.4 FURTHER STUDIES UNDER WAY

A comprehensive landscape and visual impact assessment (LVIA) will be carried out as part of the EA. This will produce photomontages, video images, and maps of visible radii.

8.9 INTERFERENCE WITH TELECOMMUNICATIONS AND AVIATION

8.9.1 DESCRIPTION OF THE IMPACT

The presence of the WTG units may affect fixed radio links, maritime radio systems, civil and military radars, and aeronautical radio navigation aids. Wind turbines can, for example, interfere with signals or create blind areas on radar coverage.

8.9.2 ASSESSING THESE EFFECTS IN THE EA

The magnitude of these effects depends on the size, extent and location of the wind turbines in relation to the affected instruments. Telecommunications and aviation may be affected by large-scale wind farm developments, but it is likely that the effects of the two demonstrator units would be very small. Nevertheless this aspect will be assessed in the EA.

A review will be made of the nature, location and use of all such facilities within a 30km radius of the WTG units. Discussions will be held with the operators/owners of these facilities to determine the detailed operating parameters of each system, to evaluate whether it would in fact be likely to be affected by the two demonstrator units. These discussions would include examination of possible mitigating measures.

8.9.3 MITIGATION PROPOSED

Mitigation measures would be confined to those that could be taken by the operators of the systems, for example in fine-tuning their signals. No mitigation measures for the demonstrator units themselves are envisaged at this stage.

8.9.4 FURTHER STUDIES UNDER WAY

No further studies or field work are planned at this stage.

8.10 POSITIVE EFFECT OF NEW STRUCTURES IN THE MARINE ENVIRONMENT

8.10.1 DESCRIPTION OF THE IMPACT

The presence of the WTG units in the sea will provide new surfaces of marine organisms ("marine fouling") to settle and grow on. They will also act as small artificial reefs (as do the platforms in the Beatrice field do), providing a new habitat attractive to fish and shellfish. Marine fouling may, however, have a negative effect on the offshore structures due to an increase in hydrodynamic loading, and impairment of visual and non-destructive testing inspection.

8.10.2 ASSESSING THESE EFFECTS IN THE EA

A brief assessment of the potential fouling and reef effects will be made in the EA using existing information gleaned from historical sub-sea surveys of the platforms in the Beatrice field. The EA for the demonstrator project will also draw on the results of a study into the reef effects of offshore wind farms being conducted at Utgrunden as part of the DOWNVInD programme.

8.10.3 MITIGATION PROPOSED

With respect to the negative effects of marine fouling, the WTG towers are designed to withstand the fouling that may develop on them over the 5 year period of the demonstration project, and no underwater inspections are planned.

8.10.4 FURTHER STUDIES UNDER WAY

It is proposed that existing and future data from diving and ROV inspections will be used to build a picture of the fouling and reef communities on and around the Beatrice field platforms and the demonstrator project. Inspections using ROVs have taken place at regular intervals at all 3 platforms and a review of archive video footage will provide useful information on the communities present and some idea of what communities could be expected to develop on the wind farm structures. Ongoing surveys of the demonstrator structures will provide data on colonization and indicate what is likely to happen on any commercial development.

9 IMPACTS OF DECOMMISSIONING AND DISPOSAL

9 IMPACTS OF DECOMMISSIONING AND DISPOSAL

9.1 INTRODUCTION

If the WTG units are no longer needed at the end of the demonstration period, they will be removed (Section 3.9).

9.2 POTENTIAL IMPACTS AND MAIN RECEPTORS

The *use of vessels* in the Beatrice field to remove the WTG units may cause local and short-term impacts to commercial fishing operations, shipping, and oil and gas operations. *Underwater cutting operations to sever the piles of the base unit* will create underwater noises that may affect marine mammals and fish. Exposing the buried subsea cables using a *plough or water-jetting device* will disrupt the existing benthic community. The *removal of concrete mattresses* and other *subsea work at Beatrice and the WTG units* may disrupt seabed sediments and cause local transient effects in the water column and pelagic environment, and impact the benthos and fish and shellfish in the immediate area. The *removal of the WTG units* themselves will eliminate a potential source of interference to shipping and fishing, and the *removal of the base units* will re-expose a small area of natural seabed.

All of these potential impacts will be assessed in the EA, and further information about the key issues is provided below.

9.3 NOISE EFFECTS OF UNDERWATER CUTTING OPERATIONS

9.3.1 DESCRIPTION OF IMPACT

It is likely that the 3 or 4 piles on each base unit would be severed using cold-cutting techniques (e.g. water-jetting or diamond wire cutting). The cuts would below the natural level of the seabed; if parts of the piles were left protruding above the sea bed they might present a snagging risk to fishing operations. If suction piles are used to anchor the substructures, removal would be the preferred option.

9.3.2 ASSESSING THIS EFFECT IN THE EA

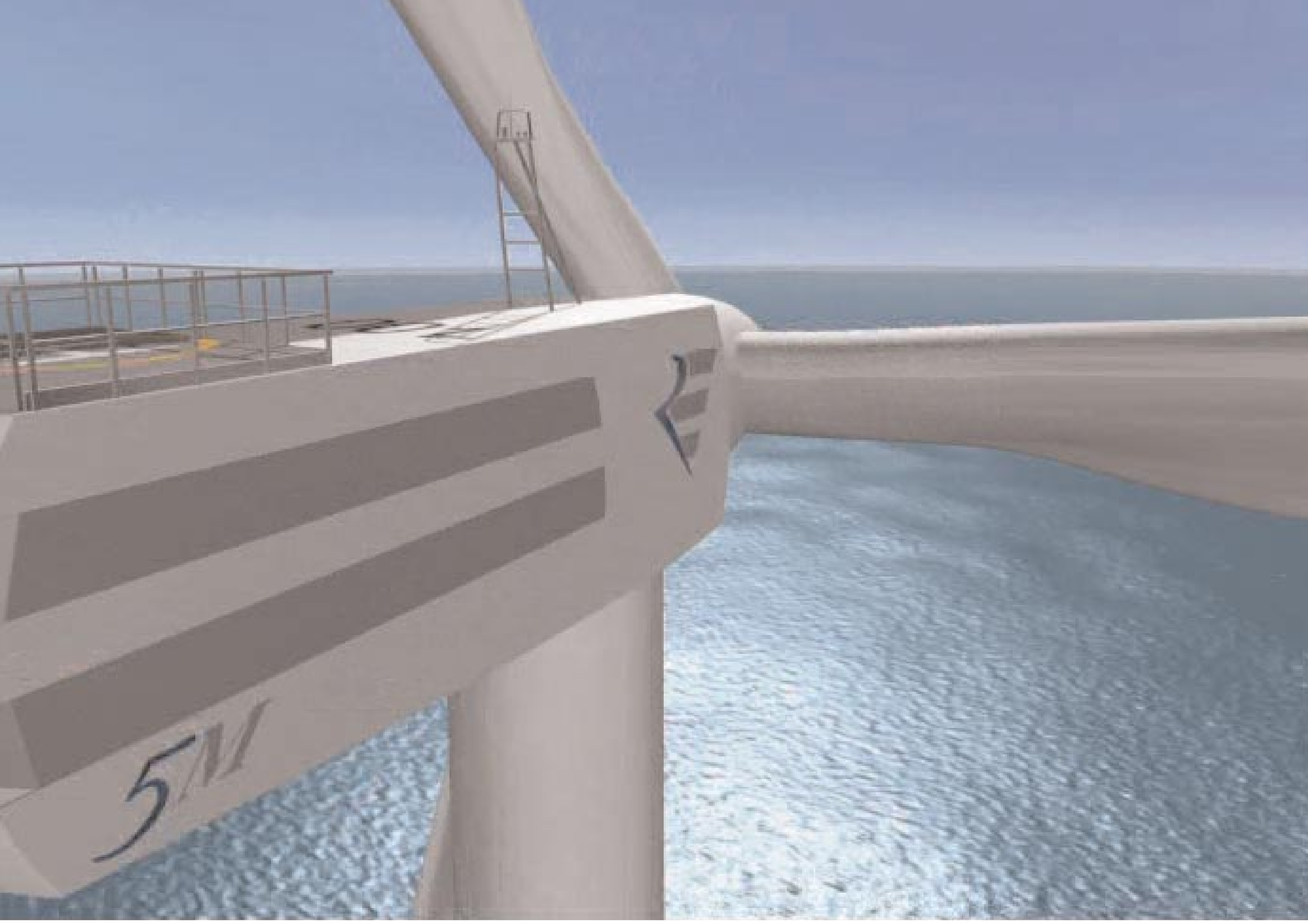
Literature will be reviewed to obtain data on predicted noise levels from cutting operations. These will be used in conjunction with data on the distribution of marine mammals, and their response to different sound levels, to make a prediction of the potential effect of these operations.

9.3.3 MITIGATION PROPOSED

The use of cold-cutting techniques would reduce the risk of noise effects on mammals and fish, and eliminate the environmental risk inherent in using underwater explosive cutting. The cutting operations would take only a few hours. The cuts would be below the natural level of the seabed, so that the sections of piles left in the sea did not protrude.

9.3.4 FURTHER STUDIES UNDER WAY

No further studies of this issue are proposed at present but there will be a review of the techniques available and their environmental effects nearer the time.



10 SUMMARY OF IMPACTS AND WORK IN HAND

Tables 10-1 to 10-4 summarise the following information for each of the 4 phases of the demonstrator project:

- The activity giving rise to effects
- The aspects of the environment that may be impacted
- The nature of the impact
- The mitigation that will, or may, be incorporated in the project to reduce the potential effect
- The action that will be taken to further quantify the potential impact, or assess it fully in the EIA, or reduce its potential effect

TABLE 10-1 SUMMARY OF THE IMPACTS IDENTIFIED FOR THE ONSHORE ASSEMBLY PHASE, AND A DESCRIPTION OF THE WAY IN WHICH THEY WILL BE ADDRESSED IN THE FULL EA

ACTIVITY	ASSEMBLY AT ONSHORE LOCATION		
Environmental Aspect	**Potential Impacts**	**Mitigation**	**Action**
Impact on local infrastructure Impact on local communities	Effects of shipping materials by land or sea on roads and infrastructure. Impacts on local communities and amenity as a result of e.g. additional traffic, noise, light.	Careful selection of port capable of handling and storing components. Auditing of port's management, EMS and HSE systems. Robust planning.	Talisman to select site. Site to be audited. Consultees views to be addressed. Impacts to be assessed in EA.

TABLE 10-2 SUMMARY OF THE IMPACTS IDENTIFIED FOR THE OFFSHORE CONSTRUCTION AND INSTALLATION PHASE, AND A DESCRIPTION OF THE WAY IN WHICH THEY WILL BE ADDRESSED IN THE FULL EA

ACTIVITY	DRIVEN PILING OF SUPPORT STRUCTURE		
Environmental Aspect	**Potential Impacts**	**Mitigation**	**Action**
Impact of underwater noise	Disturbance or in extreme cases physical injury to marine mammals and fish	Use marine mammal observers before piling Use "soft start" technique at beginning of piling operations Select most efficient piling system to reduce duration	Predict piling noises accurately Survey presence of marine mammals at and around the site Address views and information from consultees Assess potential impacts fully in EA Investigate other mitigation techniques
ACTIVITY	**DRIVEN PILING OF SUPPORT STRUCTURE**		
Environmental Aspect	**Potential Impacts**	**Mitigation**	**Action**
Impact of physical disruption to seabed	Impact to seabed sediments and benthic communities	Limit area of impact to "footprint" of support structure	Assess potential impacts fully in EA.

TABLE 10-3 SUMMARY OF THE IMPACTS IDENTIFIED FOR THE OFFSHORE OPERATION AND MAINTENANCE PHASE, AND A DESCRIPTION OF THE WAY IN WHICH THEY WILL BE ADDRESSED IN THE FULL EA

ACTIVITY	PRESENCE OF SUBSEA STRUCTURE ON SEABED		
Environmental Aspect	**Potential Impacts**	**Mitigation**	**Action**
Erosion of sediments Changes in sediment deposition patterns	Sediment around base of WTG units may be eroded by currents. However, the tidal and residual currents in the area are weak. No erosion or sedimentation effects have been noted at the Beatrice platform.	Place concrete mattresses on seabed around the base of the support structure and at locations where the buried subsea electrical cable emerges from the sediment.	Analyse video footage from ROV inspections of the Beatrice platforms for evidence of deposition or scour Assess potential impacts fully in EA.
ACTIVITY	**PRESENCE AND OPERATION OF WTG UNITS**		
Environmental Aspect	**Potential Impacts**	**Mitigation**	**Action**
Creation of underwater noise	Disturbance of marine mammals (behaviour, feeding, social interactions) and fish	Selection of efficient turbines Maintenance of turbines	Assess sound source levels from turbines Monitor actual noise levels on demonstrator Survey presence of marine mammals at and around the site Monitor presence and behaviour of marine mammals during demonstrator Address views and information from consultees Assess potential impacts fully in EA

TABLE 10-3 CONTINUED SUMMARY OF THE IMPACTS IDENTIFIED FOR THE OFFSHORE OPERATION AND MAINTENANCE PHASE, AND A DESCRIPTION OF THE WAY IN WHICH THEY WILL BE ADDRESSED IN THE FULL EA

ACTIVITY	PRESENCE AND OPERATION OF WTG UNITS, CONTINUED		
Environmental Aspect	**Potential Impacts**	**Mitigation**	**Action**
Interactions with birds	Disturbance of bird movements, with effects on feeding, behaviour and migration Potential to pose strike risk	Careful selection of colours and reflectivity of towers and blades	Survey presence of birds in area Address views and information from consultees Assess potential impacts fully in EA Monitor presence and behaviour of birds during demonstrator Monitor bird movements before and after demonstrator built, using radar.
Interaction with commercial fishing operations	The presence of the two WTG units may interfere with commercial fishing operations, making it more difficult or expensive for fishermen to obtain their total allowable catches.	Plan to minimize area of exclusion zone (if required), and the duration of other disturbance Potential for snagging risks on seabed is reduced by proper planning, design, construction and maintenance of WTG support structures and cables All components and materials will be removed at end of demonstrator project if commercial scale wind farm does not proceed	Address views and information from consultees Assess potential impacts fully in EA
Interaction with navigation	Interference with shipping and possible navigational hazard	WTG units marked on Admiralty charts and notified in "Notices to Mariners" WTG units will be properly lit and visible to radar Lower part of WTG towers may be painted to enhance visibility	Address views and information from consultees Assess potential impacts fully in EA

TABLE 10-3 CONTINUED SUMMARY OF THE IMPACTS IDENTIFIED FOR THE OFFSHORE OPERATION AND MAINTENANCE PHASE, AND A DESCRIPTION OF THE WAY IN WHICH THEY WILL BE ADDRESSED IN THE FULL EA

ACTIVITY	PRESENCE AND OPERATION OF WTG UNITS, CONTINUED		
Environmental Aspect	**Potential Impacts**	**Mitigation**	**Action**
Visual impact on landscape and seascape	Presence of WTG units may create visual impact on surrounding area, to the detriment of its landscape or seascape qualities and overall amenity	Sensitive selection of colours and reflectivity of towers and blades to minimize visual impact when viewed from the land	Address views and information from consultees Assess potential impacts fully in EA by means of a landscape and visual impact assessment (LVIA)
Telecommunications and aviation	Presence of WTG units could interfere with telecommunications, radar and navigational aids	Discussions with operators / owners of such equipment and facilities to ensure that equipment is tuned / operated in such a way as to minimise risk of interference from the WTG units	Address views and information from consultees Assess potential impacts fully in EA
ACTIVITY	**CREATION OF LOCAL ELECTROMAGNETIC FIELDS**		
Environmental Aspect	**Potential Impacts**	**Mitigation**	**Action**
Effects on fish	Local E-Fields may affect navigational and or feeding ability of some species	Cables will be buried for most of their length Cable sheathing that may reduce E-Fields is being investigated	Address views and information from consultees Assess potential impacts fully in EA

TABLE 10-4 SUMMARY OF THE IMPACTS IDENTIFIED FOR THE DECOMMISSIONING PHASE, AND A DESCRIPTION OF THE WAY IN WHICH THEY WILL BE ADDRESSED IN THE FULL EA

ACTIVITY	UNDERWATER CUTTING OPERATIONS		
Environmental Aspect	**Potential Impacts**	**Mitigation**	**Action**
Creation of underwater noise	Disturbance of marine mammals (behaviour, feeding, social interactions) and fish	Explosives would not be used to cut piles Cutting operations by diamond wire or abrasive water jetting would be carefully planned to minimize duration of operations and reduce potential impacts Other measures, such as "soft start" to operations, and use of marine mammal observers, may also be appropriate	Assess sound source levels from underwater cutting Survey presence of marine mammals at and around the site Assess potential impacts fully in EA Monitor presence and behaviour of marine mammals during demonstrator Address views and information from consultees

11 EFFECTS ON SPECIAL AREAS OF CONSERVATION AND SPECIAL PROTECTION AREAS

11 EFFECTS ON SPECIAL AREAS OF CONSERVATION AND SPECIAL PROTECTION AREAS

11.1 INTRODUCTION

None of the facilities or operations associated with the construction, installation and operation of the 2 demonstrator WTGs would take place, or be located within, an SAC or SPA. However, the development is adjacent to such sites and Talisman assumes that there may be implications for some of these sites. This section therefore presents more information pertinent to the detailed assessment of the implications of the demonstrator project on such sites, and this will be examined during the consultation process and described in greater detail in the EA.

The European Directives on the Conservation of Natural Habitats and of Wild Flora and Fauna (the "Habitats Directive")(92/43/EEC) and the Conservation of Wild Birds (the "Birds Directive")(79/409/EEC) aim to conserve and protect important, rare or threatened species and habitats.

The Habitats Directive aims to contribute to the conservation of biodiversity by requiring Member States to take measures designed to maintain or restore certain natural habitats and wild species at a favourable conservation status in the Community, giving effect to protection objectives for both sites and species. Under this Directive Member States are required to designate Special Areas of Conservation (SACs) for the protection of species or habitats. A ruling in 1999 extended the provision of the Habitats Directive to cover all of the water around the UK up to 200 miles offshore.

The Birds Directive applies to birds, their eggs, nests and habitats. It provides for the protection, management and control of all species of naturally occurring wild birds in the European territory of Member States; requires Member States to take sufficient measures to preserve a sufficient diversity of habits for all species of wild birds naturally occurring within their territory in order to maintain populations at ecologically and scientifically sound levels, and it requires Member States to take special measures to conserve the habitat of certain species of conservation concern and of migratory species.

The Birds Directive requires that the species listed in Annex 1 and all species of regularly occurring migratory birds shall be the subject of special conservation measures concerning their habitat. Member States of the EU are required to classify Special Protection Areas (SPA) for the conservation of these species. A network of SPAs has been established for important inland, estuarine and terrestrial sites in the UK. Collectively, SAC and SPA sites are referred to as "European Sites", and the network of sites across the European Community is known as "Natura 2000".

The Offshore Marine Conservation (Natural Habitats etc.) Regulations 2003 will apply both the Habitats Directive and the Birds Directive to UKCS waters up to a limit of 200 nautical miles from the baseline. The Regulations will put in place the statutory requirements and framework for identifying and establishing SPAs and SACs in UK offshore waters. The Regulations will encompass both site and species (e.g. cetaceans) protection. The Regulations are currently out to consultation.

To date, only one wholly marine SPA has been classified (Carmarthen Bay, Wales) but work is under way to identify a suite of marine SPAs throughout the UK. Bird species that use the seas around the UK and for which marine SPAs are being considered are listed in Table 11-3. The incidence of these species in and around the site of the demonstrator project is described in Section 4.2.6.

11.2 EFFECTS OF DEMONSTRATOR PROJECT ON SACs AND SPAS

11.2.1 INTRODUCTION

The locations and nature of all the SACs and SPAs in the wider area of the demonstrator project were described in Section 4, and the potential effects of the project were identified and described in Sections 6-9. Some of these effects may directly or indirectly impact on the "qualifying interest" of some SACs or SPAs (i.e. the particular conservation importance for which the site has been so designated). Tables 11-1 and 11-2 list those Natura 2000 sites that may be affected by the proposed demonstrator project, indicating why the Project may have an effect on the qualifying feature.

TABLE 11-1 SAC SITES IN THE NATURA 2000 SERIES AND THE QUALIFYING INTEREST THAT MAY BE AFFECTED BY THE BEATRICE WIND FARM DEMONSTRATOR PROJECT

SITE NAME	QUALIFYING INTERESTS AFFECTED		REASON WHY PROJECT MAY AFFECT INTERESTS
	ANNEX I	ANNEX II	
Moray Firth SAC UK0019808	Sandbanks		Covered and disturbed by foundations and cable laying
	Shallow inlets and bays		At risk from accidental oil spills from vessels
		Bottlenose dolphin	Affected by underwater noise from piling and turbine operations
Dornoch Firth and Morrich More SAC UK0019806	Sandbanks Estuaries Mudflats and sandflats Reefs Atlantic salt meadows		At risk from accidental oil spills from vessels
		Common seal	Affected by underwater noise from piling and turbine operations
Culbin Bar SAC UK0019807	Atlantic salt meadows		At risk from accidental oil spills from vessels

TABLE 11-2 SPA SITES IN THE NATURA 2000 SERIES AND THE QUALIFYING INTEREST THAT MAY BE AFFECTED BY THE BEATRICE WIND FARM DEMONSTRATOR PROJECT

SITE NAME	QUALIFYING INTERESTS AFFECTED		REASON WHY PROJECT MAY AFFECT INTERESTS
	BREEDING	OVER WINTER	
Cromarty Firth SPA UK9001623	Common tern *Sterna hirundo*	Bar-tailed godwit *Limosa lapponica* Whooper swan *Cygnus cygnus* Greylag goose *Anser anser*	Feeding movements or migration patterns may be affected by presence of WTGs. Possible risk of mortality caused by collision with blades.
Inner Moray Firth SPA UK9001624	Common tern *Sterna hirundo*	Bar-tailed godwit *Limosa lapponica* Greylag goose *Anser anser* Red breasted merganser *Mergus serrator* Redshank *Tringa totanus* Scaup *Aythya marila*	Feeding movements or migration patterns may be affected by presence of WTGs. Possible risk of mortality caused by collision with blades
Dornoch and Loch Fleet SPA UK9001622		Bar-tailed godwit *Limosa lapponica* Greylag goose *Anser anser* Wigeon *Anas penelope*	Feeding movements or migration patterns may be affected by presence of WTGs. Possible risk of mortality caused by collision with blades.
Loch Eye SPA UK9001621	Common tern *Sterna hirundo*	Whooper swan *Cygnus cygnus* Greylag goose *Anser anser*	Feeding movements or migration patterns may be affected by presence of WTGs. Possible risk of mortality caused by collision with blades.
Moray and Nairn Coast SPA UK9001625		Bar-tailed godwit *Limosa lapponica* Greylag goose *Anser anser* Pink-footed goose *Anser brachyryhynchus* Redshank *Tringa totanus*	Feeding movements or migration patterns may be affected by presence of WTGs. Possible risk of mortality caused by collision with blades.
Loch Spynie SPA UK9002201		Greylag goose *Anser anser*	Feeding movements or migration may be affected by presence of WTGs. Possible risk of mortality caused by collision with blades.

TABLE 11-2. CONTINUED SPA SITES IN THE NATURA 2000 SERIES AND THE QUALIFYING INTEREST THAT MAY BE AFFECTED BY THE BEATRICE WIND FARM DEMONSTRATOR PROJECT

SITE NAME	QUALIFYING INTERESTS AFFECTED		REASON WHY PROJECT MAY AFFECT INTERESTS
	BREEDING	OVER WINTER	
East Caithness Cliffs SPA UK9001182	Guillemot *Uria aalge* Herring Gull *Larus argentatus* Kittiwake *Rissa tridactyla* Razorbill *Alca torda* Shag *Phalcrocorax aristotelis*		Feeding movements or migration patterns may be affected by presence of WTGs. Possible risk of mortality caused by collision with blades. At risk from accidental oil spills from vessels
Caithness Lochs SPA UK9001171		Greenland White-fronted goose *Anser albifrons flavirostris* Whooper swan *Cygnus cygnus* Greylag goose *Anser anser*	Feeding movements or migration patterns may be affected by presence of WTGs. Possible risk of mortality caused by collision with blades.
Troup, Pennan and Lion's Head SPA UK9002471	Guillemot *Uria aalge*		Feeding movements or migration patterns may be affected by presence of WTGs. Possible risk of mortality caused by collision with blades. At risk from accidental oil spills from vessels
Loch of Strathbeg SPA UK9002211		Barnacle goose *Branta leucopsis* Whooper swan *Cygnus cygnus* Greylag goose *Anser anser* Pink-footed goose *Anser brachyryhynchus*	Feeding movements or migration patterns may be affected by presence of WTGs. Possible risk of mortality caused by collision with blades.

TABLE 11-3

BIRD SPECIES FOR WHICH UK SPAs ARE BEING CONSIDERED. www.jncc.gov.uk

SPECIES	STATUS	
Red-throated diver *Gavia stellata*	Annex 1	
Black-throated diver *Gavia arctica*	Annex 1	
Great northern diver *Gavia immer*	Annex 1	
Great crested grebe *Podiceps cristatus*		Migratory
Red-necked grebe *Podiceps griena*		Migratory
Slavonian grebe *Podiceps auritus*	Annex 1	
Black-necked grebe *Podiceps nigricolis*		Migratory
Northern fulmar *Fulmarus glacialis*		Migratory
Cory's shearwater *Calonectris diomedea*	Annex 1	
Great shearwater *Puffinus gravis*		Migratory
Sooty shearwater *Puffinus griseus*		Migratory
Manx shearwater *Puffinus puffinus*		Migratory
Balearic shearwater *Puffinus mauretanicus*	Annex 1	
European storm-petrel *Hydrobates pelagicus*	Annex 1	
Leach's storm-petrel *Oceanodroma leacorhoa*	Annex 1	
Northern gannet *Morus bassanus*		Migratory
Great cormorant *Phalacrocorax carbo*		Migratory
European shag *Phalacrocorax aristotelis*		Migratory
Greater scaup *Aythya marila*		Migratory
Common eider *Somateria mollissima*		Migratory
Long-tailed duck Clangula hyemalis		Migratory
Black scoter *Melanitta nigra*		Migratory
Surf scoter *Melanitta perspicillata*		Migratory
Velvet scoter *Melanitta fusca*		Migratory
Common goldeneye *Bucephala clangula*		Migratory
Red-breasted merganser *Mergus serrator*		Migratory
Goosander *Mergus merganser*		Migratory
Red-necked phalarope *Phalaropus lobatus*	Annex 1	
Pomarine skua *Stercorarius pomarinus*		Migratory
Arctic skua *Stercorarius parasiticus*		Migratory
Long-tailed skua *Stercorarius longicaudus*		Migratory
Great skua *Catharacta skua*		Migratory
Mediterranean gull *Larus melanocephalus*	Annex 1	
Little gull *Larus minutus*		Migratory
Sabine's gull *Larus sabini*		Migratory
Black-headed gull *Larus ribundus*		Migratory
Common gull *Larus canus*		Migratory
Lesser black-backed gull *Larus fuscus*		Migratory
Herring gull *Larus argentatus*		Migratory
Iceland gull *Larus glaucoides*		Migratory
Glaucous gull *Larus hyperboreus*		Migratory
Black-backed kittiwake *Rissa tridactyla*		Migratory
Sandwich tern *Sterna sandvicensis*	Annex 1	
Roseate tern *Sterna dougalii*	Annex 1	
Common tern *Sterna hirundo*	Annex 1	
Arctic tern *Sterna paradisaea*	Annex 1	
Little tern *Sterna albifrons*	Annex 1	
Common guillemot *Uria aalge*		Migratory
Razorbill *Alca torda*		Migratory
Little auk *Alle alle*		Migratory
Atlantic puffin *Fratercula arctica*		Migratory

12 CONSULTATION PROGRAMME

12 CONSULTATION PROGRAMME

12.1 AIMS OF CONSULTATION PROGRAMME

In accordance with the requirements of the Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999, and following best practice, Talisman in conjunction with its co-venturer Scottish and Southern Energy will conduct a comprehensive consultation programme in 2005. The purpose of this programme will be to:

- Gather views and concerns of all stakeholders about the proposed demonstrator project
- Obtain further more detailed information about potential impacts from individuals and organisations with specialist or local knowledge, and incorporate these data into the full EIA
- Further refine the plans for the design, construction and operation of the demonstrator project

12.2 PROPOSED CONSULTATION PROGRAMME

The consultation programme will comprise the following elements:

- Distribution of the Scoping Report to identified stakeholders, along with a letter seeking their views and comments
- Distribution of Scoping Report to public libraries and local authorities so that it can be viewed by the public
- Making the Scoping Report available as a pdf down-load from the internet
- Public presentations on the demonstrator project at selected locations in the northeast of Scotland
- Meetings with individual statutory and non-statutory consultees

12.3 TIMETABLE FOR CONSULTATION PROGRAMME

The draft timetable for the consultation programme is as follows:

APRIL:
Distribution of Scoping Report and letter to all consultees
Distribution of Scoping Report to libraries and local authority offices
Notification of Scoping Report availability in local press

MAY:
Stakeholder workshop in Dingwall
Meetings with individual consultees, arranged by the co-venturers
Public presentations and meetings in the Moray Firth area
Further meetings with individual consultees

12.4 CONTACTING TALISMAN

If you have any views, concerns, comments or questions about the demonstrator project, you can contact Talisman in the following ways:

IN WRITING TO:
The Environment Manager
Talisman Energy (UK) Limited
Talisman House
163 Holburn Street
Aberdeen AB10 6BZ

BY EMAIL TO:
environment@talisman.co.uk

WEBSITE ADDRESS:
www.beatricewind.co.uk

12.5 FURTHER INFORMATION THROUGH THE INTERNET

ABOUT THE DEMONSTRATOR PROJECT

www.beatricewind.co.uk

ABOUT THE DOWNVInD INITIATIVE

www.airicole.se/platform/components/upload/consume/streamfile.asp?id=402
www.vindenergie.org/presentationer/20-DOWNWIND.pdf

ABOUT TALISMAN ENERGY (UK) LIMITED

www.talisman-energy.com/operatingareas/northsea/index.html

ABOUT TALISMAN INC

www.talisman-energy.com

ABOUT SCOTTISH AND SOUTHERN ENERGY

www.scottish-southern.co.uk

ABOUT THE BRITISH WIND ENERGY ASSOCIATION

www.bwea.com

ABOUT THE DTI

www.og.dti.gov.uk

13 REFERENCES

13 REFERENCES

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