moray offshore renewables ltd

Developing Wind Energy In The Outer Moray Firth

Environmental Impact Assessment
Scoping Report
Eastern Development Area
Offshore Wind Farm Infrastructure:
Offshore Wind Turbines, Substations
& Interarray Cables.

edp renewables

SeaEnergy RENEWABLES

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Executive Summary

EDP Renováveis (EDP) and SeaEnergy Renewables Limited (SERL) have formed the partnership Moray Offshore Renewables Limited (MORL), which on 8th January 2010 was awarded a Zone Development Agreement by The Crown Estate to develop zone 1 of the nine UK Round 3 offshore zones. Zone 1 is located in the outer Moray Firth, within the UK Renewable Energy Zone (REZ).

Through the zone appraisal process MORL has produced the zone development strategy which determines the phasing by which areas within the zone will be developed and consented. As a result of this review MORL has prioritised the eastern section of the zone as the focus for the first stage of development. Investigations into the potential for development of the western section of the zone are in progress and are anticipated to be concluded in 2012. The Environmental Impact Assessment process for the Western Development Area is anticipated to commence in 2013.

MORL propose to develop up to 1.14GW of offshore wind within the eastern development area of the zone. The wind farm development area covers approximately 296 km^2 and is located approximately 22 km to the nearest coastline which is east of the Highlands coastline in Scotland. It is anticipated to consist of approximately 200 turbines and have a potential generation capacity of 1-1.14GW. The proposed development area was identified following a study of the defined spatial constraints within the zone.

This scoping report has two purposes:

1. To gather further information on constraints to siting wind farms and assist identify sites within the development area; and
2. To seek the opinion of statutory and non-statutory consultees on the scope of the Environmental Impact Assessment (EIA) which will be submitted to support the application for the consents required for the construction and operation of wind farms in the development area.

It should be noted that this scoping report only covers the wind turbines, substations and inter-array cables. Although MORL expects to consent the Offshore Transmission Operator (OFTO) infrastructure (i.e. OFTO offshore substation, offshore export cable, onshore export cable and onshore substation), these are not discussed in detail within this scoping report. A separate scoping report will be prepared for these offshore and onshore works at a later date when more details of the cable routes and onshore substation location are known.

The turbines within the eastern development area will contribute to the Scottish Government's target of generating 50% of Scottish electricity demand from renewable sources by 2020. The project will offset the emission of greenhouse gases, in line with the UK's commitments under the Kyoto Protocol.

This scoping report presents detail regarding the baseline environment in and around the proposed development area. This report also identifies potential impacts that may arise as a result of this development, directly, cumulatively with other offshore wind farms and in combination with other developments. Studies and surveys are proposed in order to inform the EIA process and preliminary discussion on potential mitigation and monitoring measures is included.

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ADCP	Acoustic Doppler Current Profiler
ASSI	Areas of Scientific Interest
BGS	British Geological Society
BOWL	Beatrice Offshore Wind Limited
BTO	British Trust for Ornithology
COWRIE	Collaboration for Offshore Wind Research in the Environment
dGPS	differential Geographic Positioning System
DDV	Drop Down Video
DECC	Department of Energy and Climate Change
DEFRA	Department for Environment, Food and Rural Affairs
DTI	Department of Trade and Industry
EDPR	EDP Renováveis
EGNOS	European Geostationary Navigation Overlay Service
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPS	European Protected Species
ES	Environmental Statement
FLO	Fisheries Liaison Officer
FTOWDG	Forth and Tay Offshore Wind Developers Group
GLA	General Lighthouse Authority
GIS	Geographical Information System
GPS	Geographical Positioning System
ICES	International Council for Exploration of the Sea
IHO	International Hydrographic Organisation
IUCN	International Union for Conservation of Nature
JNAPC	Joint Nautical Archaeology Policy Committee
JNCC	Joint Nature Conservation Committee
LNR	Local Nature Reserve
MaRS	Marine Resource System
MCA	Maritime and Coastguard Agency
MESH	Marine European Seabed Habitats
MNR	Marine Nature Reserves
MORL	Moray Offshore Renewables Limited
MFOWDG	Moray Firth Offshore Wind Dev elopers Group
MWDC	Mine Warfare Data Centre
NERL	NATS En Route Plc
NMBAQC	National Marine Biological Analytical Quality Control scheme
NNR	National Nature Reserve
OFTO	Offshore Transmission Operator
OWF	Offshore Wind Farm
OREI	Offshore Renewable Energy Installation
PSA	Particle Size Analysis
REZ	Renewable Energy Zone
SAC	Special Areas of Conservation
SCADA	Supervisory Control and Data Acquisition
SEA	Strategic Environmental Assessment

SEERAD	Scottish Executive Environment and Rural Affairs Department
SERL	Sea Energy Renewables Limited
SFF	Scottish Fishermen's Federation
SNH	Scottish Natural Heritage
SPA	Special Protection Areas
SSC	Suspended Sediment Concentrations
SSSI	Sites of Special Scientific Interest
STW	Scottish Territorial Waters
SUT	Society for Underwater Technology
UKBAP	UK Biodiversity Action Plan
UKHO	United Kingdom Hydrographic Office

1 Introduction

Moray Offshore Renewables Limited (MORL) has been awarded a Zone Development Agreement by The Crown Estate to develop Zone 1 of the nine UK Offshore wind Round 3 zones. Zone 1 is located in the outer Moray Firth within the UK Renewable Energy Zone (REZ) (Figure 1-1).

Using a zonal constraints analysis (see section 2.4), MORL has identified two potential development areas (Figure 1-2). The eastern development area is currently considered to have the higher potential for development and is being progressed first. It is anticipated that 1-1.14GW of power capacity will be developed in this area. However, the specific offshore wind farm sites within this development area have not yet been identified and site selection will be based upon feedback from the scoping report and consultation during the EIA process.

Details of the potential development within the western development area are anticipated to be released in 2012/2013. A grid connection agreement has not yet been agreed and therefore details of the offshore export cable and any potential onshore works will go through a separate scoping process. In addition, MORL has not yet selected any ports or harbours for construction or operation and maintenance work for either development area. Any works required in association with this project for ports and harbours will be scoped separately. **Therefore, this scoping document relates to the eastern development area only.**

The proposed eastern development area (Figure 1-2) is located approximately 22 km to the east of the Scottish coast and covers an area of approximately 296 km^2. The current assumption is that the areas will have approximately 200 wind turbines of 5-8 MW with a potential generation capacity of 1-1.14GW and a potential yield of 3,967 GWh per year.

The purpose of this scoping report is to seek the opinion of the statutory and non-statutory consultees on the scope of the Environmental Impact Assessment relating to the wind farm sites themselves, which will be submitted to support the application for the consents required for the development of offshore wind turbines in this area. **It should be noted that this scoping report only covers the wind turbines, offshore substations and inter-array cables.** It is currently anticipated that MORL will also consent the Offshore Transmission Operator (OFTO) infrastructure (i.e. export cables, OFTO offshore substation, ancillary onshore works and works in the inter-tidal zone), these are not discussed in detail within this scoping report. A separate scoping report will be prepared for these offshore and onshore works at a later date when more details of the cable routes and onshore substation location are known. It should however be noted that the offshore wind farm EIA will take into account through in-combination effects, any potential impacts resulting from the combination of the activities.

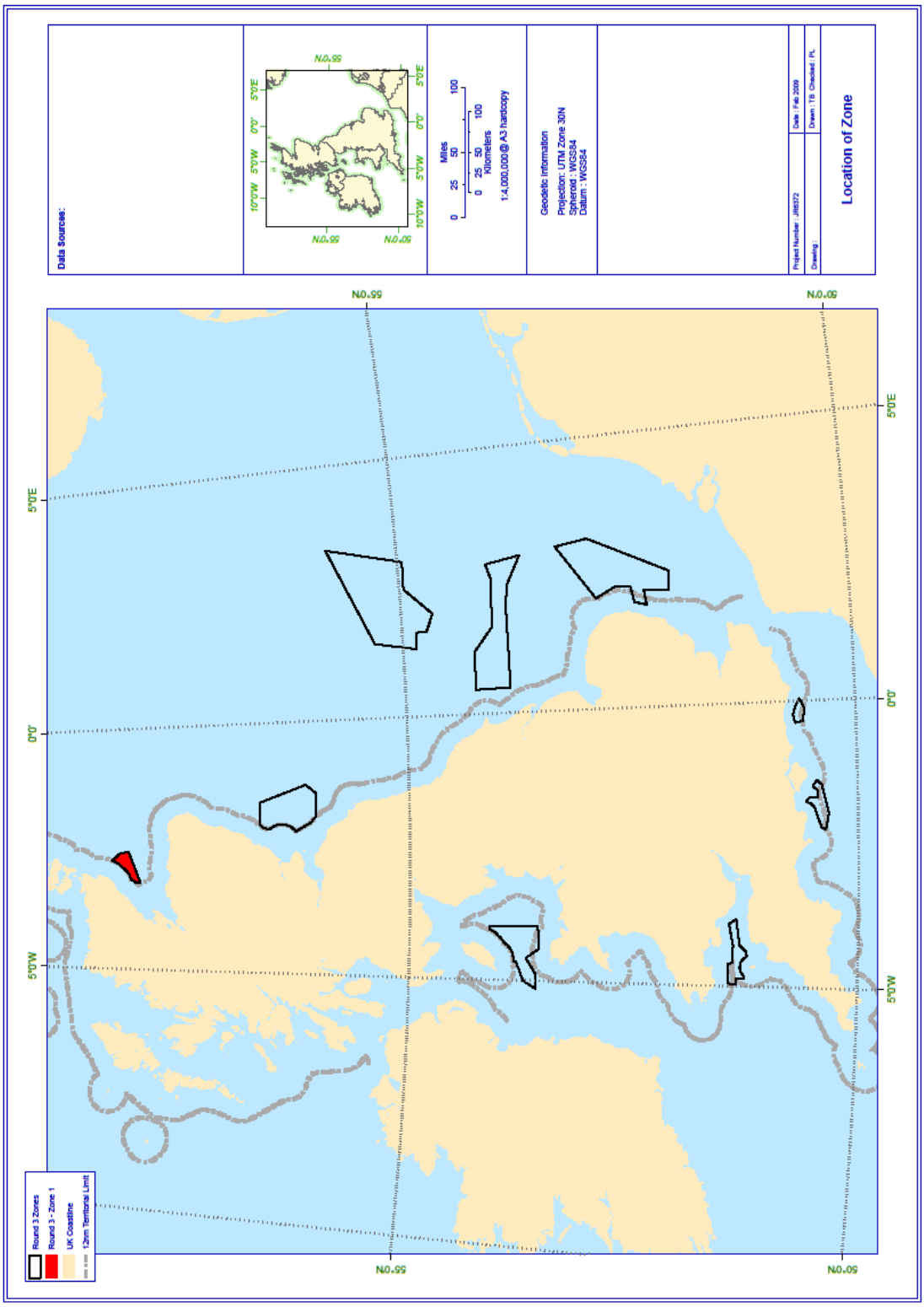


Figure 1-1: Round 3 zones (Moray Firth zone highlighted in red)

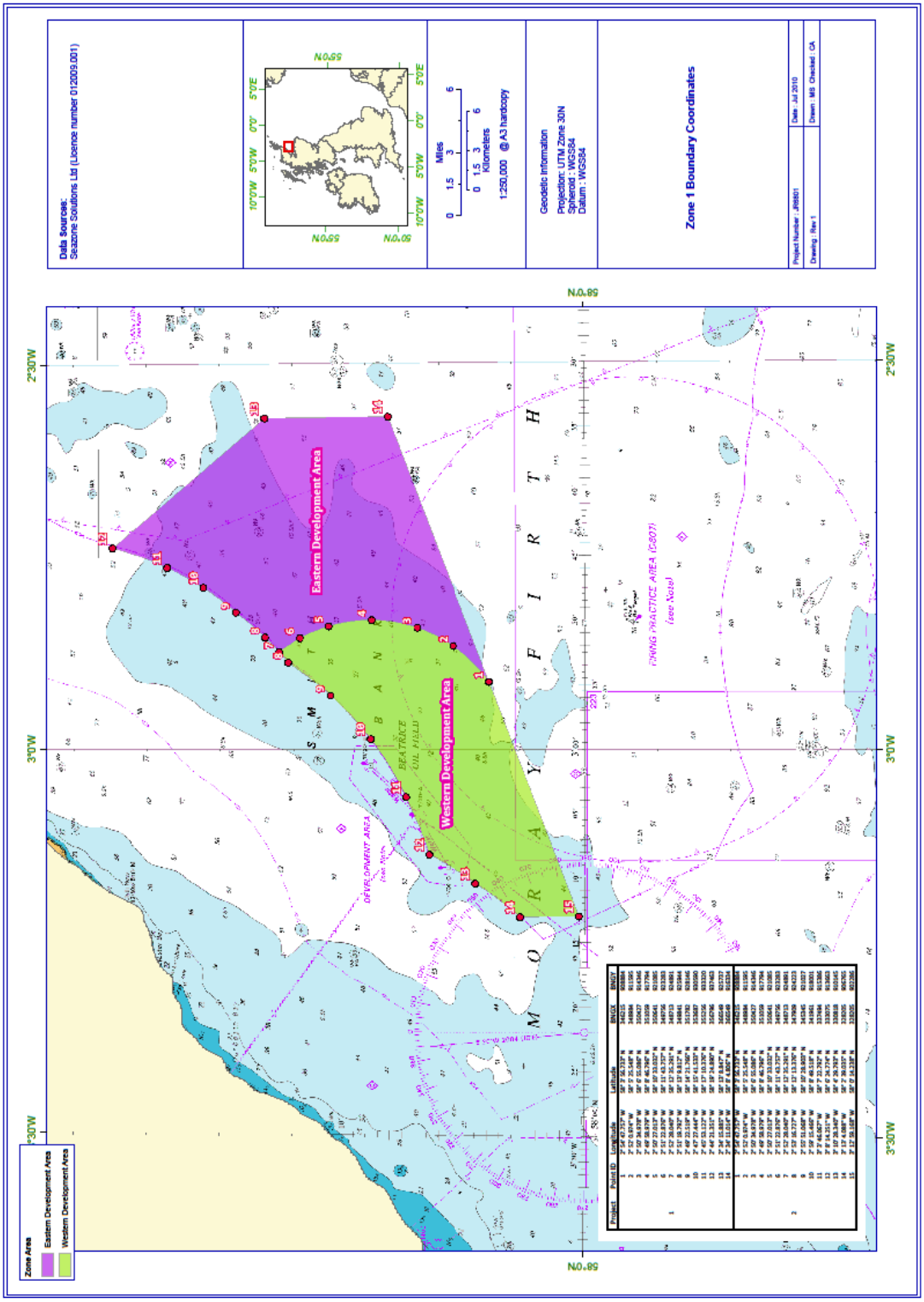


Figure 1-2: Location of the eastern and western development areas for offshore wind turbines.
Please note that OFTO infrastructure is not included on this figure as the grid connection has yet to be agreed

Scoping is an early stage of the environmental assessment process and is designed to ensure that the environmental studies undertaken provide all the relevant information required for the assessment. Scoping is the process for determining the content and extent of the matters which should be covered in the environmental information to be submitted to a competent authority for projects with are subject to EIA. The scoping process is designed for consultees to input into the EIA process for a particular project. In respect to this zone, the scoping process will also be used to collect information to assist with the process of locating suitable wind turbine sites within the eastern development area.

This scoping report provides details of the proposed development area along with baseline environmental information currently available. The potential impacts of the development have been identified, along with cumulative and in-combination impacts, following which the further assessment required for the EIA has been presented and an outline scope of works provided.

The results of the EIA stage will be published in the Environmental Statement. The fundamental purpose of the Environmental Statement (ES) will be to demonstrate that:

a) The proposed site/s has been selected to minimise environmental impacts and conflicts of interest, where possible.
b) The scheme has been designed to mitigate any potential adverse impacts as far as reasonably possible.

The final ES will clearly inform stakeholders of the residual impacts and facilitate informed consent decisions.

1.1 THE DEVELOPERS

1.1.1 MORAY OFFSHORE RENEWABLES LIMITED (MORL)

Moray Offshore Renewables Limited (MORL) is an incorporated Joint Venture company owned by EDP Renováveis and SeaEnergy Renewables Ltd. The purpose of MORL is to develop, consent, finance, construct, operate and maintain over the lifetime offshore wind sites within the Moray Firth Round 3 zone.

1.1.2 EDP RENOVÁVEIS

EDP Renováveis (EDPR) is a wholly owned subsidiary of EDP Group. The EDP Group was formed in 1976 and is a major European energy group, being the third largest energy group in the Iberian Peninsula, according to OMEL, and the largest Portuguese enterprise based on market capitalization.

EDPR was incorporated on December 4, 2007 to hold and operate EDP's growing European and North American renewable energy assets and activities. Shortly after its creation, EDPR acquired EDP's principle existing European and North American renewable energy subsidiaries, Nuevas Energias de Occidente and Horizon Wind Energy LLC, respectively.

EDPR has been involved in the wind energy sector since its inception in December 2007. Currently, wind power energy represents 100% of its business operations. However, the companies that have been consolidated into EDPR have been in the wind energy sector in Europe since 1992 and in the USA since 1998. EDPR's offshore energy involvement consists of research into wave energy and a multi-source offshore energy platform.

1.1.3 SEAENERGY RENEWABLES LTD

SeaEnergy Renewables Ltd (SERL) is a renewable energy developer based in Scotland and was created to participate in the global opportunities for offshore marine renewables, with an initial focus on offshore wind energy. The company has a unique combination of skills gained from the offshore renewable sector including the "Beatrice Demonstrator" project and the Oil and Gas and Utility Sectors.

SERL's technical expertise has been recognised worldwide and the company has been involved in a number of research and development programmes. SERL are also involved in developing the Beatrice STW and the Inch Cape (STW) wind farm projects.

1.2 NATIONAL POLICY AND OFFSHORE WIND DEVELOPMENT

The introduction of the Climate Change Act (2008) committed the UK to a legally binding target of at least 34% reduction by 2020 and at least an 80% cut in greenhouse gas emissions by 2050. The Climate Change (Scotland) Act (2009) committed Scotland to cut emissions by 42% by 2020 and 80% by 2050. These targets meet and exceed European agreements of which the UK is subject. As part of the Renewable Energy Strategy for the UK, the Government has set national targets for >30% of electricity to be generated from renewables (DECC, 2009a). The Scottish Government has set a target of "50% of gross electricity consumed in Scotland to come from renewable sources by 2020" (Scottish Government, 2010).

Wind energy is a means of generating electricity without producing significant airborne or waterborne toxic emissions, and is not dependant on finite reserves of fossil fuels. It is ultimately a sustainable and proven technology, a fact that is recognised the UK Government approach to the wind development. To date there have been three UK wide rounds of offshore wind development in the UK, administered by The Crown Estate. As of April 2010[1] the UK had an installed offshore wind generation capacity of 688.4 MW, with a further 1,147.8 MW under construction and 3,127.2 MW consented under Round 1 and 2 releases.

1.3 THE ROUND 3 PROCESS

In support of the UK Government's renewable energy targets, The Crown Estate initiated the Scottish Territorial Waters (STW), Round 2.5 and Round 3 offshore wind lease bids in 2008 and 2009.

[1] www.bwea.com/statistics accessed on 21 April 2010.

In 2009 The Crown Estate requested initial expressions of interest from companies wishing to be considered for developing commercial scale wind farms within the Round 3 process and the final allocation of Zone Development Agreements under the Round 3 process was determined in January 2010. Zone Development Agreements were awarded for nine zones distributed within UK waters, with a total award capacity of 32.2 GW, see Figure 1-1 and Table 1-1.

Table 1-1: Round 3 zone allocations. Source: The Crown Estate website.

Zone Ref	Location	Company/ Consortia	Size (GW)	Area (km^2)
1	Moray Firth	Moray Offshore Renewables Limited (EDP Renováveis & SeaEnergy Renewables)	1.3	520
2	Firth of Forth / Firth of Tay	SeaGreen Wind Energy Ltd (SSE Renewables & Fluor)	3.5	2,852
3	Dogger Bank	Forewind Consortium (SSE Renewables, RWE npower renewable, Statoil & Statkraft)	9	8,660
4	Hornsea	Smart Wind (Mainstream Renewable Power & Siemens Project Ventures)	4	4,735
5	Norfolk	East Anglia Offshore Wind Ltd (Scottish Power Renewables & Vattenfall Vindkraft)	7.2	6,037
6	Hastings	E.ON Climate and Renewables UK	0.6	270
7	West Isle of Wight	Eneco New Energy	0.9	724
8	Bristol Channel	RWE npower renewable Ltd	1.5	950
9	Irish Sea	Centrica Renewable Energy (& RES Group)	4.2	2,200

1.3.1 STRATEGIC ENVIRONMENTAL ASSESSMENT

The Department of Energy and Climate Change (DECC) undertook a Strategic Environmental Assessment (SEA) of a draft plan/programme to hold further rounds of offshore wind leasing in the UK Renewable Energy Zone and the territorial waters of England and Wales with the objective of achieving 25 GW of additional generation capacity by 2020.

In January 2009, DECC published the SEA Environmental Report (DECC, 2009b). The purpose of this report was to identify, describe and evaluate the likely significant effects on the environment of implementing the draft plan/programme. This included the implication of alternatives to the plan/programme and the potential spatial interactions with other users of the sea. The report was intended to provide a basis of information for formal consultation with the statutory consultation bodies and authorities and with the public.

The following alternatives to the draft plan/programme were assessed by the SEA:

- not to offer any areas for leasing/licensing;
- to proceed with a leasing and licensing programme; and
- to restrict the areas offered for leasing and licensing temporally or spatially.

After the consultation period and the Appropriate Assessment, the conclusion of the SEA was unaltered and alternative 3 was considered the preferred option, with the area offered restricted spatially through the exclusion of certain areas (DECC, 2009c).

1.4 REGULATORY AND POLICY BACKGROUND

The eastern development area is located in the UK REZ. However, jurisdiction for this area lies with the Scottish Government. Therefore, the licenses and consents required for the construction and operation of the wind farm will need to comply with Scottish legislation, where relevant.

MARINE (SCOTLAND) ACT 2010

The planning regime for development in Scotland is currently being revised after the passing of the Marine (Scotland) Act 2010. The Act introduces a framework for sustainable management of the seas around Scotland, aiming to ensure environmental protection is balanced with economic growth of marine industries. It introduces a simpler licensing system, minimising the number of licences required for development in the marine environment with the aim to reduce time taken to consent and the current system's complexity.

ELECTRICITY ACT 1989 (SECTION 36)

The development of offshore wind farms would be subject to an application for consent to Scottish Ministers under Section 36 of the Electricity Act 1989 for construction and operation. The scope of this consent will include the wind turbines, offshore substation(s) and inter-array cables.

Where a consent is granted in relation to construction and operation of an offshore wind farm under section 36A (I) of the Electricity Act 1989 (Declaration), a declaration under section 36A (I) (as outlined in section 99 of the Energy Act 2004) and section 100 of the Energy Act 2004, as respects rights of navigation may be made at the same time.

Under section 36B of the Electricity Act 1989 (as outlined in section 99 of the Energy Act 2004) the Scottish Ministers may not grant Section 36 consent where the generating station, whether in the territorial seas or the REZ, would interfere with 'recognised sea lanes essential to international navigation'. In deciding whether navigation will be obstructed, the Scottish Ministers must take into account how they intend to exercise their powers in relation to any application for a declaration to extinguish public rights of navigation and any application for a safety zone.

ENERGY ACT 2004 (SECTION 95)

Under Section 95 of the Energy Act 2004 where a renewable energy installation is proposed to be constructed, and the Scottish Ministers consider it appropriate for safety reasons, a notice declaring that specified areas are to be designated as safety zones may be issued. Such zones are intended to secure the safety of the renewable energy installation or other installations in the vicinity during construction, operation, extension or decommissioning. Importantly the purpose of the safety zone is also to secure the safety of individuals in or around the installation, vessels in the vicinity and individuals on such vessels.

REQUIREMENT FOR AN ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

The EC Directive 85/337/EEC as amended by Directive 97/11/EC (the EIA Directive) requires wind farms to be subject to EIA. The purpose of the Directive is to ensure that, in considering whether to grant consents for developments that are likely to have significant environmental effects, the consenting authorities have all the necessary environmental information on which to base their decision. Offshore wind farms are listed as a Schedule 2 project as 'installations for the harnessing of wind power for energy production (wind farms)'.

The need for an EIA for electricity generation projects requiring consent under Section 36 of the Electricity Act 1989 is provided for in Scotland by the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 and amended in 2008. These set out the statutory process and minimum requirements for EIA. Regulation 7 of the 2000 Regulations enables a written request to be submitted to the Scottish Ministers to give an opinion as to the information to be provided with the Environmental Statement (ES) (a scoping opinion).

There is also a requirement to consider cumulative and in-combination impacts as part of the EIA process. Projects to be included in such an assessment must include existing projects and those currently in the planning system. Projects to be included in such an assessment must include not only the other potential renewable energy projects but also other types of project taking place in the marine environment.

MARINE LICENSE

Under the Marine Bill (Scotland) 2010, the requirement for a Marine License was introduced. In effect, this replaces the requirement for a consent under section 5 of the Food and Environmental Protection Act (1985) (for the deposit of objects on the seabed below mean high water springs) and a consent under section 34 of the Coast Protection Act (1949) (for the deposit of objects which may endanger the safety of navigation). The primary objectives of the legislation are to protect both the marine ecosystem and human health and to minimise interference and nuisance to other legitimate users of the sea. However, until secondary legislation is passed, there is still a requirement for separate FEPA and CPA licenses.

CROWN ESTATE ACT 1961

The Crown Estate, as the main landowner of the seabed, requires a lease to be granted for the development of offshore wind farms on the marine estate. A lease will be granted when all the consents for the project have been obtained. Rights of Occupation are granted by The Crown Estate Commissioners under Section 3 of The Crown Estate Act 1961 for the purpose of placing structures on or passing cables over the seabed or foreshore. This is a statutory consent granted in the form of a lease.

HABITATS AND BIRDS DIRECTIVE: REQUIREMENT FOR APPROPRIATE ASSESSMENT

The Habitats Directive was transposed into UK Law by the Conservation (Natural Habitats &c) Regulations 1994, as amended (Habitat Regulations). This requires an Habitats Regulation Assessment to be conducted by the 'competent authority' before a plan or project that is likely to have a significant effect on designated or candidate Special Protection Areas (SPA) or Special Areas of Conservation (SAC), can be given consent, permission or other authorisation. The UK SACs and SPAs form the Natura 2000 network.

Habitats listed in Annex I and species listed in Annex II in the European Directive on the *Conservation of Wild Birds* (EC Directive 79/409/EEC) (the Birds Directive) are protected in the UK. There are 81 SACs with marine components and 73 SPAs with marine components.

EUROPEAN PROTECTED SPECIES

Annex IV of the Habitats Directive lists certain species of European Community interest which are in need of strict protection. Any of these species whose natural range includes any area in Great Britain are called 'European Protected Species'.

Licences may be given authorising activities involving European protected species of plants or animals which would otherwise be illegal under the Regulations. The licences are granted by Scottish Natural Heritage (SNH) or the Scottish Government depending on the reason for the license application.

WILDLIFE AND COUNTRYSIDE ACT 1981

The Wildlife and Countryside Act 1981 (as amended by the Countryside Rights of Way Act 2004) is the principal legislation by which wildlife is protected in the UK. All species of wild birds are afforded protection under Section 1 of the Act. Protection is afforded to animal species listed on Schedule 5 of the Act in Section 9.

1.5 OFTO PROCESS

An Offshore Transmission Operator (OFTO) will construct and manage the offshore transmission infrastructure that is required to connect the wind farm the National Grid. The OFTO infrastructure will include offshore substations, offshore export cables, landing points, the onshore substation and any onshore cables / overhead lines required to reach the onshore substation.
An OFTO will be appointed through a tendering process, run once a year and managed by OFGEM. This process will require MORL to submit all applicable data, studies and consents into a 'data room' for potential OFTO's to review and base their tender upon.

MORL is currently acting as an 'interim OFTO' and is carrying out all relevant onshore surveys and offshore surveys, in order to support the EIA and obtain the relevant consents and licences for the OFTO infrastructure. However there is currently some uncertainty regarding the implementation of OFTO process and the consenting strategy allows flexibility in the OFTO entrance window. As such the extent to which MORL will conduct work on behalf of the to-be-appointed OFTO is not currently confirmed.

The wind farm will also be subject to an application for consent under Section 37 of the Electricity Act if the onshore elements of the development require new overhead power lines

2 Project Description

This section provides a high level description of the proposed project based on information available at the time of writing. It should be noted that the wind farm design process is at an early stage, and therefore many of the detailed parameters of the project are yet to be determined.

2.1 OBJECTIVES OF THE DEVELOPMENT

The primary objective of the development is the generation of energy from a renewable source, in line with the UK and Scottish Governments targets of generating >30% and 50%, respectively, of electricity demand from renewable sources by 2020. The project will offset the emission of greenhouse gases, in line with the UK's commitments under the Kyoto Protocol.

2.2 CLEAN ENERGY GENERATION / ELECTRICITY SUPPLY

Development of wind turbines within the proposed development area will make a significant contribution towards the reduction of harmful greenhouse gas emissions that could otherwise be generated from fossil fuel electricity generation. It is estimated that the eastern development area could produce enough power for approximately 779,760 homes[2].

2.3 DEVELOPMENT AREA LOCATION

The eastern development area is approximately 22 km off the north-east coast of Scotland on the eastern section of the Smith Bank in the outer Moray Firth (see Figure 1-2). The eastern development area is approximately 296 km^2.

2.4 SITE SELECTION

Zone 1 was identified along with eight other zones by The Crown Estate using their strategic management system MaRS (Marine Resource System). "*MaRS is a decision support tool which interrogates third party data sets using GIS technology to identify potential areas for sectoral development. The tool produces three key outputs: site suitability for potential business activity, the sustainability value of that activity and financial analysis of the potential revenue to the business which will enable long term informed decision-making for marine development*" (The Crown Estate, 2010).

In order to identify development areas within Zone 1, MORL undertook a zonal constraints assessment process: this included an assessment of the known spatial constraints to wind turbine development associated with engineering properties of the area and physical, biological and human environmental constraints. All information used in the assessment was obtained from public sources.

[2] Predicted annual generation from an installed offshore wind farm, where 1 MW of installed offshore wind energy provides for 684 homes (DECC, 2009d).

A summary of the key factors influencing the choice of the eastern area for initial offshore wind farm development is listed below:

- Good access to suitable ports and local supply chain for construction and operations
- Outside any conservation designated area
- Out with the 0-6nm aviation safety zone around oil platforms with heli-decks
- Out with shipping access routes to oil platforms

The key constraints associated with the eastern section of the zone are currently anticipated to be:
- Use of the area by conservation protected species
- Use of the area by commercial fisheries
- The presence of a helicopter main route
- Ministry of Defence low flying practice areas
- Proximity and use of airspace by civil aviation
- Impact on seascape, landscape and visual receptors

The development area indicates the region in which MORL intends to develop 1-1.14 GW of wind turbines. It is anticipated that the area will be divided into wind farm sites, which may be joined to effectively form one large site, or they may be located in spatially discrete areas. The process of identifying sites within the development area is currently ongoing and this will be influenced by the results of the programme of engineering and environmental surveys and stakeholder consultation that will be carried out over the next 2 years.

2.5 THE PROPOSED SCHEME

2.5.1 TIMELINE

An indicative timeline for development of the eastern development area is provided in 2-1. The proposed programme is to undertake 2 years of studies to support the EIA and consent applications. It is currently understood the Scottish Government Energy and Consents Unit and Marine Scotland aim to determine consent applications within a 9 month period. Therefore, the award of consents would be anticipated for early-mid 2013. Pre-FEED and FEED studies will be undertaken between 2010-2013. A phased installation process will begin in 2015 and the operational wind farm is anticipated for completion in 2019.

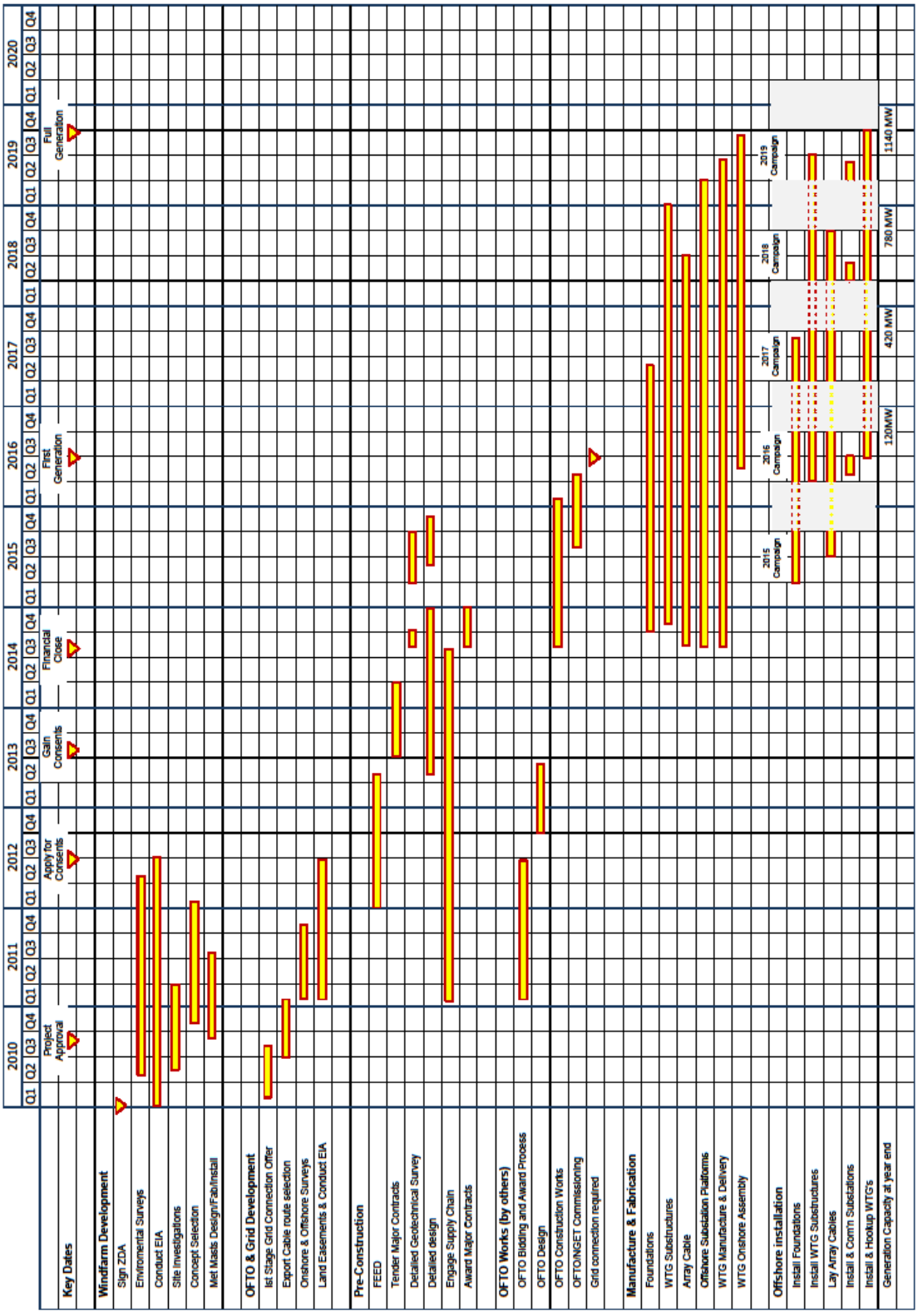


Figure 2-1: Illustrative timescale for the development

OFFSHORE WIND TURBINES

The precise type and number of turbines is currently unknown but the following will be assumed as a starting point for the purposes of environmental assessment:

- Approximately 200 turbines
- Wind turbines of between 5 – 8 MW generating capacity
- Blade tip height: 158.5 m (5MW) - 182 m (8 MW)
- Minimum water clearance at mean high water springs – 22 m
- Estimated rotor diameter: 125 m (5MW) – 150 m (8 MW)
- Estimated rotation speed: 6.9-12.1 rpm (5 MW) – 12-15 rpm (8 MW)
- Expected installed capacity of between 1,000 – 1,140 MW

Further detail on the range of wind turbine parameters to be constructed (known as the Rochdale envelope) will be provided in the Environmental Statement.

2.5.3 OFFSHORE WIND FARM INFRASTRUCTURE

FOUNDATION & SUPPORT STRUCTURES

This section includes foundations and support structures for the wind turbines, offshore substation platforms and meteorological masts.

The overriding factors influencing the choice of foundation and support structure for a specific project are the type of wind turbine to be used, nature of ground conditions in the area and water depth. Preliminary studies of ground conditions have been carried out by Senergy (2009).

Based on the known physical properties within the zone and the inherent uncertainty with the seabed properties, the most versatile and robust turbine support structure concept is likely to be a lightweight jacket structure. The generic description of 'lightweight jacket structures' covers a number of different concepts including:

- Braced monopods
- Tripod structures
- Four legged jacket structures

The actual structure type can be tailored to suit the variable water depths and seabed gradients. Jacket foundation design borrows from the expertise built up from oil and gas operational experience in the North Sea, recognising the dynamics associated with wind turbine support structures. Possible foundation types will include pin piles or suction caissons.

Other structure concepts are considered less suitable for the following reasons:

- Monopiles appear to be practically and economically unfeasible in water depths greater than approximately 30 m as monopile diameter is limited by available hammers and lateral capacities, and their dynamic response becomes problematic;
- Gravity base structures are likely to be prohibitively large, heavy and expensive for the water depths under consideration, as well as being relatively 'soil sensitive structures';

- Guyed towers could appear to be highly efficient; however, the risks to shipping from the mooring wires and the reduced operating integrity of the wind farm due to potentially damaged wires is high; and
- Floating structures are a new technology currently under development, however they are typically better suited to sites with water depths greater than those expected across the proposed development area.

The installation methods for substructures are not detailed at this stage as there is limited experience in constructing offshore wind farms in deep water. The recent Alpha Ventus offshore wind farm substructure installation showed a refinement of the techniques used on the Beatrice Demonstrator project by using a template to drive the 4 corner piles before placing the jacket substructure on them. This is currently the most up to date installation method for this type of foundation but the exact methodology, vessels and logistics to be used will require detailed study and design work.

These represent preliminary findings and will be reviewed when site specific survey data is available. Other than monopiles, MORL is not officially ruling any particular foundation type out at this stage due to changing economic and technological circumstances that may prove one or another technology more appropriate nearer the time of construction.

Turbine support structures will include access facilities and appropriate lighting and marking for surface navigation. Options for the configuration of the support structures, and details of their potential environmental impacts, will be included in the Environmental Statement.

SCOUR PROTECTION

The substructure and foundation concept as well as the current regime approaching seabed level defines the type and extent of scour protection required, and typically a 'scour allowance' is specified when designing types of North Sea jackets. However, as foundation size increases the potential scour depth around the structure also increases and hence there is a greater the need to protect the foundation, i.e. it becomes more efficient to protect the foundation rather than utilise a design scour protection allowance.

North Sea gravity platforms have used rock dump in a relatively complex scour protection blanket, involving the dumping of carefully specified and graded rock to satisfy both stability criteria of the surface armour layer, but also the performance of a filter layer to prevent finer material being drawn through the armour layer.

The suitability of installing rock dump or mattresses for cable protection especially around turbine bases will be assessed based on the seabed current data across the proposed development area.

Electrical Infrastructure

The electrical infrastructure required will comprise of inter-turbine cables: an array of submarine cables to collect the energy generated by the wind turbines and transmit it to a number of central points (offshore platforms). These cables are likely to be at 33 or 66 kV and may include fibre-optic communication links. A number of offshore substations may also comprise part of the offshore wind farm infrastructure. All other electrical infrastructure will be owned and operated by the offshore transmission operator (OFTO).

At this stage it is anticipated that array cables will be buried to a depth of approximately 1.0m (as is typical for offshore hydrocarbon pipelines and umbilicals) other than close to turbine and substation foundations and areas where ground conditions make it impracticable. The actual design depth of burial will be addressed in the concept development and defined in the FEED, based on a number of factors, including potential environmental effects, fishing and other activities, dropped object risk assessments etc.

2.5.4 OFFSHORE TRANSMISSION INFRASTRUCTURE

The purpose and functions of the offshore and onshore transmission infrastructure associated with the Eastern Development Area will be detailed in a separate OFTO scoping report. The following sections aim only to provide stakeholders with an overview of the entire offshore wind farm development(s) as they would exist in operation.

The project will require transmission infrastructure for transferring the energy generated by the wind turbines into the National Grid transmission system. This will form the offshore transmission infrastructure and will be constructed and owned by the Offshore Transmission Operator (OFTO; see section 1.5). The EIA associated with the offshore transmission infrastructure will be subject to a separate scoping report and potentially a separate impact assessment. However, a description of the infrastructure that is likely to be required is provided below.

Electrical Infrastructure
The electrical infrastructure required will comprise the following:

- Offshore Substation Platforms: a number of platforms, located within the Project area housing substations which will form the interface between the inter-turbine cables and the offshore transmission system.
- Offshore Transmission System: a number of submarine export cables between the offshore platforms and the shore, which are used to transmit the energy generated by the wind turbines to the shore. These cables are likely to be 275kV AC but could be HVDC (High-voltage DC) depending on the distance to the onshore connection point. The number of cables required will be determined by the overall capacity of the wind farm and the voltage used (132kV, 275kV, 400kV, HVDC). The cables may include fibre optic communication links.
- Cable Landfall: The point at which the submarine cables are physically brought ashore.
- Onshore Substation: the interface between the offshore and onshore transmission systems.
- Onshore Transmission System: a number of circuits (either overhead or underground) which transmit the energy generated by the wind turbines from the onshore substation to the connection point.
- Transmission System Connection Point: the interface into National Grid transmission system.

ELECTRICAL INFRASTRUCTURE – DETAILED DESIGN
The design of the electrical infrastructure is at an early stage. In order to provide the required level of detail on the project that will be required for the EIA, options are currently being considered by MORL for the following key components:

- Type, number and location of turbines
- Number and location of offshore substation platforms
- Subsea cabling specification (AC or DC, voltage levels i.e. 33kV / 132 kV / 275V)

- Inter-array cabling
- Location of cable landfall site(s)
- Offshore cable routes between the platforms and the shore
- Location of transmission system connection point and onshore substation(s)
- Routes of overhead lines or underground cables for transferring the power from the shore to the transmission system.

CABLE LANDFALL

The choice of sites for the cable landfall will be subject to the investigation and assessment and will be guided by the identification of an onshore substation location which will be dependent upon the grid connection offer from National Grid. All potential options will be considered in terms of technical, environmental and commercial terms before a final decision is made.

2.5.5 METEOROLOGICAL MASTS AND OTHER MONITORING EQUIPMENT

Meteorological masts (met-masts) are used to measure the meteorological characteristics of the area.

Meterological data currently available for this area is of limited quality. The principle source has been data estimated from the UK Met Office wave model calibrated using experience gained at Beatrice during the DOWNVInD project and the Met Office's own model validation data.

As part of the proposed development within the Round 3 zone further meteorological measurement devices will be used. The devices to be deployed may include the following:

- Offshore met-mast(s);
- Onshore met mast located close to the shoreline; and
- A LiDAR system on a fixed platform.

Depending on the development of new measurement techniques and their state of the art, other devices may include:

- Floating met-mast; and
- Floating Lidar system.

The exact locations of all the instrumentation have yet to be decided, but it is anticipated that the met-mast will be installed within the proposed wind farm site area. The foundations of the met-mast are anticipated to comprise of a jacket structure and a steel lattice tower, the height of which will be nominally 100 m above mean sea level. The potential use and locations of the other infrastructure are still to be determined.

The required consents and licences will be sought for all proposed meteorological and oceanographic equipment that may need to be installed throughout the development process.

2.6 WIND FARM CONSTRUCTION

2.6.1 ENVIRONMENTAL MANAGEMENT

Prior to construction, a comprehensive Environmental Management Plan (EMP) will be implemented in consultation with statutory consultees, with a suite of complementary management plans corresponding to different aspects of the construction activity. The EMP will form a component part of the construction contract for the development. The documents, which will be tailored specifically to ensure compliance with the consent conditions for the project and current environmental best practice, will include the following:

- Monitoring Protocol (as per statutory consents)
- Incident Reporting and Non Conformance Procedure
- Emergency Response Plan
- Collision Risk Management Plan
- Marine Pollution Contingency Plan
- Dropped Objects and Materials Recovery Plan
- Archaeological Plan
- Noise, Dust and Vibration Management Plan
- Waste Management Plan

The EMP is a live document and will therefore be revised for pre-construction, construction and operational phases. Any monitoring and/or mitigation methods that are considered in the final Environmental Statement will be incorporated in the pre-construction, construction and operation EMPs, where relevant.

2.6.2 CONSTRUCTION

Offshore construction is likely to occur over a period of four to five years. Only limited information is available at present on the nature of the construction process, since the major parameters of the proposed development have not yet been defined in detail. Key aspects in defining the construction methodologies (and therefore the likely construction activities) will be choices on the following:

- Port(s) used as a base for the construction phase
- Vessels to be used for the offshore construction works.

Decisions on these will also be influenced by the nature of the support structures to be used, which will be addressed during the EIA phase. More detail on the options for ports and vessels will be provided in the ES. However, for the purpose of this document, it can be assumed that the principal stages of manufacturing and transporting the various wind farm components to sites within the zone are likely to be as follows:

- Manufacture of components (including foundations, towers, nacelles, blades, gearbox, generators etc, as well as electrical components);
- Transport of components to the area;
- Storage and assembly of components as required at the port location(s) chosen as the construction base;

- Marine transportation of components to site of installation;
- Moving construction vessels to the installation site.

It can be assumed that the key stages associated with the installation of the wind farm are likely to be as follows:

- Pre-construction site investigation (i.e. CPT / boreholes);
- Foundation installation and associated site preparation;
- Disposal, if necessary, of any spoil excavated during installation;
- Installation of tower, nacelle, hub and blades;
- Installation of meteorological masts
- Installation of offshore transformer platforms (owned by MORL); and
- Inter-turbine cable installation.

Other works associated with the OFTO are likely to include

- Installation of offshore transformer platform(s);
- Potential installation of DC platforms;
- Export cable installation;
- Construction of the required onshore electrical infrastructure (such as terrestrial cables, substations and overhead lines) to link the development to the National Grid transmission system, and associated traffic.

It should be noted that construction compounds and storage facilities are likely to be required at the ports used as the construction base(s). In addition, construction compounds, laydown areas and access / haulage tracks are likely to be required for the construction of any onshore electrical infrastructure.

It is likely that the installation of cables between wind turbines within the array and from the wind farm to the shore will be performed from floating or submerged craft. The applicability / suitability of burying the cables will be assessed using a detailed trenching review and burial protection index study.

2.7 WIND FARM OPERATION

2.7.1 ACCESS TO SITES

Operation and maintenance of the offshore wind farm(s) will continue 24 hours per day; 365 days per year, and therefore the final site(s) identified within the proposed development area will require access to the site(s) at any time.

2.7.2 LIGHTING AND MARKING

The lighting and marking of the wind farm will be agreed in consultation with the Northern Lighthouse Board, the General Lighthouse Authority (GLA) for Scotland and the Isle of Man, the Maritime and Coastguard Agency (MCA), the Civil Aviation Authority (CAA) and the Ministry of Defence (MOD).

The positions of the wind turbines, subsea cables and ancillary structures will be conveyed to the UK Hydrographic Office (UKHO) so that they can be incorporated into Admiralty Charts and the Notice to Mariners procedures.

2.7.3 WIND FARM CONTROL

Once commissioned, the wind farm(s) will operate automatically with each turbine operating independently of the others. The operation and control of the wind farm(s) will be assessed by a Supervisory Control and Data Acquisition (SCADA) system, installed at each turbine and at the onshore control base. The SCADA system will enable the remote control of individual turbines or the wind farm in general, as well as information transfer, storage and the shutdown of any wind turbine in emergency circumstances.

2.7.4 WIND FARM INSPECTION AND MAINTENANCE

The wind farm will be serviced and maintained throughout its life (c. 50 years with repowering) from a local port. Maintenance of a wind farm is normally separated in to three categories:

- Periodic overhauls
- Scheduled maintenance
- Unscheduled maintenance

PERIODIC OVERHAULS

These will be carried out in accordance with the turbine manufacturer's warranty. They are planned for execution in periods of the year with the best conditions, preferably in the summer.

They are carried out according to the supplier's specifications and typically include function and safety tests, visual inspections, analysis of oil samples, change of filters, lubrication, check of bolts, replacement of brake pads, oil change on gear box or hydraulic systems, etc.

SCHEDULED MAINTENANCE

This applies primarily to inspections and work on wear parts susceptible to failure or deterioration in between the periodic overhauls. A scheduled inspection of each turbine is likely to occur every 6-12 months. Tasks will typically include inspection on faults and minor fault rectification.

Scheduled maintenance will be performed using small personnel craft operated from the local harbour.

UNSCHEDULED MAINTENANCE

This applies to any sudden defects. The scope of such maintenance would range from small defects to complete failure or breakdown of main components. Such maintenance would require the intervention of construction vessels similar to those involved with the construction of the wind farm.

Inspections of support structures and subsea cables will be performed on a regular basis as will ad-hoc visits for surveillance purposes.

2.8 OPERATION MANAGEMENT (ENVIRONMENTAL)

The wind farm will be designed, constructed and operated to a high standard, incorporating the appropriate levels of environmental control. Effective and environmentally aware management will minimise the impact of the development on the local environment.

MORL will require the main contractors responsible for construction, operation and decommissioning of the wind farm to operate an Environmental Management System in accordance with ISO 14001 and the appropriate 'best practice' guidelines will be in place at the time of decommissioning.

2.9 WIND FARM DECOMMISSIONING

The Crown Estate lease is likely to be for 50 years, with the design life of the turbines and other components of the wind farm being of a similar order when repowering is considered. Decommissioning will be a key requirement by The Crown Estate lease agreement and Energy Act 2004 and will influence all stages of design of the wind farm. This will be addressed in the Environmental Statement.

The wind turbines, cables and support structures will be decommissioned following the end of their operational life. The extent of decommissioning is dependent on the type of support structure adopted, and options will be assessed in conjunction with the design of the development in the Environmental Statement.

2.10 PORTS & HARBOURS

Ports and or harbours will be required during the construction and operation & maintenance phases of the project. During the construction phase, deepwater ports with facilities for pre-assembly (e.g. site office, laydown areas, warehouses etc) will be required. The ports or harbours used during the operation & maintenance phase are likely to be smaller than that used during construction. MORL are in the process of identifying and agreeing which ports and harbours will be used during the lifetime of the project.

3 Cumulative and In-combination Impacts

Cumulative impacts are the effects of one type of development with other types of the same development (i.e. wind farms and other wind farms). In-combination effects are the effects of the above in combination with other, different projects and activities (e.g. wind farms in combination with dredging or wind farms in combination with oil infrastructure development).

Not all existing or planned infrastructure/operations will be used in each individual impact assessment. However, the following provides a list of those infrastructure/operations which may be used within the EIA. Developments which will be included within the cumulative impact assessment for the eastern development area sites include:

- Moray Firth Round 3 zone western development area;
- Beatrice Offshore Wind Farm; and
- Beatrice demonstrator offshore wind turbines.

Developments/Activities which will be included within the in-combination impact assessment for the eastern development area sites include:

- Existing oil infrastructure
- Proposed oil infrastructure developments or activities (e.g. Polly well and/or seismic activity)
- Existing commercial fisheries in proximity to the proposed development area
- OFTO infrastructure works associated with MORL offshore wind farm sites
- OFTO infrastructure works associated with the Beatrice offshore wind farm
- Ministry of Defence operations (where known)
- Moray Firth marina development
- Proposed Shetland-Viking subsea cable
- Potential offshore HVDC hub.

In light of the potential for cumulative and in-combination impacts, MORL and Beatrice Offshore Wind Limited (BOWL) have formed the Moray Firth Offshore Wind Developers Group (MFOWDG), in association with The Crown Estate. The purpose of MFOWDG is to allow for collaboration to identify potential cumulative effects and ensure a standardised approach to their future assessment as part of individual project Environmental Impact Assessments (EIAs). This standardised approach is anticipated to be in line with those methodologies being prepared by the Forth and Tay Offshore Developers Group (FTOWDG).

MORL also intends to have discussions with other Moray Firth stakeholders to determine the potential for in-combination impacts with other marine users in the area.

A similar approach was previously applied during the development of Round 2 offshore wind farm sites in the Thames and the Wash, whereby developers collaborated and agreed with statutory consultees and key stakeholders a common approach to baseline surveys and assessments which then supported the assessment of cumulative effects.

4 Consultation

4.1 RELATIONSHIPS AND STAKEHOLDER ENGAGEMENT

The proposed project will be of interest to a wide range of organisations, individuals and communities, especially in north-east Scotland and a stakeholder engagement strategy has been produced to encourage and enable them to be part of its development.

The strategy details our approach to communications and outlines the intended programme of activities and communication requirements associated with the eastern development area, including but not limited to:

- Identification of Stakeholders
- Methods of Engagement
- Management of Communications

Both EDP Renováveis and SERL have significant experience in the utility, renewables and oil and gas industry, with regard to engaging and consulting with stakeholders and recognise the importance of developing and maintaining good relationships.

MORL remains committed to engaging with the communities in which they operate, to address any concerns they may have in advance of the project application submission. This will be achieved through the various processes detailed in our strategy, including letters, meetings, events and exhibitions, newsletters and websites.

A programme of activities has been developed for communication and consultation with key stakeholder groups including:

- Statutory consultees
- Aviation organisations
- Recreational organisations
- Business & Enterprise
- Environmental organisations
- Fisheries
- Government, Regional and Local Authorities
- Landscape and Cultural Heritage
- Elected Representatives
- Local Communities
- Defence
- Navigation and Shipping organisations
- Other Users
- Tourism

Communications with these stakeholder groups will be co-ordinated by MORL Stakeholder Manager, Craig Milroy.

5 Preliminary Environmental Considerations

This section is divided into three areas and includes the potential for impacts of the proposed development on the physical, biological and human environment. A holistic approach to the EIA process will be taken, which will identify the potential inter-linking of the environmental features and the potential for indirect impacts.

Existing baseline information, data gaps, scoping of potential impacts, guidance documents and EIA methodologies are presented if the information has been available at the time of writing.

The location of export cables is not currently known, and any potential impacts will be discussed in a separate scoping report.

5.1 PHYSICAL ENVIRONMENT

Key aspects of the physical environment that are relevant to understanding the potential environmental impacts of construction and operation of the wind farm are categorised as follows:

- Geology
- Bathymetry
- Wind climate
- Hydrodynamics (wave climate and tidal regime)
- Sedimentary and Coastal Processes

Modification of these environmental factors does not necessarily imply an impact of the wind farm, if there is no resulting impact upon sensitive environmental, ecological or socio-economic receptors that are either of concern to local stakeholders or subject to special protection under the law. These receptors must be separately identified and their sensitivity characterised by the scoping process.

In the following sections, the present day baseline condition of the above items is summarised with particular consideration for the location of the proposed development. The understanding of the present day environment informs the subsequent EIA scoping.

In the EIA issue scoping section, consideration is then given to particular potential modifications to the baseline environmental processes and pathways. Where the baseline environmental condition is thought likely to be modified by the development, an initial list of relevant receptors is identified and a study approach is proposed to assess the issue.

5.1.1 DATA SOURCES

The following previously collected or developed data sources provide information on the present natural physical environment:

General:
- UK Offshore Energy Strategic Environmental Assessment, DECC

- SEA 5: Strategic Environmental Assessment of parts of the northern and central North Sea to the east of the Scottish mainland, Orkney and Shetland, DTI

Additional sources for:

Geology, bathymetry and Sedimentary and Coastal Processes -
- UK Hydrographic Office Admiralty Charts
- British Geological Society
- Satellite geodesy and ship soundings by Smith & Sandwell
- SEA 5: Seabed and Superficial Geology and Processes (Holmes et al, 2004)
- Remote sensing and aerial photography (Google Earth)

Wind -
- UK Meteorological Office
- Beatrice demonstrator project

Hydrodynamics (waves and tides) -
- UK Hydrographic Office
- UK Meteorological Office wave model data
- Wavenet directional wave buoy data
- British Oceanographic Data Centre
- National Tide and Sea Level Facility
- Scottish Environmental Protection Agency
- Atlas of Renewable Energy Resources (BERR, 2008)

5.1.2 PHYSICAL ENVIRONMENT

5.1.2.1 BASELINE ENVIRONMENT

The baseline environmental description is provided in the context of the whole Zone rather than the eastern development area.

5.1.2.2 BATHYMETRY AND GEOLOGY

The following overview of the geological environment of the Moray Firth provides a context for both the metocean and sedimentary environments. Descriptions of the deeper geological units are of relevance when considering the likely nature of any potential drill arisings.

A review of the existing bathymetry and geology for the proposed development area was undertaken by Senergy (2009) and as part of national strategic studies by Holmes *et al*. (2004). The findings relevant to this study are summarised below.

The geomorphology (which includes the bathymetry) of the outer Moray Firth is characterised by a number of banks and deep water channels; the largest bank feature being the Smith Bank. Within the proposed site, water depths range from approximately 35 m LAT to 60 m LAT; there is a deep water channel to the north of the site which is up to 70m deep and maximum water depths elsewhere in the Firth can be as deep as 110m (Figure 5-1; Admiralty Chart 115; Smith & Sandwell, 1997).

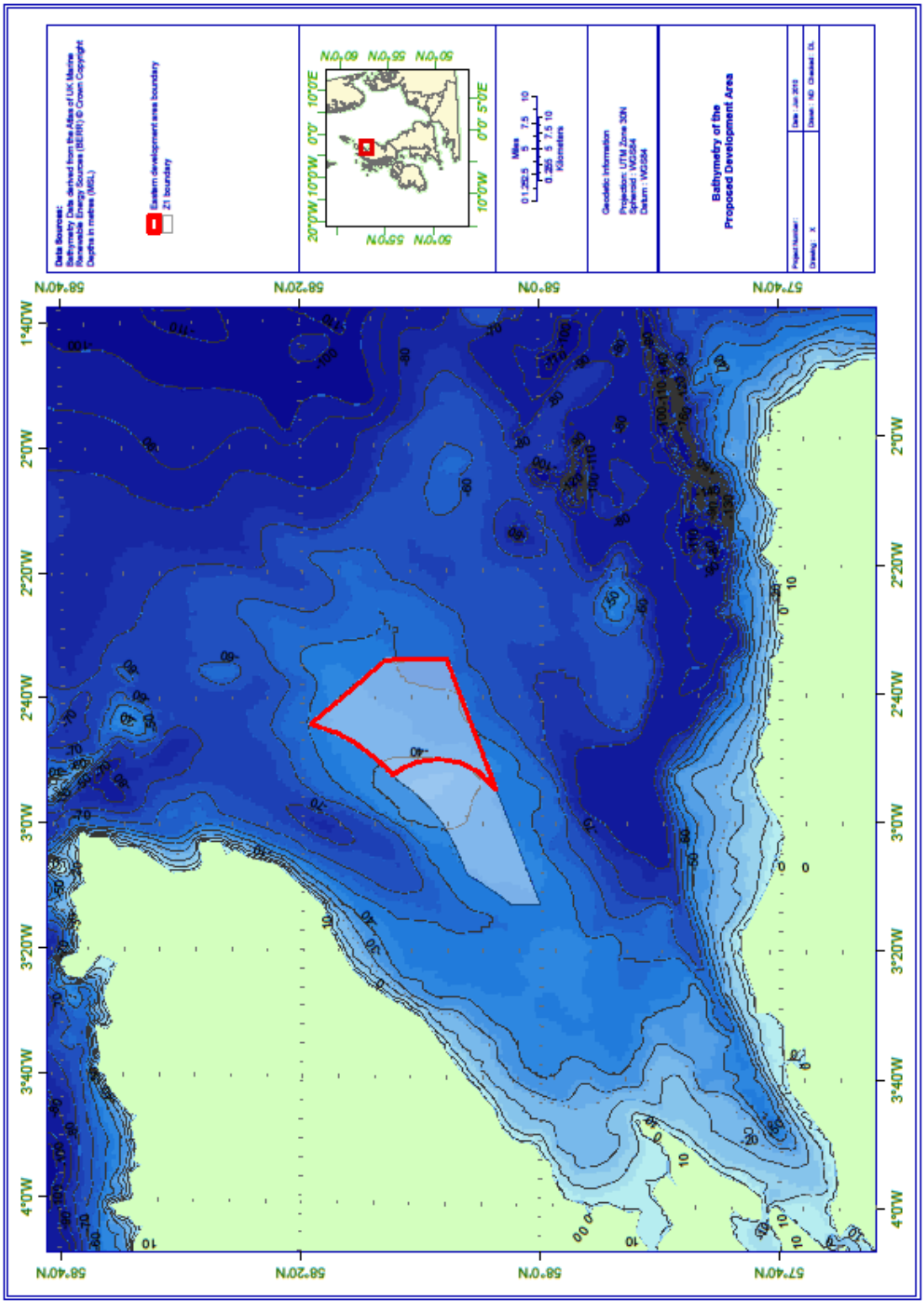


Figure 5-1: Bathymetry of the proposed development area.

The bathymetric datasets (Admiralty Chart 115; Smith & Sandwell, 1997) and assessment of a selective coverage of high resolution bathymetry data by Holmes *et al*. (2004) suggest that the seabed undulates gently across the proposed development area with no indications of extreme or rugged topography; a discrete area of megaripples approximately 50m in length and 0.5 to 1m high has been reported on the northern flank of the Smith Bank (Holmes *et al.*, 2004). It should be noted that the charted data sets do not provide the level of detail needed to define local topographic irregularities and the high-resolution data was only of limited spatial coverage.

The present day seabed surficial soils were laid down within the last 10,000 years during the Holocene Epoch. The British Geological Society (BGS) reports that these seabed sediments comprise sand or gravelly sand to sandy gravel and are present in a layer between 1 and 2m thick.

Holocene sediments are underlain by Quaternary soils of the Pleistocene Epoch, deposited between 2,300,000 and 10,000 years before present (BP) and is described by geological unit in Table 5-1. Although the geological units within the development area are described as undifferentiated, they can be correlated to formations present east of the Inner Moray Firth Basin.

The Quaternary soils are underlain by Lower Cretaceous bedrock, which is described in Table 5-1. These range from argillaceous shales and siltstones, calcareous sandstones and possibly limestones and are described as Cromar Knoll sediments. The Cromar Knoll sediments are known to behave as firm to very hard clay with thin laminae or layers of find sand and mica and have been sampled as such in boreholes acquired for the Beatrice and Jacky platforms.

Table 5-1: Summary of Soil Deposits

Approximate Thickness of Unit (m)	Unit	Anticipated Soil Description
1 – 2m thick	Holocene	Loosely consolidated sand or gravelly sand to sandy gravel
10 - 25m thick	Quaternary (Forth Formation)	Medium dense to very dense fine to coarse sand with sections of very soft to soft clay and gravel
5 – 10m thick	Quaternary (Coal Pit Formation)	Soft to very hard sandy clay with laminae of fine sand and mica
>100 m thick	Lower Cretaceous (Cromar Knoll)	Firm to very hard clay with thin laminae or layers of find sand and mica

Faulting has been detected in the Lower Cretaceous sediments up to the base of the Quaternary soils (Holmes *et al*., 2004).

There is no evidence at this stage to suggest that shallow gas is present across the development area (Holmes *et al*., 2004).

There is no evidence of chalk or peat deposits in the underlying geology that might be resuspended as a result of drilling activities.

The UK and the Moray Firth in particular are areas of low seismicity and the risk to offshore structures is considered to be correspondingly low (Health & Safety Executive, 2002; Holmes *et al*., 2004).

It is also noted that there is the possibility for the occurrence of potentially hazardous unexploded ordnance (UXO) which may occur as a result of military practice within the area and historic practices of inaccurate ammunition dumping (Senergy, 2009). This "man-made" occurrence would potentially pose a hazard to construction. Other human environment seabed obstructions are discussed in section 5.3.8 and section 5.3.11.

5.1.2.3 METOCEAN ENVIRONMENT

The following overview of the metocean climate provides an indication of the magnitude and variability of the driving forces to the sedimentary environment. Of particular relevance is the wind and wave climate, which is shown in the following section to largely control sediment transport and natural turbidity in the Firth. Tidal processes, playing a secondary but not insignificant role in guiding the direction of sediment transport, are shown to be largely benign.

5.1.2.4 WIND CLIMATE

The following summary of wind climate in the Moray Firth is important to the study in so far as it controls wave climate at the site. Wave climate will be shown in the next section to be the dominant control on sediment transport processes in the outer Moray Firth and within the proposed development.

Wind data most closely representative of the Moray Firth Round 3 Zone are currently available from two sources. The primary source for in-situ measured wind data in the outer Moray Firth is a LiDAR installation on the Beatrice Alpha platform, which was installed in 2006 to support the Beatrice Demonstrator project. In addition, hindcast data are available from a UK Met Office meteorological model which has two data cells located at the eastern and the western ends of the Zone. The data were for an effective height of 19 m above sea surface and were obtained in the form of annual and monthly frequency statistics based on approximately 9 years of hindcast data.

EDPR/SeaEnergy Renewables (2009) have reviewed the wind climate for the Moray Firth Round 3 Zone area to characterise and quantify the likely energy yield of the development area.

The annual average statistics are summarised inFigure 5-2 in the form of wind roses for the full data set (annual average) and for representative summer (June) and winter (December) periods. The data show winds most commonly originate from south-westerly or south-easterly directions with wind speeds up to 12m/s. During summer months, wind speeds do not typically exceed 12m/s, but are more likely to come from a wider range of wind directions. Stronger winds (from 12 to 25m/s) tend to occur only in winter months and dominantly come from south-westerly through to northerly directions. The frequency of relatively calm conditions (<3m/s wind speed) is also seasonal (i.e. more frequent in summer months); calm conditions occur approximately 9-10% of the year on average.

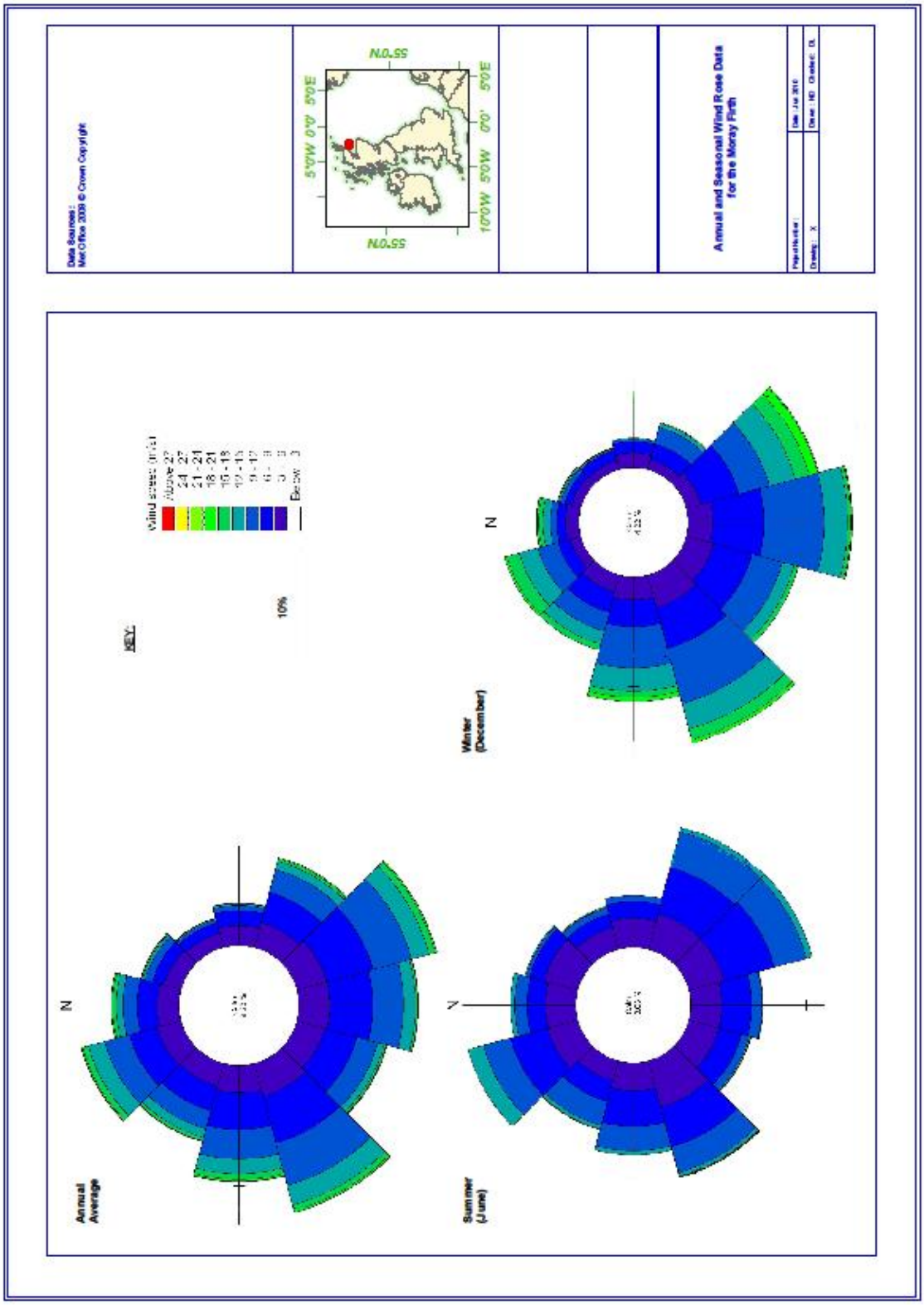


Figure 5-2: Annual and Seasonal Wind Rose Data for the Moray Firth

TIDAL REGIME

The Moray Firth is characterised by a progressive, open coastal tidal regime. The tidal wave initially approaches from the north, from the northern North Sea, becoming aligned to the axis of the Firth in the vicinity of the Zone. The maximum tidal range in the Zone is 3.6 to 3.9m, i.e. a meso-tidal environment, decreasing with distance into the Firth. The tidal range is relatively small in comparison to the typical total water depths around the site (35 to 70m).

Tidal currents in the Zone are however notably weak, with peak near surface mean spring current speeds of only 1.2kts (0.65m/s); tidal current speeds are typically less near to the bed and for a significant proportion of the time during neap tidal conditions. Tidal currents are similarly weak into the inner Moray Firth but may be slightly greater in the vicinity of narrower tidal inlets. The tidal current streams are typically aligned to the adjacent north or south coastlines over much of the region but rotate in central parts to describe a smooth sweep of the tide into, across and out of the Firth.

Both tidal range and therefore tidal current speed predictably vary on a variety of timescales from hours (tidal cycle) to weeks (spring-neap) to months (solstice-equinox) to years (the 18.6 year nodal cycle). Mean water levels may also vary over the lifetime of the development as a result of a combination of climate change affecting mean sea level globally and regional post-glacial rebound of the underlying geology.

The northern extent of the Zone is near to the eastern approaches to the Pentland Firth, characterised by much stronger tidal current speeds. This area of more energetic tidal exchange is not thought to significantly influence tidal behaviour in the Zone itself, but may affect adjacent parts of the outer Moray Firth.

Significant storm surges are generally reported to be of relatively small amplitude in the Moray Firth, in comparison to the larger values observed elsewhere in the North Sea (2 to 3m). This is attributed to the protection afforded by the position, shape and relative orientation of the Firth in the North Sea. The modelled extreme, depth averaged, surge currents over 50 years in the Moray Firth are about 0.60 to 0.80m/s (Flather, 1987). It should be noted that, depending on their timing, storm surge effects can either be relatively accentuated or negated by normal tidal processes.

WAVE CLIMATE

The outer Moray Firth is exposed to large storm driven waves with long wave fetches from offshore directions. The largest fetch for wave development is from the north through to north-east, however, depending on the actual direction of approach, the position of the Zone behind the Wick peninsula may offer variable degrees of protection, potentially leading to variation in wave exposure over the site.

The height of short to intermediate fetch length wind waves generated within the Firth will depend upon the wind direction as well as the speed, which controls the wave fetch length. The previously described wind climate suggests that wave climate and storm intensity will be seasonal in nature and will include a wide range of approach directions.

Table-5-2 summarises the general range of wave and tidal conditions expected across the proposed development area (UKHO, 1996; ABPmer, 2004; HSE, 2002 – c.f. Senergy, 2009).

Table-5-2: Hydrodynamic conditions expected across the proposed development area

Hydrodynamic feature	Expected measurements
Maximum tidal range(1)	+3.6 to +3.9m
Maximum total water depth(1)	38.6 to 63.9m
Peak spring tide current (near surface)	0.5 – 1.2 kts (0.27-0.65m/s)
Annual mean significant wave height	1.4 - 2.1 m
Significant wave height, 50 year storm	9 - 11 m

(1)The tidal range above is taken from the level of the Lowest Astronomical Tide (LAT) to the Highest Astronomical Tide (HAT), which vary over the length of the site.

(2),Charted water depths in the site are in the range 35-60m relative to LAT or chart datum (CD),

Sources: Admiralty Chart 1407; Admiralty Chart 1409; British Isles and Adjacent Waters Co-Tidal and Co-Range Lines Chart 5058 (1996); Health & Safety Executive (2002); ABPmer, 2004; Admiralty Tide Tables (2009).

CLIMATE CHANGE

Climate change is an important and contemporary issue which may potentially affect the normal baseline environmental conditions at the site over the lifetime of the proposed development; the predicted effects of climate change are irrespective of the development's presence or chosen design. Of most relevance to an offshore wind development, climate change is predicted to cause a rise in mean sea level and an increase in average storm intensity with time. The exact magnitude and rate of these changes are not widely agreed at present due to the uncertainty involved in predicting climate change. However, the UK government does issue guidelines for appropriate consideration of these factors.

The effects of climate change are likely to be most evident along the shorelines where much of the wave energy is ultimately dissipated, potentially leading to modified rates of littoral sediment transport. The advancing position of mean high water on beaches may also lead to wave energy dissipation higher up on the foreshore with anticipated beach loss and scour in front of sea walls. In offshore areas, the relative water depth over sandbanks may increase, leading to greater exposure of the coast to the larger waves from offshore directions. Any potential effect of the proposed wind farm development will also need to be considered within the context of these natural changes.

Increased wave energy offshore may have consequences for the frequency and magnitude of sediment transport events resulting in elevated levels of suspended sediment concentrations (SSC) within the area, despite any influences brought about by the proposed development.

5.1.2.5 SEDIMENTARY ENVIRONMENT

REGIONAL SEDIMENTARY PROCESSES

The following overview of regional sedimentary processes demonstrates the stable nature of the regional geology of the Moray Firth where sedimentary bodies largely comprise relic (erosion resistant and stable) features. Also, that sedimentary processes are typically low-energy and dominantly episodically wave driven. A further consideration of naturally occurring sediment resuspension reaffirms the importance of storm waves in driving such processes.

The description of regional sedimentary processes by Holmes *et al*. (2004) as part of the SEA 5 report, is consistent with the descriptions of sediment distribution, wave climate and tidal regime published elsewhere and as described in the following sections. The findings of the Holmes *et al*. report for the Moray Firth and Smith Bank in particular are summarised in the following paragraph.

The geomorphology (bathymetry) of the outer Moray Firth is characterised by a number of banks and deep water channels; the largest bank feature being the Smith Bank. Across much of the Firth, bedrock is overlain by relatively erosion resistant gravelly moraine deposits; the majority of the volume of the Smith Bank is reported to comprise such bedrock and moraine units (stabilising the long term position of the Bank). These sedimentary units are widely overlain by relatively thin layers (1-2m thick) of Holocene sediments, mainly comprising sands and gravels but also biogenic carbonate (shell) material, in varying proportions across the Firth. Some deposition of fine (muddy) sediments has been observed in deeper channels, such as Smilers Hole along the southern margins of the Firth.

On the basis of the observed bed features and the sediment types present in comparison to the typical wave climate and tidal regime, sediment transport processes in the outer Moray Firth are considered unlikely to be driven by the normal tidal currents. Rather, the evidence shows that the magnitude of sediment transport processes is dominated by less frequent but more energetic storm events through wave action at the seabed; however, the direction of transport typically remains orientated to the tidal axis. Storms may have a relatively greater or lesser frequency and magnitude of effect in different parts of the Moray Firth as the strength of wave action felt at the bed is moderated by the local water depth.

Observations of the Smith Bank in particular provide a similar picture. The sediment veneer of the Smith Bank is typically smooth with few significant seabed sedimentary features, indicative of a normally low energy environment and low rates of sediment transport. An area of sand waves (50m wave length, 0.5-1m wave height) was observed on the northern flank of the bank (outside of the development area) during a DTI swath bathymetry survey in 2003, but no similar features were found elsewhere; other topographical irregularities near to the crest of the bank are thought to be caused by outcrops in the underlying hard geology. Surficial sediments were found to be relatively coarser on the north and east flanks of the bank and also possibly thicker than 2m near the crest (no alternative value was provided).

In addition to the above summary of the offshore environment, a review of aerial photography (Google Earth, 2010) indicates that the northern coastline adjacent to the site typically comprises a rocky and sometimes cliffed shoreline with occasional wave cut rock platforms and gravelly beaches; these become more extensive and sandy (i.e. softer coastlines) with distance into the Firth. A similar pattern is observed on the southern coastline of the Firth but also with a more frequent occurrence of pocket embayments and small sandy or rocky inlets. This pattern suggests that coastal processes at the coastline will be spatially variable in type and also therefore in response and susceptibility to the potential impacts of the proposed wind farm development.

SUSPENDED SEDIMENTS

As outlined in the following section, the strength of the normal tidal regime in the Moray Firth is considered insufficient to drive sediment transport. Local processes are instead thought to be dominated by nearbed wave action during occasional high-energy storm events. As a result, SSC, especially in the upper water column, will be typically low during periods of calm weather and/or in the absence of large swell waves.

However, levels of SSC can also be expected to rise significantly, both nearbed and extending upwards into the water column, during and for a short time after storm events when wave action at the seabed is sufficient to mobilise and resuspend the local sediments. Following a storm event, SSC will gradually decrease (settle out) to a baseline condition, controlled by the ambient regional tidal regime. The degree of local seabed disturbance and the resulting levels of SSC will depend upon the duration and intensity of the storm and the resulting character of the waves that are produced; local variability in SSC may also be observed depending upon the local sediment type (resistance to erosion) and water depth (controlling wave attenuation).

There are no known significant fluvial sources of SSC in the outer Moray Firth.

Due to the seasonal nature of the frequency and intensity of storm events, levels of SSC will likely follow a broadly seasonal pattern. It is possible that seasonal blooms of marine organisms may also contribute to seasonality in measurements of total turbidity, but this is not directly associated with resuspension of (inorganic) sediments.

5.1.3 DATA GAPS

The available historical data describing the physical environment are not presently of suitable quality or resolution to support either detailed Environmental Impact Assessment or the engineering design of the offshore wind farm. Data previously collected for the Beatrice Demonstrator project is also over 5 years old (environmental characteristics may have changed and the data collection targeted a smaller area outside of the present development). Therefore, more detailed survey data will be required to fill these data gaps. The combined data set will be used to more accurately predict the potential for impacts of the development on known sensitive receptors.

5.1.4 ENVIRONMENTAL IMPACT SCOPING

Based on the available literature, it is considered that the potential impacts on the physical environment as a result of constructing, operating and decommissioning a wind farm in the Moray Firth Round 3 Zone may include:

Impact Description	**Potential site specific impact**	**Potential cumulative and/or in-combination Impact**
Changes to hydrodynamic (wave and tidal) conditions	✓	✓
Changes to the sedimentary environment	✓	✓
Changes to sedimentary structures	✓	✓
Changes to suspended sediment concentrations	✓	✓

Consideration of the above issues will be made with respect to the following spatial scales, as relevant to the proposed development:

- Near-field (i.e. the area within the immediate vicinity of the turbine grid); and
- Far-field (e.g. the coastline, sites of scientific and conservation interest).

5.1.4.1 SITE-SPECIFIC IMPACT ASSESSMENT METHODOLOGY

For each of the potential impacts described above, the potentially present sensitive receptors, the surveys or studies required to address outstanding data gaps and a proposed method of impact assessment are described in the tables below. In each case, a more specific list of sensitive receptors relevant to the site will need to be identified via the scoping and stakeholder feedback and agreed in advance with the regulator for consideration in the ES.

Potential Impact	**Changes to hydrodynamic conditions**
Sensitive Receptors	Potentially sensitive receptors include: • Surfing wave climate on the south coast of the Moray Firth. • Safety of nearby offshore infrastructure affected by modified wave climate. And, if identified during stakeholder engagement: • Navigational safety in the vicinity of adjacent ports affected by modified wave climate.
Survey/Study Proposed to	To inform studies to determine the potential for impacts on the wave and tidal regime, the following surveys and studies will be undertaken:

Assess Impact	• Identification of key recreational surfing venues and identification of key port and offshore infrastructure. • Bathymetric surveys • Metocean surveys: ADCP surveys and wave buoys • Computational modelling
Method of Impact Assessment	A more specific list of sensitive receptors will be identified for study. Historical and newly collected survey data will be used to inform conceptual and numerical modelling which will be used in turn to determine the magnitude, extent and significance of changes in the wave climate within the Outer Moray Firth affecting the identified sensitive receptors.

Potential Impact	**Changes to the sedimentary environment & Changes to sedimentary structures**
Sensitive Receptors	Potentially sensitive receptors include: • The form and function of the Smith Bank surficial sediments. • Sediment transport pathways affecting the form and function of similar adjacent sedimentary systems. • Changes to patterns of coastal sediment transport affecting coastal stability and recreational beach resource. • Loss of habitat due to sediment displacement as a result of scouring around the base of turbine foundations.
Survey/Study Proposed to Assess Impact	To inform studies to determine the potential for impacts on the sedimentary environment during the operational phase of the wind farm, the following surveys and studies will be undertaken: • A more detailed review of sedimentary information including the location of potentially susceptible coastlines in the Outer Moray Firth. • Bathymetric surveys • Side-scan sonar • Benthic survey and review of key habitats present • Metocean surveys: ADCP surveys and wave buoys • Seabed sediment samples & particle size analysis • Suspended sediment concentration monitoring • Computational modelling
Method of Impact Assessment	A more specific list of sensitive receptors will be identified for study. Historical and newly collected survey data will be used to inform conceptual and numerical modelling which will be used in turn to determine the magnitude, extent and significance of changes in the sedimentary environment affecting the identified sensitive receptors.

Potential Impact	Changes to suspended sediment concentrations
Sensitive receptors	Potentially sensitive receptors include: • Habitats and ecosystems sensitive to modification of the naturally present levels of suspended sediment or rates of sediment deposition (if found to be present).
Survey/Study Proposed to Assess Impact	To inform studies to determine the potential for changes to normal patterns and levels of suspended sediment concentration during the construction (foundation and cable installation) and operational phases of the wind farm development, the following surveys and studies will be undertaken: • Benthic ecology surveys • Bathymetric surveys • Side-scan sonar • Metocean surveys: ADCP surveys and wave buoys • Seabed sediment samples & particle size analysis • Suspended sediment concentrations • Sub-bottom geophysical survey and vibro-coring • Computational modelling
Method of Impact Assessment	A more specific list of sensitive receptors will be identified for study on the basis of the benthic surveys, informed by the detailed bathymetric and side-scan sonar surveys. If sensitive receptors are found to be present, historical and newly collected survey data will be used to inform conceptual understanding in conjunction with numerical modelling which will be used in turn to determine the magnitude, extent and significance of changes in the typical levels of suspended sediment concentration and their potential for re-deposition.

The following issues have been considered and are scoped out of the proposed study:

- Due to the presence of only a thin layer of mobile Holocene sediments overlying erosion resistant sedimentary units, it is considered that there will be no significant impact on the underlying geology of the site or the regional bathymetry. Therefore, these subject areas have been **scoped out**.
- Due to the naturally benign tidal regime in the region, it is considered that there will be no significant impact on the tidal regime in relation to navigational safety either within the site or in the surrounding area. Therefore, this subject area has been **scoped out**.
- The presence of UXO is not considered as a potential impact to the environment but will be considered a potential impact to the safety of the construction programme.

5.1.4.2 CUMULATIVE AND IN-COMBINATION IMPACT ASSESSMENT

Cumulative impacts arise where the footprints of potential impacts (e.g. areas of reduced wave height or tidal current speed) of two or more simultaneously present developments overlap, resulting in a greater potential impact locally.

In-combination impacts may arise where the footprint of temporary impacts (e.g. plumes of suspended sediment) from two or more simultaneously occurring operations overlap, resulting in a greater potential impact locally. Operations with the potential to result in in-combination effects may also include other marine operations unrelated to the wind farm construction such as cable or pipe laying and dredging.

There is foreseeable potential for the extent or magnitude of environmental impacts identified in the previous sections to be cumulatively increased by the simultaneous presence of the Moray Firth and Beatrice offshore wind farm developments. The extent to which these cumulative effects may arise will depend upon the number, design and array layout of foundations in each development.

The extent to which in-combination effects (e.g. sediment resuspension from foundation installation) may arise, will depend upon the anticipated construction schedules and the likelihood of such activities occurring at the same time in both developments. No other regular activities with potential to cause in-combination effects were identified in the Outer Moray Firth.

The methodologies with which cumulative and in-combination effects will be identified and assessed will be agreed with consultees as part of a future scoping exercise.

5.1.4.3 SITE SPECIFIC SURVEY METHODOLOGY

BEST PRACTICE GUIDANCE

The survey designs will take into consideration industry best practice for each survey type and best practice survey/data requirements to inform upstream modelling and analysis methods which are foreseeably part of EIA. These will ensure both a sufficient quantity and quality of data are collected:

- Marine Guidance Note MGN 371 (compliance with International Hydrographic Organisation (IHO) Order 1 standards)
- CEFAS (2004)*. Offshore Wind Farms – Guidance note for Environmental Impact in respect of FEPA and CPA requirements.
- COWRIE (2009) Coastal Process Modelling for Offshore Wind Farm Environmental Impact Assessment: Best Practice Guide. Eds: Lambkin, D.O., Harris, J.M., Cooper, W.S., Coates, T.
- SUT (2005). Guidance Notes on Site Investigation for Offshore Renewable Energy Projects (UK Society for Underwater Technology (SUT)
- JNAPC (2006). JNAPC Code of Practice for Seabed Development – Joint Nautical Archaeology Policy Committee

*This guidance is expected to be revised in 2010 to account for the potential impacts of the Round 3 offshore wind farm programme.

5.1.4.4 SUMMARY OF METHODOLOGY

GEOPHYSICAL SURVEYS

Geophysical surveys commenced in May 2010 and are expected to complete in Q3 2010.

Analogue seabed surveys are to be undertaken to provide data on the bathymetry, seabed features and sub-bottom conditions to at least 40 m depth below the surface for input to turbine foundation planning. In particular, it is planned to map the distribution and thickness of the Quaternary soils within the survey area. A UHR digital survey is also being undertaken. This is designed to extend the depth of investigation achieved by the analogue surveys. The survey will provide information on any geotechnical features that may impact foundation design. A minimum penetration of 100 m below the seabed is required.

The equipment that is being used includes:

- Analogue and digital: Multi-beam echo sounder to map seabed bathymetry across the development area.
- Analogue and digital: Single beam echo sounder to confirm water depth along the vessel track.
- Analogue only: Dual frequency digital side scan sonar to identify obstructions, habitats, archaeological features and sediment distribution.
- Analogue and digital: Hull-mounted 'pinger' sub-bottom profiler to image near-seabed geology and buried features.
- Analogue only: Second sub-bottom profiler chosen to image intermediate depth geology.
- Digital only: UHR digital sub-bottom profiler system to image intermediate and deep geology.
- Analogue only: Magnetometer/gradiometer to identify igneous intrusions and ferro-magnetic objects.

Stage 1 of the surveys encompass the entire Zone 1 R3 area, using primary line spacing of 600 m and cross-line spacing of 1000 m. Stage 2 of the analogue surveys will encompass a detailed infill of the eastern development area, with primary line spacing of 300 m and cross-line spacing of 500 m. Stage 2 of the digital surveys will encompass a detailed infill of the eastern development area with primary line spacing of 150 m and cross-line spacing at 500 m (Figure 5-3).

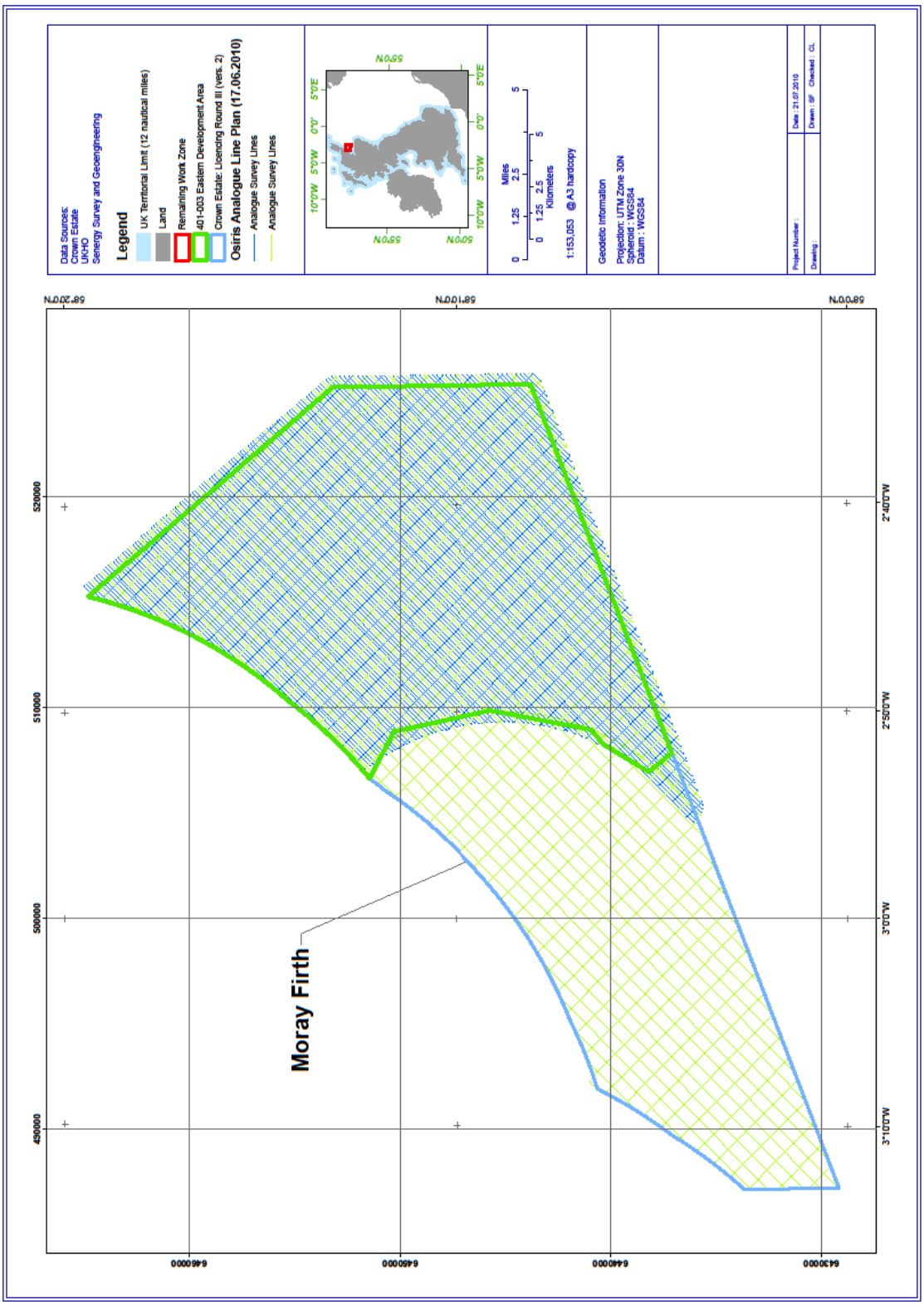


Figure 5-3: Geophysical survey transect lines

GEOTECHNICAL SURVEYS

Geotechnical and benthic surveys will be used to establish ground truth against which geophysical data can be correlated and to determine and quantify surficial and sub-surface sedimentary conditions. Following the execution of the detailed geophysical survey, and the integration of the results into a geo-spatial model, a preliminary geotechnical survey will be designed and specified; a benthic survey aimed at characterising the distribution of benthic habitat and ecology in the site will also be designed. The survey scope is dependent on the apparent variability in seabed and sub-soil conditions shown by the geophysical results. However, typical surveys may include:

- Seabed surficial sediment grab sampling and PSA analysis;
- Cone Penetration Tests; and
- Vibrocorer.

METOCEAN SURVEYS AND MODELLING

The metocean campaign was commenced in June 2010. The campaign includes one directional wave buoy and four seabed frames each with an acoustic doppler current profiler (ADCP, measuring wave climate, tidal height and tidal current profiles), an optical backscatter device (OBS, measuring suspended sediment concentration) and a static sediment trap. The wave, tidal and turbidity data that are collected will be used to inform and validate coastal process models of the area. A limited amount of seabed sediment sampling will also be undertaken at the locations of the deployed devices in addition to other seabed sampling programmes. The wave buoy will be in the water for a period of at least 6 months or longer until a representative range of typical conditions are successfully observed (including calm and storm events and at least one 1 in 1 year event from each of the three characteristic wave fetch sectors). The seabed frames will be deployed for a minimum of 29 consecutive days to provide at least two full neap-spring tidal cycles of concurrent tide, wave and turbidity data.

illustrates the locations of the equipment.

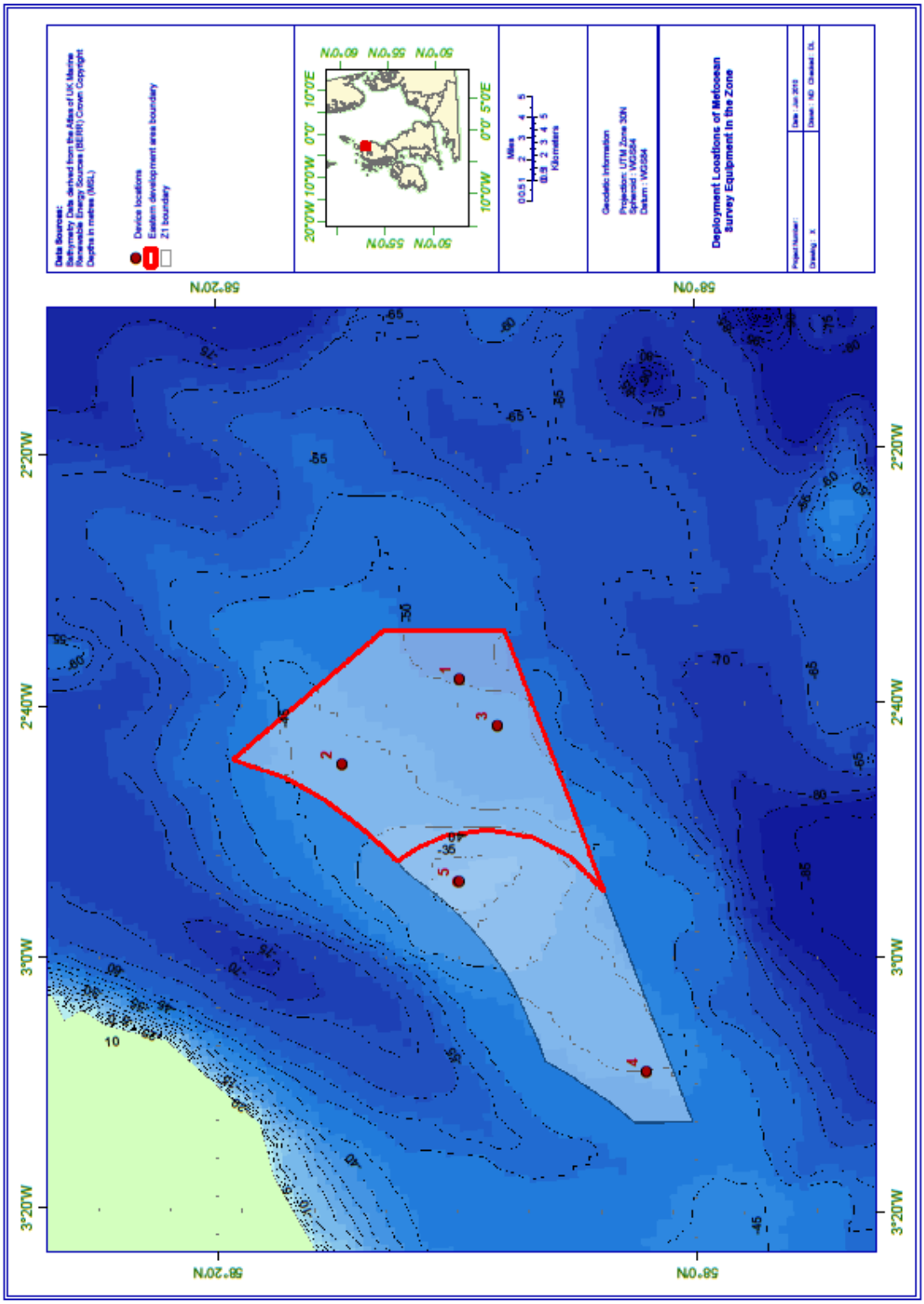


Figure-5-4: Deployment Locations of Metocean Survey Equipment in the Zone.

A numerical model of coastal process and metocean conditions will be designed and applied within the study according to best practice guidance for numerical modelling in relation to EIA for offshore wind farms (COWRIE, 2009). Once suitably calibrated and validated, the numerical model can be used to inform assessments of the magnitude and significance of impacts to any sensitive receptors identified, caused directly by changes to the following environmental processes:

- Hydrodynamics (e.g. wave climate, tidal regime);
- Sedimentary environment (e.g. sediment composition and particle size, sediment re-suspension, sediment transport pathways and sediment deposition);
- Sedimentary structures (e.g. channels, banks); and
- Suspended sediment concentrations (SSCs).

The results of the physical modelling will also be used to inform the following associated impact assessments:

- Benthic ecology
- Fish
- Nature conservation
- Archaeology and culture heritage
- Recreation
- Potential cumulative and in-combination impacts

5.1.4.5 METEOROLOGY

Meteorology (primarily wind) data is expected to be collected from a combination of methods, such as onshore met masts and weather stations, offshore based LiDAR and, later in the development programme, an offshore met-mast.

5.1.4.6 POTENTIAL MITIGATION METHODS

Potential mitigation measures associated with changes to the sedimentary environment include the type and design of turbine foundation, the use of scour mats around turbine bases and the choice of construction techniques, including installation of foundations and cable burial.

The mitigation measures proposed in the final ES will be dependent upon the infrastructure choices available after the preliminary front end engineering design work (which will be influenced by engineering properties of the area and the cost of materials) and the potential impacts to sensitive receptors found to be present, as determined by the EIA scoping and further studies. Options of mitigation will be discussed and with the relevant authorities prior to submission of the ES.

5.2 BIOLOGICAL ENVIRONMENT

The biological environment receptors are categorised as follows:

- Benthic Ecology
- Fish and Shellfish
- Marine Mammals
- Ornithology
- Designated Sites

5.2.1.1 DATA SOURCES

The following data sources provide information on the existing biological environment at the current time:

General:
- Marine Scotland (formerly known as Fisheries Research Services)
- UK Offshore Energy Strategic Environmental Assessment, DECC
- SEA 5: Strategic Environmental Assessment of parts of the northern and central North Sea to the east of the Scottish mainland, Orkney and Shetland, DTI
- Beatrice Demonstrator Project Environmental Statement
- Scottish Natural Heritage (SNH)
- Joint Nature Conservation Council (JNCC)
- Universities

Additional sources for:

Benthic ecology -
- Marine European Seabed Habitats
- European EUNIS habitat classification system, JNCC
- The Marine Life Information Network for Britain and Ireland (MarLIN)

Fish and shellfish -
- International Council for Exploration of the Sea (ICES)
- Centre for Environment, Fisheries and Aquaculture Science
- Fishbase
- Marine Conservation Society
- Commercial fisheries data (see section 5.3.2)

Marine Mammals -
- Sea Mammals Research Unit (SMRU)
- Special Committee on Seals (SCOS)
- Atlas of cetacean distribution in north-west European waters, JNCC
- Small cetacean abundances in the North Sea (SCANS – I and II)
- Aberdeen University Lighthouse Field Station
- Department of Energy and Climate Change – Assessing the impacts of seismic surveys in the Moray Firth
- NORCET Ferry Surveys

- The Seawatch Foundation
- Cetacean Research (and Rescue) Unit
- Whale and Dolphin Conservation Trust (WDCS)

Ornithology –
- The Crown Estate enabling actions survey data for Round 3
- Wildfowl and Wetlands Trust (WWT)
- European Seabirds at Sea database, JNCC
- Royal Society for the Protection of Birds (RSPB)
- British Trust for Ornithology (BTO)
- Regional Bird Groups

Designated sites –
- Centre for Ecology and Hydrology
- The National Trust
- Royal Society for the Protection of Birds

5.2.2 BENTHIC ECOLOGY

5.2.2.1 BASELINE ENVIRONMENT

The most comprehensive benthic studies in the Moray Firth have been conducted on the Smith Bank (McIntyre, 1958; Hartley & Bishop, 1986; DTI, 2004; Ithaca, 2008), which coincides with the location of the Round 3 zone area and the Beatrice oil field (Hartley & Bishop, 1986; Talisman, 2006). There have been few studies of the other offshore benthic habitats of the Moray Firth, although some sampling was conducted within the outer Moray Firth as part of the SEA 5 process (DTI, 2004).

Callaway *et al*. (2002) investigated the benthic epifauna of the North Sea, including a sample site in the outer Moray Firth. The authors noted that the free-moving community was dominated by crustaceans such as *Pagarus bernhardus* and echinoderms such as *Asterias rubens* and *A. irregularis*. The sessile fauna was noted as being diverse, with abundant hydrozoans, bryozoans and tube-dwelling polychaetes. Jennings *et al*. (1999) sampled a site very similar in location to that described by Callaway *et al*. (2002). They classified the mobile epifauna as a 'central' North Sea sub-group, dominated by *A. rubens* and the crustaceans *Crangon allmanni* and *P. bernhardus*. Sessile epifauna belonged to a 'north' North Sea sub-group, dominated by the bryozoan *Flustra foliacea* and the hydroid *Hydrallmania falcata*. Survey data from SEA 5 for the outer Moray Firth (DTI, 2004) indicated that sediments were variable, ranging from generally coarse sediment cover to muddy, very fine to fine sands becoming finer with depth. The macrofauna was relatively consistent, with numerically dominant taxa including species characteristic of stable fine sands (e.g. the polychaete worm *Galathowenia oculata agg*., the amphipods *Ampelisca tenuicornis* and *Harpinia antennaria*, and echinoid *Echinocyamus pusillus*). The capitellid polychaete *Peresiella clymenoides* was widely distributed in both areas (DTI, 2004).

Benthic surveys of the Beatrice oil field area (1986), the Beatrice demonstrator site (ERT, 2005; Talisman, 2006) and the SEA 5 surveys (DTI, 2004) all indicate that the infaunal taxa is relatively uniform across the region, characterised by fine sand species with the numerically dominant taxa being annelida, bivalves, crustacea and echinoids. Of these, annelida are numerically dominant (Hartley & Bishop, 1986; ERT, 2005). High diversity has been recorded within the Beatrice oil field and demonstrator sites (Hartley & Bishop, 1986; ERT, 2005), with up to 233 macrofaunal taxa

recorded by ERT (2005). Hartley & Bishop (1986) suggested that the high species abundance in the area was more comparable with inshore areas such as Sullom Voe than areas further offshore.

Hartley & Bishop (1986) described several community types in the Beatrice area as a result of the variable sediment characteristics (and therefore the variety of habitats present). These ranged from an assemblage in finer muddier sand sediment in slightly deeper waters in the south and west of the field, dominated by bivalve, seapen and polychaete species; to the coarser sand (>5% gravel) sediments of the Smith Bank in the northeast, dominated by bivalves and elevated numbers of polychaetes. Localised patches of shell gravel were inhabited by faunal communities characterised by molluscs. Two fine sand communities were also distinguished, typified by the abundance of *T. flexuosa* in muddier sediments and *Crenella decussata* in coarser deposits.

A recent site specific survey for the nearby Jacky development in Block 12/21 showed some variation in the faunal community between the nine sampling stations. Most samples were of medium to coarse sands and dominated by polychaetes, whilst 2 stations contained a high proportion of gravel and pebbles and the fauna was dominated by epifauna (Ithaca, 2008).

Although site specific sampling has not yet been carried out for the proposed development area, survey data for the nearby Beatrice area, Smith Bank and Jacky Development area show consistent results in terms of benthic species composition and diversity and we would therefore expect the proposed development area to show similar benthic characteristics to these sites, with a high species diversity and dominance of polychaetes, molluscs, crustacean and echinoderms.

Rare or protected benthic species

Important species potentially found in the Moray Firth include the horse mussel *Modiolus modiolus* and the fan mussel *Atrina fragilis* (UK BAP, 2010). *Modious modiolus* is common throughout the inner Moray Firth and solitary individuals have been recorded in gravel/pebble substratum areas around the Hacky platform (Ithaca, 2008). However, there are no known areas of *Modiolus* reef (an Annex I habitat). The fan mussel is protected under Schedule 5 of the Wildlife and Countryside Act 1981 and both *Modiolus* beds and the fan mussel are also listed on the UK Biodiversity Action Plan.

The cold water coral *Lophelia pertusa* has been observed on several oil installations in the North Sea (Bell & Smith, 1999; BMT Cordah, 2004) and may occur on suitable substrates in the outer Moray Firth, although no colonies of conservation interest are currently known.

5.2.2.2 DATA GAPS

Site specific surveys will be required to determine the potential for Annex I habitats and the anticipated similarity of benthic communities with previous surveys of the outer Moray Firth.

5.2.2.3 ENVIRONMENTAL IMPACTS SCOPING

Based on available literature, the following are perceived to be the potential impacts on benthic ecology as a result of wind farms within the marine environment:

Impact Description	Potential site specific impact	Potential cumulative and/or in-combination Impact
Temporary increases in suspended sediment concentrations from trenching, augering, seabed preparation (plume effects) and temporary increases in sediment deposition from plumes	✓	✓
Release of contaminants bound in sediments	✓	✓
Loss of seabed habitat through presence of turbines and foundations, and (albeit temporary) loss due to inter array and export cabling	✓	✓
Change in hydrodynamic regime and sediment transport leading to changes in habitats such as scour effects	✓	✓
Colonisation of turbines leading to a change in the benthic ecology and/or an increase in biodiversity	✓	✓
Potential release of pollutants from construction plant e.g. from accidental spillage/leakage or sacrificial anodes	✓	✓

5.2.2.4 IMPACT ASSESSMENT METHODOLOGY

For each of the potential impacts described above a survey or study and method of impact assessment is described in the tables below. The potential effects listed have been developed from (a) relevant guidance notes and (b) ESs published for other Round 1 and Round 2 offshore wind farms.

Potential Impact	**Temporary increases in suspended sediment concentrations from trenching, augering, seabed preparation (plume effects) and resultant temporary increases in sediment deposition from plumes.**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Filter/suspension feeding species To determine potential increases in suspended sediment loads and deposition the following studies and surveys are proposed: Drop Down Video Benthic Grabs: Infaunal and Particle Size Analysis (PSA) Beam Trawls; 2m scientific
Method of Impact Assessment	The benthic environment will be described using standard marine ecological survey techniques (i.e. bathymetry and sidescan sonar with ground truthing using benthic grab, drop down video and epibenthic trawl; Davies *et al*., 2001; Boyd *et al*., 2002; CEFAS *et al.,* 2004). Ground truthing locations, both within the

	development area and the sphere of likely impact (i.e. tidal excursion), will be selected on the basis of data from the bathymetric and sidescan sonar surveys. The aim of ground truthing methods will be to characterise the benthic ecology of the area and determine the biotopes present, their extent and relative conservation importance. An assessment of impacts of sediment resuspension and deposition upon the benthic environment will be carried out within the EIA based on a review of the ecientific literature and results of monitoring data from other Round 1 and 2 OWF. Impact significance will be determined using standard EIA methodologies. Annex I reefs will be identified using methodologies compiled by JNCC (Gubbay, 2007; Irving, 2009).

Potential Impact	**Release of contaminants bound in sediments**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Filter/suspension feeding species - Trophic web To determine potential contaminants bound in the sediments the following studies and surveys are proposed: Desk top study of historical contaminants within the surrounding seabed. If historical contamination is identified then it may be necessary, following discussions with statutory authorities to undertake: Chemical analysis of sediments (from subsamples from the benthic grab survey)
Method of Impact Assessment	The data obtained during the desk study (and benthic survey) will be used to assess the likelihood of sediment contamination using standard EIA methodologies and comparison against Canadian Interim Sediment Quality Guidelines and CEFAS Action Levels In Dredged Materials.

Potential Impact	**Loss of seabed habitat through presence of turbines and foundations, and (albeit temporary) loss due to inter-array and export cabling**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Regional benthic community To determine potential loss of seabed habitat the following studies and surveys are proposed: Drop Down Video Benthic Grabs (and PSA) Beam Trawls A detailed benthic characterisation survey is proposed across the development area, plus the surrounding area (as described above) to identify the biotopes and habitats present (including Annex I reefs).
Method of Impact Assessment	Potential impacts through direct habitat loss will be assessed via quantifying any losses in terms of % loss of certain biotopes/habitats, previous experience gained during the assessment of Round 1 and Round 2 OWF and standard EIA methodologies.

Potential Impact	**Change in hydrodynamic regime and sediment transport leading to changes in habitats such as scour effects.**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Regional benthic community To determine potential impacts of alterations of the local hydrodynamic regime and sediment transport the benthic ecology will be characterised through the following studies and surveys: Drop Down Video Benthic Grabs (and PSA) Beam Trawls
Method of Impact Assessment	Potential impacts on the benthic environment through scour/sediment transport changes will be assessed by applying the findings of the coastal processes assessment to the characterisation benthic datasets, and previous experience gained during the assessment of Round 1 and Round 2 OWF and standard EIA methodologies.

Potential Impact	**Colonisation of turbines leading to a change in the benthic ecology and biodiversity**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Regional benthic community The benthic ecology and biodiversity will be characterised through the following studies and surveys: Drop Down Video Benthic Grabs (and PSA) Beam Trawls
Method of Impact Assessment	This characterisation biotope data will be used to assess the impact of increased hard substrate area on the surrounding marine ecology. Reference will also be made to the results of monitoring programmes for other OWFs and other relevant literature (Linley *et al.*, 2007) in order to determine the communities likely to become established on the turbines. Standard EIA methodologies will be used to determine significance.

Potential Impact	**Potential release of pollutants e.g. from accidental spillage/leakage or sacrificial anodes**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Regional benthic community - Trophic web The benthic ecology will be characterised through the following studies and surveys: Drop Down Video Benthic Grabs (and PSA) Beam Trawls
Method of Impact Assessment	The potential impact of the release of pollutants will be assessed during the EIA using standard EIA methodologies and previous literature and experience gained from Round 1 and 2 OWF, taking consideration of the likely mitigation measures.

	Potential for accidental spillage or leakage to be mitigated by correct servicing and maintenance of equipment and vessels, together with adherence to best practice and appropriate legislation, including appropriate Pollution Control Plans, Site Environment Management Plans and onsite monitoring/reporting.

5.2.2.5 SITE-SPECIFIC SURVEY METHODOLOGY

BEST PRACTICE GUIDANCE

The following references provide best practice guidance for use in assessing impact upon benthic ecology:

- Davies *et al*. (2001). Marine Monitoring Handbook
- Boyd *et al*. (2002). Guidelines for the Conduct of Benthic Studies at Aggregate Dredging Sites. (To be updated and reissued early 2010)
- NMMP (2003). National Marine Monitoring Programme Green Book. V7.
- CEFAS (2004). Offshore Wind Farms: guidance notes for Environmental Impact Assessment in respect of FEPA and CPA requirements. Version 2
- DEFRA (2005) Nature conservation guidance on offshore wind farm development
- Hendrick *et al.* (2006). *Sabellaria spinulosa* reef: a scoring system for evaluating 'reefiness' in the context of the Habitats Directive
- Gubbay (2007). Defining and Managing *Sabellaria spinulosa* Reefs: Report of an Inter-agency Workshop
- OSPAR (2008). OSPAR Guidance on Environmental Considerations for Offshore Wind Farm Development
- IEEM (2009). Guidelines for Ecological Impact Assessment in Britain and Ireland - Marine and Coastal Consultation document
- Irving (2009). Identification of the Main Characteristics of Stony Reef Habitats under the Habitats Directive. Summary of an Inter-agency Workshop 26-27, March 2008

SURVEY DESIGN

The following provides an indicative scope to undertake a benthic ecology characterisation utilising Drop Down Video (DDV), benthic grabs and beam trawls, to characterise the site so that potential impacts may be identified and assessed and also to inform a subsequent preconstruction (baseline) survey. The proposed surveys and brief methodologies are outlined in the following sections. The final survey design will be based upon the findings of the geophysical survey and will be agreed with Marine Scotland, JNCC and SNH.

The spatial extent and timing of the proposed benthic survey will be discussed with Marine Scotland Science and JNCC. The sampling methodology will be based on a systematic grid sampling array, over the extent of the tidal excursion and the wave affected region behind the device, and in discreet reference sites in similar areas of habitat but beyond the zone of influence of the proposed development area. Exact sample locations will be informed by the suite of geophysical surveys proposed for the site, including swathe bathymetry, side scan sonar and sub bottom profiler. The analysis of this data will be used to inform the positioning of sites to ground truth broad sediment types identified and inform the micro-siting of sample locations in order to ground truth the presence of substrate features identified as possible Annex 1 habitats such as *Sabellaria, Modiolus* and *Mytilus* reefs. Final positions will be in agreement with Marine Scotland, JNCC and SNH.

DROP DOWN VIDEO SURVEY

It is recommended and proposed that a combined DDV and benthic grab sampling survey be undertaken, with the DDV conducted prior to the deployment of a grab sampler. The deployment of a DDV would allow the identification of benthic species and biotopes, which will provide in-situ information to augment benthic data obtained using a grab sampler. The deployment of the DDV will also allow for the identification of any potential Annex 1 designated under the Habitats Directive features by trained marine biologists in the field, prior to the deployment of a grab. Any potential Annex 1 habitat (e.g. biogenic reefs such as *Sabellaria*, *Modioulus* and cobble reefs) features would be subject to DDV only, rather than a combination of drop down video and benthic grabs.

The video tracks and photographic stills from the DDV survey will be reviewed and analysed using office based facilities and undertaken by experienced marine ecologists. The DDV footage will be used to assign epibenthic biotopes based on the habitat and species present at each station. Species will be identified using video stills and their abundance or percent coverage quantified using the SACFOR scale. Substrate composition will be recorded based upon the Folk classification and textural group. Where possible, this assessment will be conducted on three images per station and one average relative abundance score (on the SACFOR scale) assigned to each station. Epibenthic biotope classification will then be conducted using the JNCC Marine Habitat Classifications for Britain and Ireland (Conner *et al*., 2004) based on those communities present.

Relevant data will then be transferred to GIS format so that spatial plotting of information can be achieved. Information gathered from the benthic surveys will be interpreted to provide a biotope map for the area and detailed information on the location and extents of any Annex I habitat features within the vicinity of the proposed offshore wind farm. The report will highlight significant species and habitats within the context of nature conservation. Where appropriate, reference will be made to relevant legislation and the known geographical distribution of the feature.

BENTHIC GRAB SURVEY

Benthic infaunal sampling is required to characterise and determine baseline conditions and the sensitivity of benthic species and communities within proximity to the site. Limited benthic sampling may be undertaken in areas identified as containing potential Annex I habitats. Sediment sampling will be undertaken in order to determine the physical nature of the substrate to aid faunal community characterisation and allow assessment of associated seabed disturbance. Samples will also be taken for sediment chemistry (if deemed necessary following discussion with client and regulatory authorities).

The survey has been designed based on guidance provided by 'Procedural guideline No. 3-9 – quantitative sampling of sublittoral sediment biotopes and species using remote operated grabs' included in the JNCC Marine Monitoring Handbook (Davies *et al*., 2001). Reference has also been made to Guidelines for the conduct of benthic studies at aggregate extraction sites (Boyd *et al*., 2002).

Samples will be collected using a suitable grab. It is recommended that a day grab or Hamon grab be used depending on the substrate composition. The grab will be fitted with stainless steel jaws, to allow for sediment chemistry sampling if required.

PARTICLE SIZE ANALYSIS (PSA)

Each sediment sample will be processed in the laboratory through sieves over the range 64 mm to 63 µm (0.063 mm) on the Wentworth scale in accordance with (Boyd *et al*., 2002) to determine the particle size composition of the seabed sediments. The sediment is washed through a 63 µm (0.063 mm) sieve and the retained material oven dried at 80ºC before being transferred to the coarsest of a series of stacked sieves.

These are placed on an automatic shaker for 15 minutes and the contents of each sieve subsequently weighed. Material washing through the 63 µm sieve will be collected in pre-weighed beakers, oven dried at 30ºC and weighed as a separate fraction. This fraction can be analysed by laser sizing should this be required for coastal process studies.

For each sampling station the results will be expressed as cumulative percentage of each particle size passing through each sieve size. For the purposes of the report and the statistical analysis to be carried out, these percentages are converted to absolute percentage retained on each sieve size.

BENTHIC INFAUNA ANALYSIS

The preserved sample material will be processed in a suitably accredited laboratory by carefully washing the samples with a large volume of tap water through a 1mm sieve. Samples will be elutriated with water in order to float off the smaller, lighter components of the fauna. These will be retained on a fine mesh sieve (250 µm), transferred to a petri dish and all fauna picked out under a binocular zoom microscope.

For samples with large quantities of retained material, (where time constraints make examination of the whole fraction under a microscope unrealistic) material will be placed in griddled, white trays and sorted by eye to remove all remaining fauna. The faunal samples will be preserved in 70% IMS for identification, enumeration and specimen coding following Picton and Howson (1999; CD ROM Version). Colonial organisms e.g. bryozoans, will be recorded as present (P) and for the purposes of abundance counts will be allocated a numerical value of 1. All samples will be subsequently retained in methanol for Quality Assurance Audit purposes if required. Ten percent (10%) of the benthic samples will be subject to internally QA. The laboratory undertaking the analysis will be a participant in the National Marine Biological Analytical Quality Control scheme (NMBAQC), and thereby takes part in the UK wide Quality Assurance scheme for this type of analysis.

BIOMASS DETERMINATION

Blotted wet weight biomass will be obtained for major faunal groups by weighing after external fluid has been removed on filter paper. Animals will be left on the filter paper until no more distinct wet traces can be seen. Animals with shells are weighed with shells attached. In the case of bivalves, fluid is drained off prior to weighing. Similarly, echinoids are punctured and drained before weighing. Organisms will be weighed to the nearest 0.0001 g. This methodology is in accordance with the National Marine Monitoring Programme Green Book (NMMP, 2003).

BEAM TRAWLING

Epibenthic sampling, using a standard scientific 2 m Jennings beam trawl fitted with a 5 mm cod end, will also be undertaken. This methodology is primarily designed to collect information on epibenthic invertebrate species, as well as small demersal and juvenile fish. Beam trawl tow distance at each site will depend on the nature of the seabed type, however it is anticipated that tows will be between 200-800 m in order to produce a manageable sample size. For the anticipated ground types in the area, each target tow will be of a 10 minute duration assuming a maximum towing speed of approximately 1.5 knots. A log will be maintained of the start heading, trawl speed, trawl direction, tidal state and weather condition. For the start position (when the trawl is on the seabed) the time, latitude, longitude, depth will be recorded. The same will be recorded for the end position (when the trawl is lifted from the seabed).

Where practicable, the entire catch will be processed onboard, with all species identified, enumerated and weighed. Species will be measured using the methods set out in EC Council Regulation 850/98 – For the Conservation of Fishery Resources Through Technical Measures For The Protection Of Juveniles Of Marine Organisms.

MS and local and district fishermen's organisations will be informed of the position, date, timing and expected duration of the benthic survey and epifaunal surveys. Dispensation for the use of under-sized mesh (5 mm) on the beam trawl will also be obtained prior to commencement of the survey work.

DATA ANALYSIS

Species abundance and biomass data collated from the benthic grab and beam trawl surveys will be collated in excel spreadsheets, and each dataset will separately be run through the multivatriate statistical analysis package PRIMER v6.

Univariate analysis of the data will include Margalef's index of Richness, Pielou's Evenness index, the Shannon-Wiener Diversity index and Simpson's index of Dominance. Reference to the calculation of these indices can be found in Clarke and Warwick (1994). Such indices are useful in reducing large faunal datasets to a single figure, which may be used in comparison to other sites in assessing community structure.

Macro-invertebrate community structure will be investigated with the use of classification analysis (hierarchical agglomerative clustering). This uses the Bray Curtis similarity coefficient to assess the similarity of sites based on the faunal components.

5.2.2.6 CUMULATIVE AND IN-COMBINATION IMPACT ASSESSMENT & SURVEY METHODOLOGIES

The methodologies and potential survey requirements by which cumulative and in-combination effects will be assessed will be agreed with consultees as part of a future scoping exercise undertaken by the MFOWDG.

5.2.2.7 POTENTIAL MITIGATION METHODS

Potential mitigation measures for marine benthic impacts include micrositing turbines around features and choice of installation techniques for turbine foundations and cables.

The mitigation measures proposed for the final sites will be dependent upon the final design of the site and the potential impacts as determined by the EIA studies. Options of mitigation will be discussed with the relevant authorities prior to ES submission.

5.2.3 FISH AND SHELLFISH ECOLOGY

5.2.3.1 BASELINE ENVIRONMENT

SPAWNING AND NURSERY AREAS

The Moray Firth contains one of the most important plaice spawning grounds in the northern North Sea, which is centred on the Smith Bank (Coull *et al.*, 1998). The Smith Bank is also an important spawning area for sandeel and cod, the latter migrate from offshore to spawn. Discrete banks of clean gravel in the Moray Firth are used by spawning herring, with the inner firths being used as nursery grounds by juvenile herring. The outer Moray Firth is also an important area for adult, spawning and juvenile lemon sole. Whiting spawn at relatively low densities in the area of the Moray Firth. Sprat utilise deeper waters of the outer Moray Firth to spawn, with adults overwintering in nearshore areas of the firth. Other species which also spawn in the Moray Firth area are whiting and *Nephrops*. Species with spawning grounds in the vicinity of the proposed development area include whiting, herring, sandeel, saithe, lemon sole, haddock and *Nephrops*.

Spawning and nursery grounds are dynamic features of fish life history and are rarely fixed in one location from year to year. In addition, fish may spawn earlier or later in the season in response to environmental change. Therefore, the information provided in Figure 5-5 and Figure 5-6 represents the widest known distribution of spawning and nursery grounds.

NATURAL FISHERIES RESOURCE

Fisheries are discussed in section 5.3.2.

DIADROMOUS SPECIES

Within the Moray Firth there are several species that migrate between fresh and salt waters. These are the Atlantic salmon *(Salmo salar*), sea trout (*Salmo trutta*), sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*), eel (*Anguilla anguilla*), twaite shad (*Alosa fallax*) and allis shad (*Allosa alosa*) (Barnes *et al*., 1996; DTI, 2004). Atlantic salmon, river and sea lamprey, twaite shad and allis shad are listed as protected species in Annex II of the EU Habitats Directive. Sea trout are also a UKBAP species. These species are anadromous, spawning in freshwaters and completing their life cycle in the marine environments. Several sites with the Moray Firth area have been designated Special Areas of Conservation (SACs) for the presence of one or more of the Annex II species (Section 5.2.6; JNCC, 2009).

Salmon and sea trout are also recognised under the UK Salmon and Freshwater Fisheries Act (1975). Allis and twaite shad are also protected under Schedule 5 of the Wildlife and Countryside Act 1981.

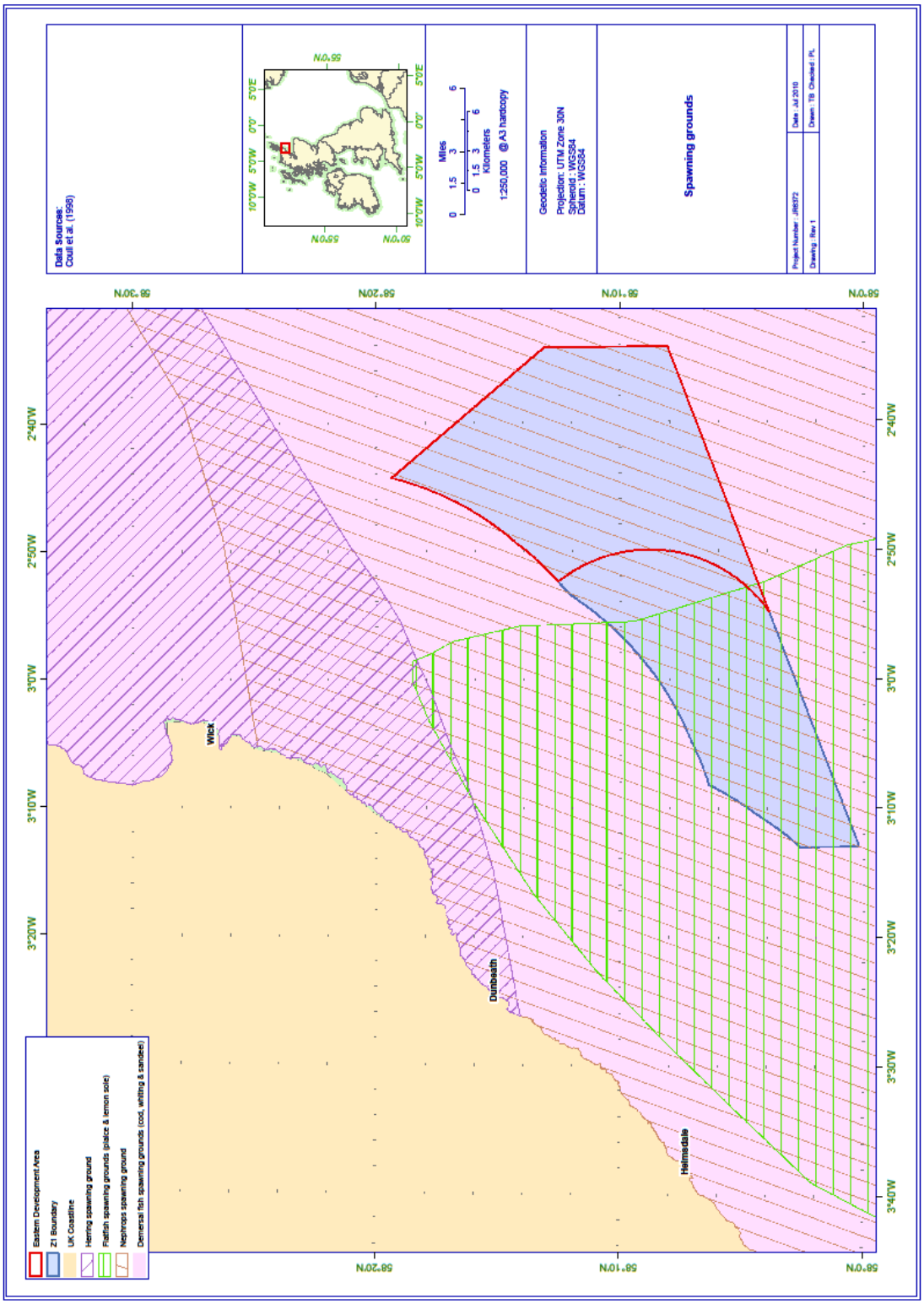


Figure 5-5: Spawning grounds in the outer Moray Firth.

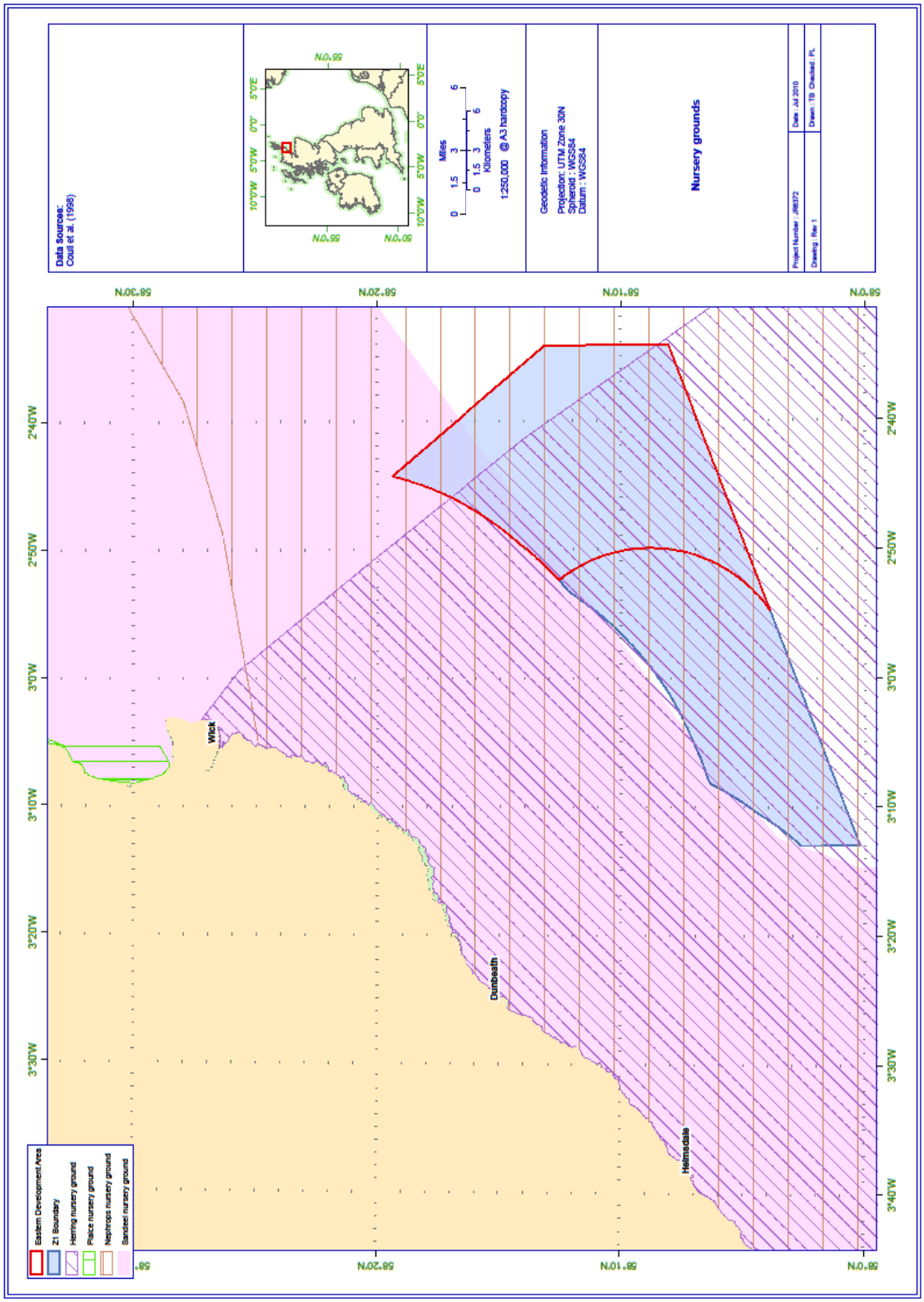


Figure 5-6: Nursery grounds in the outer Moray Firth.

ELASMOBRANCHS

The basking shark (*Cetorhinus maximus*) is listed under: OSPAR Initial List of Threatened and/or Declining Species and Habitat; as 'vulnerable' on the IUCN Red List of Threatened Species; in Appendix II of CITES; and the Wildlife and Countryside Act (1981), Schedule 5. The distribution of basking sharks in British waters is predominantly along the west coast of the British Isles, with peak sightings occurring in May to August (MCS, 2005). Studies conducted by the Marine Conservation Society indicate an increase in the numbers of basking sharks sighted in British waters, with a 65% increase in Scottish waters between 2001 and 2004. The majority of sightings are from the west coast of Scotland; however, there has been an increase in basking shark sightings on the Scottish east coast since 1999. In the Moray Firth, there were seven sightings recorded by the MCS between April and November 2005, these sighting were all confined to the southern Moray coast with three of the seven sighting in the outer Moray Firth (MCS, 2005). Small numbers were also recorded in the coastal waters of the Moray Firth in summer between 2004 and 2006 (Bloomfield & Solandt, 2007).

Porbeagle sharks (*Lamna nasus*) are found throughout the North Atlantic, with the largest population in UK waters found to the north of Scotland, and appear to belong to a Norwegian population. Recorded sightings of porbeagle sharks within the North Sea have generally occurred offshore in the central North Sea, between May and September (JNCC, 2009).

ELECTROMAGENTIC SENSITIVE SPECIES AND ELECTROMAGNETIC FIELDS

A number of reports have been produced in recent years that investigate issues surrounding the potential for sub-sea power cables required for offshore wind farms to create electromagnetic fields (EMF) (e.g. see www.offshorewind.co.uk/Pages/Projects/Research___project_areas/Fish__Shellfish_and_Benthos). Specific concerns have been expressed that should such fields result, there is the potential for an effect on electrically and/or magnetically sensitive marine organisms, mainly fish species and in particular elasmobranchs (sharks and rays). However, Gill *et al*. (2008) has suggested that EMF may have no significant biological effects on sharks and rays.

COMMERCIAL SPECIES

Commercial species have a grouped action plan and some individual commercial species (e.g. cod and mackerel) have individual species action plans under the UKBAP.

5.2.3.2 DATA GAPS

The quality and resolution of the available data for fish and shellfish will need to be reviewed to determine whether it is suitable for use in impact assessments and habitat characterisation. Site specific surveys may be required.

5.2.3.3 ENVIRONMENTAL IMPACTS SCOPING

Based on available literature, the following are perceived to be the potential impacts on fish and shellfish as a result of wind farms within the marine environment:

Impact Description	Potential site specific impact	Potential cumulative and/or in-combination Impact
Habitat loss and displacement	✓	✓
Disturbance to nursery/spawning grounds as a result of construction and increases in sediment deposition	✓	✓
Disturbance or physical injury associated with construction and operation noise	✓	✓
Behavioural responses to electromagnetic fields associated with cabling	✓	✓
Sediment plumes creating temporary disruption to migratory pathways and localised avoidance	✓	✓
Reduced fishing pressure within wind farm site and increased fishing pressure within areas which previously may have seen limited effort (due to displacement)	✓	✓
Increased habitat complexity due to presence of turbines and creation of reef effects following construction	✓	✓
Changes to the ecosystem such as effect upon shoaling due to presence of turbines	✓	✓

5.2.3.4 SITE-SPECIFIC IMPACT ASSESSMENT METHODOLOGY

For each of the potential impacts described above a survey or study and method of impact assessment is described in the tables below.

Potential Impact	**Habitat loss and displacement**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Regional fish community To determine the potential for habitat loss and displacement, the following surveys and studies will be undertaken: Fish and shellfish desk based study Benthic and epibenthic surveys (see section 5.2.2) Fisheries surveys (e.g. Beam/otter trawling, or other appropriate fishing method)
Method of Impact Assessment	The spatial and temporal nature of habitats in the study area will be fully described and losses of these habitats through turbine placement and temporary losses during the inter-array and export cabling quantified. Potential affects from any fishery exclusion zone will also be highlighted.

Potential Impact	Disturbance to nursery/spawning grounds as a result of construction and increases in sediment deposition
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Species with spawning/nursery grounds within the Moray Firth To determine the potential for disturbance to nursery and spawning grounds the following surveys and studies will be undertaken: Fish and shellfish desk based study Benthic and epibenthic surveys (see section 5.2.2) Should the desk based study indicate the presence of spawning or nursery areas within the proposed development site it may be necessary, following discussions with the statutory authorities, to complete: Planktonic egg/larvae surveys- for sensitive species (e.g. herring) to more clearly define local spawning areas.
Method of Impact Assessment	Potential impacts on spawning habitats through increased sediment loads will be assessed using the outputs of the coastal process assessment and published data on the sensitivity of fish species found to be spawning in this area to high sediment loads (including Round 1 and 2 OWF data).

Potential Impact	Disturbance or physical injury associated with construction and operation noise
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Regional fish community - Species with spawning/nursery grounds within the Moray Firth To determine levels of disturbance to fish species associate with noise the following studies and surveys will be undertaken: Fish and shellfish desk based study Fisheries surveys (e.g. Beam/otter trawling, or other appropriate fishing method) Data gathered will be used to determine the distribution and extents of fish populations and spawning and nursery grounds within the development and surrounding area Baseline underwater noise survey
Method of Impact Assessment	Potential noise impacts during the construction phase on those fish species found to be present in the vicinity of the development area will be assessed via a review of the relatively large body of data that exists on this topic, including developer-led work and COWRIE projects (Bio/Consult AS, 2001; Wahlberg and Westerberg, 2005; Nedwell *et al.*, 2007). Use of assessment tools such as audiograms and species-metrics will be adopted, where appropriate. The underwater noise survey will also be used to estimate the potential impacts of construction noise.

Potential Impact	**Behavioural responses to electromagnetic fields associated with cabling**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Electromagnetic field sensitive species To determine the distribution of electromagnetic sensitive species the following studies and surveys will be undertaken: Fish and shellfish desk based study Fisheries surveys (e.g. Beam/otter trawling, or other appropriate fishing method) Consultation with fishermen and fisheries organisations.
Method of Impact Assessment	The findings of recent COWRIE projects (Gill *et al.,* 2005, Gill *et al.*, 2009) investigating the effects of EMF on sensitive fish species will be used to determine the significance of any impacts on fish species from EMF associated with the wind farm cables.

Potential Impact	**Sediment plumes creating temporary disruption to migratory pathways and localised avoidance**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Migratory fish species To determine potential disturbance from sediment plumes the following studies will be undertaken: Fish and shellfish desk based study Benthic and epibenthic surveys (See section 5.2.2) Fisheries Surveys (e.g. Beam/otter trawling, or other appropriate fishing method) The potential disturbance caused by sediment plumes will also be informed by the Particle Size Analysis undertaken following the Benthic Grab survey.
Method of Impact Assessment	Potential impacts on behavioural responses through increased sediment loads will be assessed using the outputs of the coastal process assessment, published data on the sensitivity of fish species (including Wound 1 and 2 OWF data) found in this area to high sediment loads and standard EIA methodologies.

Potential Impact	**Reduced fishing pressure within wind farm site and increased fishing pressure within areas which previously may have seen limited effort (due to displacement)**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Regional fish community To determine potential changes in fishing pressure the following studies will be undertaken: Fish and shellfish desk based study, which will be informed and by the commercial fisheries studies. Fisheries Surveys (e.g. Dredge/beam/otter trawling, or other appropriate fishing method)
Method of Impact Assessment	Impact assessment will include a consideration of potential affects from a change/reduction/cessation in commercial fishing within the proposed development area and the displacement of commercial fisheries to other areas which previously were not used as intensively. Impact assessment methodology

	will be informed by previous experience and literature published following the development of Round 1 and 2 OWF and undertaken using standard EIA methodologies.

Potential Impact	**Increased habitat complexity due to presence of turbines and creation of reef effects following construction**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Regional fish community To determine potential impacts of changes in habitat complexity the following surveys will be undertaken: Fish and shellfish desk based study Benthic and epibenthic surveys (see section 5.2.2) Fisheries surveys (e.g. Beam/otter trawling, or other appropriate fishing method)
Method of Impact Assessment	A review of the potential colonisation of new structures (piles, scour protection etc) and potential benefits afforded by this will be undertaken. This requires an objective assessment of the relative merits of a general increase in biodiversity *per se* over an increase in species that naturally and locally colonise local hard substrata (Linley *et al*., 2007). However whether such "artificial reefs" increase productivity in the long-term is controversial and such structures should not automatically be assumed to be beneficial (CEFAS *et al*., 2004). The method of Impact Assessment is to be based on the findings from Round 1 and 2 developed sites where monitoring has already been instigated, supplemented with site specific information on species and local conditions (e.g. turbidity).

Potential Impact	**Changes to the ecosystem such as the effect upon shoaling due to presence of turbines**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Regional fish community To determine changes to the ecosystem the following studies will be undertaken: Fish and shellfish desk based study Fisheries Surveys (e.g. Beam/otter trawling, or other appropriate fishing method)
Method of Impact Assessment	Recent research published following the development of Rounds 1 and 2 OWF will be used to inform the assessment of ecosystem effects.

5.2.3.5 SITE-SPECIFIC SURVEY METHODOLOGY

The following relates to the surveys for the EIA. Marine Scotland, JNCC and SNH will be consulted with regards to the requirements for data collection to support an Appropriate Assessment. It is noted that in some cases, impacts on SACs where salmon is a designating feature, the potential for impacts on the freshwater pearl mussel will also need to be considered.

BEST PRACTICE GUIDANCE

The following references provide best practice guidance for use in assessing impact upon fish and shellfish ecology:

- Davies *et al*. (2001) Marine Monitoring Handbook
- CEFAS (2004) Offshore Wind Farms: guidance notes for Environmental Impact Assessment in respect of FEPA and CPA requirements. Version 2
- DEFRA (2005) Nature conservation guidance on offshore wind farm development
- OSPAR (2008) OSPAR Guidance on Environmental Considerations for Offshore Wind Farm Development

PROPOSED SURVEY PROGRAMME

The overall approach to the survey programme is intended to characterise the spatial and temporal variations in seasonal fish and shell fish assemblages, commercial fisheries species and establish the occurrence of any species of conservation concern within the vicinity of the proposed development area. The characterisation methodology will entail a suite of complementary surveys, as recommended by best practice guidelines and previous experience of requirements in the other OWF developments, over the period of a year.

The exact methodology will be determined following the completion of the desk based study of fish and shellfish within the area and through discussions with fisheries groups via the Fisheries Liaison Officer (FLO) for the project and the statutory authorities. The most appropriate method to be employed will be in line with commercial fisheries methodologies within the area.

5.2.3.6 SUMMARY OF METHODOLOGY

The following summary methodology is provided as a guide only and the final methodology will be determined in discussion with Marine Scotland, JNCC and SNH.

FISH AND SHELLFISH DESK BASED STUDY

The study will be undertaken by marine scientists in order gather data for the area to inform the development of suitable site specific sampling strategies. The desk based study will entail an interrogation of available datasets and literature, consultation with relevant authorities and fisheries associations through the FLO. Data will collated and mapped in GIS to illustrate the spatial and temporal scales of fisheries assemblages, species of commercial importance, nursery and spawning areas and the occurrence of species of conservation concern.

OTTER TRAWLS

Otter trawls are biased towards sampling demersal (seabed associated) fish species. Demersal fish are likely to be affected by the proposed offshore wind farm development due to their territorial nature and predation on invertebrate species associated with the seabed. Otter trawl sampling locations will be concentrated within a survey area delineated by a tidal excursion from the proposed development site. Final locations will be determined following the desk top study, analysis of hydrographical data of the area and through discussions with Marine Scotland.

It is anticipated that a local fishing vessel will be used to carry out the otter trawl survey. The net used will be similar to nets used by commercial vessels in the area and will be approximately 10 m across the head line, 14 m across the ground line, 1 m high with an 80 mm mesh, knot to knot. The vessel will be accurately positioned with differential Geographic Positioning System (dGPS) using a Garmin GPS Map 76CS GPS receiver with external marine antenna. Differential corrections will be received from the EGNOS (European Geostationary Navigation Overlay Service) satellite network

giving a final positioning accuracy of ± 3 m. The proposed trawl locations, admiralty chart background and real time vessel location will be displayed on a helmsman display using a Garmin Mapsource navigation package. Positions will be logged in WGS84 coordinates and converted to OSGB36 for import into GIS.

Once at the sampling station the otter trawl will be deployed and the co-ordinates logged when the net is in contact with the substrate. The trawl will be towed for 30 to 60 minutes at a speed of 1-2 knots (CEFAS, 2004). For each sample the following information will be recorded: date, time (GMT), depth of water (m), direction, orientation, speed (Knts) and the ground distance covered (m) by the trawl. The trawl track will be recorded for each trawl.

As the net is hauled in, any biota will be moved down towards the cod end or 'bosom' of the net. Once the net is on board the vessel the contents of the cod end will be placed into fish boxes and photographed. The specimens will then sorted, identified, enumerated, measured, weighed and recorded. Species will be measured using the methods set out in EC Council Regulation 850/98 – for the Conservation of Fishery Resources Through Technical Measures for The Protection Of Juveniles Of Marine Organisms. The size of crab species will be measured across the carapace, the size of lobsters will be recorded from the eye socket to the distal end of the carapace, fish will be measured from the snout to the maximal extent of the caudal fin, and rays will be measured from wing tip to wing tip.

5.2.3.7 Cumulative and In-combination Impact Assessment & Survey Methodologies

The methodologies and potential survey requirements by which cumulative and in-combination effects will be assessed will be agreed with consultees as part of a future scoping exercise undertaken by the MFOWDG.

5.2.3.8 Potential Mitigation Methods

Potential mitigation measures for impacts to fish and shellfish include choice of installation techniques for turbine foundations and cables, cabling type (e.g. AC or HVDC) and timing of construction activities.

The mitigation measures proposed for final wind farm sites will be dependent upon the final design of the site and the potential impacts as determined by the EIA studies. Options of mitigation will be discussed with the relevant authorities prior to ES submission.

5.2.4 Marine Mammals

The potential implications for the development of offshore wind farms vary, depending on issues such as the species present and how important the area is for each of these. A number of Round 1 and 2 sites (together with several in mainland Europe) have been consented and developed in the presence of certain marine mammal species (e.g. harbour porpoise and seals), albeit in some instances with additional monitoring requirements and/or modifications to the proposed construction methodology.

Marine mammals are subject to a range of legal protection and agreements, including:

- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);
- Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS);
- The Wildlife and Countryside Act 1981 (as amended);
- The European Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive');
- Conservation (Natural Habitats, & c) Regulations 1994 (as amended);
- Nature Conservation (Scotland) Act 2004;
- Conservation of Seals (Scotland) Order 2004 and 2007;
- Offshore Marine Conservation (Natural Habitat & c.) Regulations 2007;
- Offshore Marine Conservation (Natural Habitats & c.) Regulations 2007 (as amended): and
- Marine (Scotland) Act 2010.

Under the amended Conservation (Natural Habitat & c.) Regulations (1994) and amended Offshore Marine Conservation (Natural Habitats, & c.) Regulations (2007), it is an offence to "deliberately disturb wild animals of any European Protected Species in such a way as to likely significantly affect (i) the ability of any significant group of animals of that species to survive, breed or rear or nurture their young; or (b) the local distribution of abundance of that species". As a result, the onus is on the developer to assess whether there is a likelihood of committing an offence and to determine the mitigation that is required and whether a licence is required (JNCC, 2009). A wildlife licence would be required should the proposed activity be determined as causing harm to an European Protected Species (EPS).

Details are provided below of the species that are likely to be recorded within the proposed development area. It should be noted that conservation sites associated with marine mammal species are discussed in section 5.2.6.

5.2.4.1 BASELINE ENVIRONMENT

Cetaceans (whales, dolphin and porpoises), pinnipeds (walrus, eared seals and earless seals) and otters are the marine mammals most likely to be encountered within UK waters. Otters are only likely to use the marine environment to a depth of 10m, therefore, this species is highly unlikely to be using the offshore development area and is therefore not discussed within this document.

To date, a total of 14 cetacean species have been recorded alive within the Moray Firth (Table 5-3). Other species have been found stranded within the firth area but are not included in this review due to the uncertainty in the animals' location before death. Two species of pinniped also occur in the Moray Firth (Table 5-3). Occasionally other arctic seals (eg. bearded seal) are sighted in the area , but these are considered vagrants and are not included in this review.

Table 5-3: Frequency of marine mammal recordings within the outer Moray Firth.

Common Name	*Latin name*	Frequency of recordings
Pinnipeds		
Harbour Seal	*Phoca vitulina*	Common, all year
Grey seal	*Halichoerus grypus*	Common, seasonal
Cetaceans		
Harbour porpoise	*Phocoena phocoena*	Common, all year
Bottlenose dolphin	*Tursiops truncates*	Common, all year
Common dolphin	*Delphinus delphis*	Common, seasonal
White-beaked dolphin	*Lagenorhynchus albirostris*	Common, seasonal
Minke whale	*Balaenoptera acutorostrata*	Common, seasonal
Risso dolphin	*Grampus griseus*	Occasional
White-sided dolphin	*Lagenorhynchus acutus*	Occasional
Killer whale	*Orcinus orca*	Occasional
Pilot whale	*Globicephala melas*	Rare
Humpbacked whale	*Megaptera novaengliae*	Rare
Fin whale	*Balaenoptera physalus*	Rare
Sperm whale	*Physeter macrocephalus*	Rare
Northern bottlenose whale	*Hyperoodon ampullatus*	Rare
Beluga whale	*Delphinapterus leucas*	Rare

Two Special Areas of Conservation (SACs) have been designated within the Moray Firth, one for the bottlenose dolphin and another harbour seal (see section 5.2.6).

Harbour seals, grey seals, bottlenose dolphins and porpoises occur in the Moray Firth all year round, with the abundance for these species in inshore areas often being higher during summer months. However information on relative abundance in different seasons for offshore areas in the Moray Firth, and for the other marine mammal species is currently limited. For cetacean species only occasionally recorded, such as common dolphins, fin whales, humpback whales, northern bottlenose whales, long-finned pilot whales and sperm whales, the area off north-east Scotland is only a marginal part of their habitat, and is likely to be inhabited only during a restricted part of the year (Hammond *et al*., 2004).

The most commonly recorded cetacean species within the outer Moray Firth area are: bottlenose dolphin, harbour porpoise, minke whale, white-beaked dolphin and common dolphin (Figure 5-8; Thompson *et al*., 2009). Of these, harbour porpoise are the most commonly sighted species throughout the outer Moray Firth region. Bottlenose dolphin sightings are relatively rare in the outer Moray Firth, with the majority in the inner Moray Firth and long the southern coast, generally in waters of less than 25 m depth (Hastie *et al.*, 2003; Canning, 2007; Robinson *et al*., 2007).However, recent acoustic data collected as part of a DECC funded project found relatively high levels of dolphin activity in the Outer Moray Firth (Thompson *et al*., 2010) and further research is required to confirm whether or not bottlenose dolphins may be occurring more often than previously believed in this area

A number of haul out sites for harbour seals can be found within the Moray Firth, primarily in the Beauly, Cromarty and Dornoch Firths and Loch Fleet (Figure 5-8; Thompson *et al*., 1996; SCOS, 2009). Harbour seals occur throughout the year in these areas, with peak numbers at haul out sites between June and August (Thompson & Miller, 1990; Thompson *et al*., 1996). Tagging studies within the Firth found that in summer harbour seals tend to forage quite close to their haul out sites, generally travelling no more than 60 km. They tend to forage slightly further afield in the winter and seasonal differences were found in the areas used (Thompson *et al*., 1996).

Within the Moray Firth, grey seals are predominantly observed during the summer although a few can be found throughout the year. Non-breeding grey seals have been observed at the intertidal sites within the firths used by harbour seals. Breeding grey seals are mostly found at the rocky beaches and caves to the north (Thompson *et al*., 1996). Data obtained from tagged individuals published by SMRU (McConnell *et al*., 1999) has found that grey seal foraging trips fall into two categories: long distance trips up to 21,000km, and short, regular trips to local feeding areas. Tagging studies within the Moray Firth found grey seals foraged over a much wider area than the harbour seal with great variation between individuals.

5.2.4.2 DATA GAPS

There is an extensive amount of marine mammal data for the Moray Firth. However, data on species density and use of the site by species is currently lacking. Therefore, surveys and studies will focus on addressing these issues.

5.2.4.3 ENVIRONMENTAL IMPACTS SCOPING

Based on available literature, the following are perceived to be the potential impacts on marine mammals as a result of wind farms within the marine environment:

Impact Description	**Potential site specific impact**	**Potential cumulative and/or in-combination Impact**
Disturbance and potential displacement as a result of elevated construction and operational noise (including vessel noise)	✓	✓
Barrier to movement	✓	✓
Potential longer term avoidance of the development area by marine mammals	✓	✓
Increased collision risk resulting in injury or death due to construction and maintenance impacts (including vessel movements)	✓	✓
Potential reduction of the feeding resource due to effects on prey of noise and vibration, and habitat disturbance	✓	✓
Potential changes in long-term prey availability caused by the presence of infrastructure and changes in fishing activity	✓	✓

5.2.4.4 SITE-SPECIFIC IMPACT ASSESSMENT METHODOLOGY

For each of the potential impacts described above a survey or study and method of impact assessment is described in the tables below.

Potential Impact	**Disturbance and potential displacement as a result of elevated construction and operational noise (including vessel noise)**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Regional marine mammal community To determine the potential for disturbance and displacement, the following surveys and studies will be undertaken: Survey of marine mammal density and distribution Literature review of marine mammal species audiograms Underwater noise survey to characterise baseline environment Desk-top study and noise modelling to determine zones of noise around piling operations Literature study of marine mammal behavioural responses to offshore wind farms and other related activities.
Method of Impact Assessment	Marine mammal species density and distribution data will be used to model population densities across the site over time. Background noise measurements will be used to model the severity of noise of piling operations over distance. These model outputs will be assessed in relation to audiograms and species density to quantify the potential level of impact on species during construction and operational works. The potential for impacts will also be assessed with regard to the time of year so that levels of impact may be assumed with regard to different seasonal patterns of use.

Potential Impact	**Barrier to movement** **Potential longer term avoidance of the development area by marine mammals**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Regional marine mammal community To determine the potential for avoidance of the area, the following surveys and studies will be undertaken: Determination of marine mammal density and distribution Literature study of marine mammals behaviours responses to offshore wind farms and other related activities.
Method of Impact Assessment	An evidence based approach will be used in association with baseline data to determine the potential long-term impacts on marine mammal species behaviour throughout the lifetime of the wind farm.

Potential Impact	**Increased collision risk resulting in injury or death due to construction and maintenance impacts (including vessel movements)**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Regional marine mammal community To determine the potential for disturbance and displacement, the following surveys and studies will be undertaken: Determination of marine mammal distribution and density Desk study of collision risk associated with existing offshore wind farms and other vessel traffic.
Method of Impact Assessment	Marine mammal species density and distribution data will be used to model population densities across the site over time. The number of vessels required during construction and operation will be estimated over time. These data will be used to estimate collision risk with regard to the time of year so that levels of impact may be assumed with regard to different seasonal patterns of use. Where available, the results of the study will be cross-referenced against information from existing wind farms, and information on baseline traffic levels in the Moray Firth.

Potential Impact	**Potential reduction of the feeding resource due to effects on prey of noise and vibration, and habitat disturbance**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Regional marine mammal community To determine the potential for reduction of feeding resource, the following surveys and studies will be undertaken: Determination of marine mammal density and distribution Habitat distribution identification (see section 5.1.4.3) Survey of marine benthic species density and distribution (see section 5.2.2.5) Survey of fish species density and distribution (see section 5.2.3.5) Literature review of noise sensitive marine species audiograms (not including marine mammals) Underwater noise survey to characterise baseline environment Desk-top study and noise modelling to determine zones of noise around piling operations Literature study of marine mammal foraging habits and changes to marine trophic web associated with offshore wind farms
Method of Impact Assessment	The potential for marine mammal species feeding within the site will be determined by assessing the distribution and density data of marine mammals within the site and relating this to literature accounts of species foraging habitats and habitat maps and the density and distribution of marine benthic organisms and fish within the site. The potential impact of construction and operation on habitats, benthic organisms and fish species will be determined using available information. In addition, background noise measurements will be used to model the severity of noise of piling operations over distance. The potential impact of increased noise

	on prey resources will be assessed where audiograms are available for noise sensitive fish and marine benthic species. These impact assessments will be used to assess the potential impact upon the foraging habits of marine mammals. The potential for impacts will also be assessed with regard to the time of year so that levels of impact may be assumed with regard to different seasonal patterns of use.

Potential Impact	**Potential changes in long-term prey availability caused by the presence of infrastructure and changes in fishing activity**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Regional marine mammal community To determine the potential for changes in long-term prey availability, the following surveys and studies will be undertaken: Desk-top review of marine mammal foraging habits Desk-top review of biofouling of marine infrastructure Survey of fishing activity within and around the site (see section 5.3.2.5) Survey of fish density and distribution (see section 5.2.3.5) Survey of marine benthic species density and distribution (see section 5.2.2.5)
Method of Impact Assessment	The potential for biofouling and long-term changes in prey availability for marine mammals will be estimated using the baseline survey information on biota and evidence from other marine industries. The potential for changes in fishing activity and fish species density and abundance within the wind farm site will also be estimated from the baseline data and evidence from other marine industries. The potential for interaction between changes in commercial fishing activity and biofouling will also be assessed. The potential impacts on prey species will be related to known foraging behaviour of marine mammal species recorded within the proposed development area.

5.2.4.5 SITE SPECIFIC SURVEY METHODOLOGY

The following relates to the surveys for the EIA. JNCC and SNH will be consulted with regards to the requirements for data collection to support an Appropriate Assessment. It is noted that in some cases, impacts on SACs where salmon is a designating feature, the potential for impacts on the freshwater pearl mussel will also need to be considered.

BEST PRACTICE GUIDANCE

At present, there is limited guidance from Scottish Natural Heritage or the Scottish Government on how to tackle the issue of deliberate disturbance, however the JNCC (2008) has produced draft guidance which provides an interpretation of what constitutes a 'significant' group and explains the 'disturbance offence' in greater detail. It is anticipated that the final, post-consultation version of the guidance will be issued at some time in early 2010, following production of the draft version in July 2008. The guidance refers to the Habitats Directive Article 12 Guidance (European Commission, 2007) stating that in their view significant disturbance must have some ecological impact (see section 5.2.6).

LITERATURE STUDY

A desktop literature search will be carried out to collect information on and inform impacts assessments for marine mammals. These literature searches will include:

- Marine mammal species density and abundance within and around the wind farm site
- Audiograms for marine mammals and other noise sensitive species
- Marine mammal behaviours (including foraging)
- Impacts associated with offshore wind farms and the success of mitigation measures
- Biofouling of marine structures

5.2.4.6 SURVEY OF MARINE MAMMAL DENSITY AND DISTRIBUTION

VISUAL BOAT-BASED SURVEYS

Boat based visual surveys were commenced in April 2010. These surveys are to record the distribution of marine mammals in the region. The marine mammal sighting survey will share vessel time with the on-going bird surveys and will follow the pre-determined transects developed for the bird surveys that are designed to provide unbiased survey coverage of the site. See section 5.2.5.5 for further details of the methodology.

ADDITIONAL SURVEYS

For the purposes of assessing the impacts and potential mitigation of oil exploration operations in the Moray Firth, a three year programme of cetacean studies was commenced by the University of Aberdeen with funding from DECC, the Scottish Government, COWRIE and Oil and Gas UK. MORL are providing additional funding to the University of Aberdeen and the St Andrews Sea Mammal Research Unit (SMRU) to extend the examination of these data and undertake additional studies (in collaboration with the BOWL site) to establish a baseline of marine mammal activity in the region of the offshore wind farms.

The survey objectives and the proposed survey methods that are being investigated are as follows:

- **Characterisation of the temporal variability of marine mammals within the site**. This study will use data collected as part of the Beatrice demonstrator project (data available for August-November 2005-2007), the C-POD summer array survey undertaken for the work sponsored by DECC *et al*. (data available for July – October 2009), C-POD array data collected by the University of Aberdeen (data available from November 2009 – July 2010) and additional C-POD array data to be collected by MORL and BOWL from November 2010 onwards.

- **Assess density of marine mammals within the site**. The study will build upon data collected as part of the aerial survey programme between August and September 2010, which is being funded by DECC *et al*. The survey transects will be concentrated in two 25x25 km survey blocks, the first located across the BOWL and north-east Round 3 zone and the second to the south of the Round 3 zone. MORL will fund habitat association modelling work that uses these data to predict density across the whole of the Round 3 site and adjacent buffer areas. MORL will also carry out Hi-Def surveys in parallel in order to validate the Hi-Def video technique for estimating cetacean density.
- **Assessing connectivity of marine mammal SAC species**. MORL will fund additional collection of broad-band acoustic data using EARs (remote, long-term recording devices developed by the University of Hawaii). These will be deployed for two periods of 15-30 days, in each of two areas in which the C-PODs used in the DECC study detected high levels of dolphin activity in summer 2009. The whistles recorded using these devices will be used to identify which species of dolphins are occurring in these areas and, in combination with further C-POD deployments, determine the potential distribution of dolphin species (in particular, the bottlenose dolphin) within and around the offshore wind farm sites/zone. MORL will also use opportunistic photo-identification to collect additional information, when feasible. The University of Aberdeen and SMRU hold seal tracking data for the Dornoch Firth and Morrich More SACs and Loch Fleet NNR, which will also be used to assess connectivity of seals with the offshore wind farm sites/zone.
- **Habitat association**. Using the geophysical, metocean, benthic and fish data to be collected as part of the EIA, it is intended to produce habitat maps for the zone. The habitat maps and data collected as part of the marine mammal studies will be used to model the usage and density of foraging seals within the zone.

OTHER SURVEYS TO BE USED TO IDENTIFY IMPACTS

- Habitat distribution surveys are described in section 5.1.4.3.
- Marine benthic surveys are described in section 5.2.2.5.
- Fish surveys are described in section 5.2.3.5.
- Commercial fishing activity surveys are described in section 5.3.2.5.

5.2.4.7 CUMULATIVE AND IN-COMBINATION IMPACT ASSESSMENT & SURVEY METHODOLOGIES

COWRIE has recently issued new guidance on cumulative impact assessment for ornithology (King *et al.*, 2009). This proposes the use, at the scoping stage, of 'key features' tables to identify a list of species which may be at most risk of cumulative impacts. The tables are designed to provide a robust and auditable basis for initial discussions with JNCC, SNH and other stakeholders about the potential for significant effects on priority species. A further aim is to assist with the identification of any additional studies that may be required over and above the normal boat-based and aerial surveys. It is important to note that the use of these tables is a novel development and the process will require refinement. MORL intends to use this methodology for assessing the potential cumulative and in-combination impacts on marine mammals. The surveys outlined above have also been agreed with BOWL and data will be shared between the two developers to assist with cumulative and in-combination impact assessments.

It should also be noted that grey seals, harbour seals and bottlenose dolphins are qualifying features for SACs on the east coast of Scotland and therefore impacts to favourable conservation status will be addressed.

5.2.4.8 POTENTIAL MITIGATION METHODS

Potential mitigation measures for impacts to marine mammals include choice of installation techniques for turbine foundations and cables, the use of marine mammal observers and passive acoustic monitoring to ensure no marine mammal activity within a site prior to construction activities, the use of soft start procedures for piling activities and timing of construction activities. Other techniques that can be used to reduce the noise of piling techniques include the use of inflatable sleeves as noise barriers (Nehls *et al*., 2007).

The mitigation measures proposed for the final offshore wind farm sites will be dependent upon the final design of the site and the potential impacts as determined by the EIA studies. Options of mitigation will be discussed with the relevant authorities prior to ES submission.

5.2.5 ORNITHOLOGY

The primary legislation under which birds are protected is as follows:

- the European Council Directive 79/409/EEC on the conservation of wild birds (the 'Birds Directive');
- the Wildlife and Countryside Act 1981, as amended;
- the Conservation (Natural Habitats, & c) Regulations 1994 (as amended); and
- The Nature Conservation (Scotland) Act 2004.

Species on Annex I of the Birds Directive are protected through a network of Special Protection Areas (SPAs). The species of prime interest with regards to impact assessment would be any Annex I birds that are linked to an SPA population. Although species on Annex I that are likely to be present within the proposed wind farm site will be identified in this section, any associated potential impact on conservation sites will be discussed in section 5.2.6. In addition, under the Wildlife and Countryside Act 1981 (as amended) it is an offence to intentionally or recklessly kill, injure or take any wild bird or their eggs or nest. Species listed on Schedule 1 are also protected from disturbance at their nests or to their dependent young.

5.2.5.1 BASELINE ENVIRONMENT

The Moray Firth is host to internationally-important numbers of breeding seabirds, over-wintering waterbirds (seaducks, diving ducks, divers, grebes and waders), and is important for feeding during the spring and autumn migrations of species that breed at high latitude. As recognition of this, there are a number of designated areas found throughout the firth which are protected for their ornithological interests. This includes international-level Special Protection Areas (SPAs) and Ramsar sites, and national Sites of Special Scientific Interest (SSSIs). The nearest designated site to Zone 1 is the East Caithness Cliffs SPA, which lies approximately 19.95 km to the north-west. Further information on designated conservation in the Moray Firth is presented in section 5.2.6. Figure 5-8 illustrates the location of SPA sites around the Moray Firth.

Seabirds

The Moray Firth is supports internationally and nationally-important populations of fulmar, cormorant, shag, herring gull, kittiwake, guillemot and razorbill. The Moray Firth and surrounding coastline is of year round importance for birds. During the breeding season, most seabirds

congregate on the cliffs and in surrounding coastal waters along the coast which include Berriedale Cliffs and Scaps Geo to Dunbeath SSSIs. Troup Head has the only gannet breeding colony on mainland Scotland and the cormorant colony at the North Sutor is the second largest in Scotland. Breeding seabirds including kittiwake, guillemot and razorbill at colonies along the coastline, such as on the Caithness Cliffs, commute offshore to feed, over areas such as the Smith Bank. Cormorants, shags, gulls and terns tend to feed closer to shore (DECC, 2009). Table 5-4 summarises the important breeding seabird colonies in the Moray Firth area.

Table 5-4: Summary of important breeding seabird colonies in Moray Firth area

Site	Species & Total
North Caithness Cliffs	Razorbill (33,02 I), fulmar (16,310 P), kittiwake (15,630 P), guillemot (26,994 P)
East Caithness Cliffs	Guillemot (71,509 P); herring gull (9,370 P); kittiwake (31,930 P); razorbill (9,259 P); shag (2,345 P)
Cromarty Firth	Common tern (294 P)
Inner Moray Firth	Common tern (310 P)
Troup, Pennan & Lion's Head	Guillemot (29,902 P); gannet (1,085 AOS)

*Notes: Sites designated as Seabird Assemblages of International Importance are shown in **bold** (Qualifying level is 20,000 birds). P: Pairs, AOS: Apparently Occupied Sites, I: Individuals.*
Source: DECC (2009), JNCC (2009), Mitchell *et al*. (2004).

The waters of the Outer Moray Firth and the nearshore waters off the Moray coast are of particular importance as feeding areas (Tasker, 1996); the broad area encompassed by Smith Bank, as defined by the 50 m depth contour, has sandy sediment suitable for sandeel burrowing (DECC, 2009).

A large number of seabirds disperse into the coastal waters of the Firth at the end of the breeding season, and numbers peak between June and September in more open water. In the outer Firth, the largest concentrations of seabirds found have been recorded over the Smith Bank (Mudge and Crooke, 1986), particularly the north-east corner (Harding-Hill, 1993). After breeding, both adult and juvenile auks move offshore where the adults moult. The Smith Bank area has been particularly important in autumn for guillemots and razorbills, when flightless flocks of auks occur, consisting of both adults in moult and chicks. Large concentrations of auks here are enhanced by movements from colonies further north.

Fulmars are widely distributed in the Moray Firth throughout the year, whilst gannet and kittiwake numbers peak during the summer and autumn. The coasts around the Moray Firth are of particular year round importance for shags and herring gulls (DTI, 2004; DECC, 2009). Table 5-5 summarises the seasonal seabird distribution and abundance in Moray Firth area.

Table 5-5: Summary of seasonal seabird distribution and abundance in Moray Firth area

Month	Distribution & Abundance
January/February	Guillemot are abundant in the Moray Firth throughout the winter. The same is also the case for fulmar, which will start to form territories at colonies from January. Numbers of herring and great black-backed gulls peak around this time, particularly in the inner Moray Firth.
March	Many seabirds, including gannet, kittiwake, herring gull, guillemot, razorbill and puffin, will return to the vicinity of their colonies. The highest densities of fulmar are also around the main breeding areas. Herring and great black-backed gulls remaining in area are breeding birds and the inner Moray Firth is important for both species.
April	Egg-laying will commence towards the end of this month for some seabirds, such as gannet and the auks. Foraging will take place both close to colonies and further offshore. Kittiwakes remain widely distributed particularly in the north near main breeding areas. Large numbers of gannets are found near colonies. Arctic and common terns return to inner Moray Firth colonies.
May	Egg-laying will continue for those species also underway, and will commence for the remaining seabirds, such as fulmar and kittiwake. Birds can still forage at distances further from the colonies than during chick rearing (e.g. auks up to 60km and kittiwakes up to 120km). Breeding Arctic and great skua feed close to colonies.
June	Peak of breeding season, with chicks starting to hatch for most species. Majority of seabirds in coastal areas. Most breeding guillemots do not feed further than 30km from their breeding site. At end of month guillemot chicks start to leave colonies and disperse offshore into the Moray Firth. Breeding razorbills feed closer to shore than guillemots.
July/August	The nesting season for most seabird species ends by mid-July, and adult and juvenile birds start to move south to wintering grounds or move to areas where they form moulting flocks. Puffins disperse rapidly from colonies. In July/August the offshore areas of the Moray Firth support larger concentrations of birds than at any other time of the year. Young fulmar and gannet start to fledge in August.
September	Distribution of auks spreads outwards into North Sea: guillemot will remain in offshore areas of the Moray Firth but the majority of puffin and razorbill will be further offshore. Numbers of shearwaters (Manx and sooty) and skuas (mainly great and Arctic) will peak around this time. Fulmars continue to be numerous in the Moray Firth.
October/November/ December	Seabirds such as guillemot and fulmar continue to the abundant throughout the winter. Smaller numbers of other auks, gannet and kittiwake may also be present. The numbers of herring and greater black-backed gulls will increase during the winter.

Source: DECC (2009), Mudge & Crooke (1986), Tasker & Pienkowski (1987), Skov *et al*., (1995)

Seaducks and diving ducks

The inner Moray Firth is recognised as one of the most important seaduck sites in the British Isles. At least four main sites for seaduck are recognised within the Moray Firth:

- Dornoch - between Tarbat Ness and Brora
- Culbin - the area off Nairn and the Culbin bars
- Burghhead Bay - off Burghhead Point west to Findhorn
- Spey Bay - the whole area eastwards from Lossiemouth to Portgordon

The Moray Basin is important for wintering seaduck such as common scoter, goldeneye, long-tailed duck and scaup, and large numbers can be present in waters of the Moray, Cromarty and Dornoch Firths. Large numbers of red-throated divers, great crested grebes, long-tailed duck and scoter species are present in inshore waters of the Inner Moray Firth and Dornoch Firth (Lewis *et al.,* 2008). The most important sites include Ness mouth/Longman Bay for goldeneye, the Ness-Charleston area of the Inverness/Beauly Firth and the inner Dornoch Firth for tufted duck, and Edderton Bay and Longman bay in the Inverness Firth for scaup. The most consistently important mid-winter site for red-breasted merganser is the Riff Bank of the Moray Firth.

Waders and wildfowl

The Inner Moray Firth has complex areas of coastline and estuary important for international and national importance for many species of waders and wildfowl. Important areas include Culbin Sands, Loch Fleet, Dornoch Firth, Cromarty Firth, Beauly Firth and Moray Firth south shore; stretching from Helmsdale south to Spey Bay. Table 5-6 summarises important sites of non-breeding waterbirds in the Moray Firth area. The sheltered firths of mudflat, saltmarsh and estuarine habitats are particularly important for migrating wildfowl and waders in spring and autumn.

Table 5-6: Summary of important sites for non-breeding waterbirds (in decreasing relative abundance of birds) in Moray Firth area

Location	Average number[1]	Species[2]
Loch of Strathbeg SPA	69,688	**Whooper swan, pink-footed goose, barnacle goose**, teal, goldeneye
Inner Moray Firth, including the Inner Moray Firth SPA, and **Moray and Nairn Coast SPA**	60,871	**Pink-footed goose, greylag goose**, red-breasted merganser, bar-tailed godwit, redshank
Dornoch Firth and Loch Fleet SPA	40,763	**Whooper swan, greylag goose**, bar-tailed godwit, wigeon
Cromarty Firth SPA	35,583	Whooper swan, **pink-footed goose, greylag goose, barnacle goose,** red-breasted merganser, redshank
Loch Spynie SPA	16,781	**Pink-footed goose, greylag goose**

*Notes: [1]Average number is taken from the WeBS annual report and data collected between 2003/04 to 2007/08. [2]Species occurring in internationally important numbers are shown in **bold**. Sites designated as Wetland Assemblages of International Importance shown in bold (qualifying level is 20,000 birds).*

Sources: DECC (2009); Holt *et al*. (2009); JNCC (2009)

Data from Beatrice bird surveys

Between 2005 and 2008, ornithological surveys were carried out to gather information on bird activity in the vicinity of the Beatrice Wind Farm Demonstrator Project (situated to the west of the project development area). The surveys were designed using a Before After Control Impact (BACI) method to assess the impact of the two 5 MW wind turbines that were installed during August 2006 and June 2007.

The most commonly recorded species were kittiwake, auks (guillemot and razorbill), fulmar, great black-backed gull, gannet and herring gull. Several species were recorded less frequently, including cormorant, shag, great skua, manx shearwater, sooty shearwater and tern species. Sea ducks, waders and wildfowl were uncommon, with a small number of divers, eider, oystercatcher, goose species and whooper swan recorded.

The vast majority of flights for all species occurred at heights of less than 20 m, with gannet, great black-backed gull, herring gull and kittiwake being the species most often likely to fly at higher altitude in the zone close to the turbines. Fulmar and auks, although common during most months, were very rarely found at heights >20 m.

Auk numbers increased significantly during the breeding season as birds foraged in the Moray Firth area in close proximity to their cliff nesting sites. In autumn, numbers tailed off as individuals moved to their wintering grounds further out to sea. Fulmar and kittiwake showed a similar seasonal pattern although less pronounced. Gannets and great-black backed gulls had later seasonal peaks, possibly due to the presence of fledged juveniles. High numbers of gannets were observed during the main migratory periods; numbers were relatively low during the breeding season. In general, seabird numbers were much lower during winter months.

Aerial Data

Seven aerial surveys have been undertaken over the Moray Firth Round 3 zone in 2009 (May, June August, November and December) and 2010 (two in February). The first three surveys were undertaken by HiDef Aerial Surveying, and the remaining surveys by WWT Consulting. The surveys covered the entire Round 3 zone plus a 4 km buffer.

The key findings from these data for the Phase 1 development area are:

- The most frequently recorded bird species / species groups in this area were auks, with high numbers of fulmar, kittiwake and other gulls also recorded.
- Other bird species recorded within the Moray Firth site included gannet, along with very low numbers of divers, Leach's petrel, Arctic skua, great skua, and unidentified terns.
- Seasonal variations in bird numbers present within the Moray Firth site included: increasing numbers of fulmar in November compared to other months; highest numbers of gannet and kittiwake in June and August, with low numbers during the winter; and higher numbers of auks during May and June compared to the winter.

5.2.5.2 DATA GAPS

Additional complimentary methods of survey shall be considered by MORL both on an individual site basis and also in coordination with the MFOWDG in order to address any gaps in the ornithological Data for EIA and AA. These limitations will be identified following consultation with JNCC and SNH. Survey methods under consideration include a number of options:

- Seabird tagging studies;
- Additional aerial surveys;
- Habitat modelling; and
- Population Viability Analysis (PVA).

5.2.5.3 ENVIRONMENTAL IMPACT SCOPING

Given the preliminary nature of a scoping assessment potential environmental impacts may only be broadly predicted prior to the completion of detailed baseline characterisation surveys. As such the impacts listed below are largely based on similar experiences with previous offshore wind development sites around the UK coast and in European waters in general.

Impact Description	**Potential site specific impact**	**Potential cumulative and/or in-combination Impact**
Indirect habitat loss and displacement from feeding areas as a consequence of disturbance of marine prey	✓	✓
Disruption to habitat function	✓	✓
Changes in prey availability associated with presence of turbines and changes in fishing activity	✓	✓
Disturbance leading to displacement of birds (construction and decommissioning)	✓	✓
Collision with turbines whilst in flight	✓	✓
Barrier effects caused by turbines resulting in modification of flight routes (e.g. to feeding areas or migration)	✓	✓

5.2.5.4 SITE-SPECIFIC IMPACT ASSESSMENT METHODOLOGY

For each of the potential impacts described above a survey or study and method of impact assessment is described in the tables below.

Potential Impact	**Indirect habitat loss and displacement from feeding areas as a consequence of disturbance of marine prey**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Regional, national and international bird communities To determine the potential for habitat loss and impacts to prey, the following surveys and studies will be undertaken: Surveys of bird species density and distribution Surveys of bird behaviour within site area Habitat distribution identification (see section 5.1.4.3) Survey of marine benthic species density and distribution (see section 5.2.2.5) Survey of fish species density and distribution (see section 5.2.3.5) Information on fish species audiograms to be collected through desk-top study Underwater noise survey to characterise baseline environment Desk-top study and noise modelling to determine zones of noise around piling operations Literature study of bird species foraging habits and changes to marine trophic web associated with offshore wind farms
Method of Impact Assessment	The potential for bird species feeding within the site will be determined by assessing the distribution, density and behaviour data of birds within the site and relating this to literature accounts of species foraging habitats and habitat maps and the density and distribution of marine benthic organisms and fish within the site. The potential impact of construction and operation on habitats, benthic organisms and fish species will be determined using available information. In addition, background noise measurements will be used to model the severity of noise of piling operations over distance. The potential impact of increased noise on prey resources will be assessed where audiograms are available for noise sensitive fish and marine benthic species. These impact assessments will be used to assess the potential impact upon the foraging habits of bird species. The potential for impacts will also be assessed with regard to the time of year so that levels of impact may be assessed with regard to different seasonal patterns of use.

Potential Impact	**Changes in prey availability associated with presence of turbines and changes in fishing activity**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Regional, national and international bird communities To determine the potential for changes in long-term prey availability, the following surveys and studies will be undertaken: Survey of bird foraging behaviour within the site Desk-top review of bird species foraging habits Desk-top review of biofouling of marine infrastructure Survey of fishing activity within and around the site (see section 5.2.3.5) Survey of fish density and distribution (see section 5.2.3.5) Survey of marine benthic species density and distribution (see section 5.2.2.5)

Method of Impact Assessment	The potential for biofouling and long-term changes in prey availability for bird species will be estimated using the baseline survey information on biota and evidence from other marine industries. The potential for changes in fishing activity and fish species density and abundance within the wind farm site will also be estimated from the baseline data and evidence from other marine industries. The potential for interaction between changes in commercial fishing activity and biofouling will also be assessed. The potential impacts on prey species will be related to observed and known foraging behaviour of bird species recorded within the proposed development area.

Potential Impact	**Disturbance leading to displacement of birds (construction and decommissioning)** **Disturbance may be initiated both by vessels (especially of swimming and diving species such as divers and auks) and by noisy construction activity such as pile-driving that may affect all species**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Regional, national and international bird communities To determine the potential for disturbance and displacement, the following surveys and studies will be undertaken: Survey of bird species density and distribution Survey of bird behaviour Review of construction, operation and decommissioning activities Literature study of bird behavioural responses to offshore wind farms and other related activities.
Method of Impact Assessment	Bird species density, distribution and behavioural data will be used to model population densities across the site over time and uses of the site. The impact of the anticipated construction, operation and decommissioning activities will be assessed in relation to these baseline data. The potential for impacts will also be assessed with regard to the time of year so that levels of impact may be assumed with regard to different seasonal patterns of use. The significance of potential impacts will be assessed using the sensitivity of the receptors against a measure of the magnitude of the effect (assessed from a measure developed by Garthe & Hüppop, 2004).

Potential Impact	**Collision with turbines whilst in flight**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Regional, national and international bird communities To determine the potential for collision risk, the following surveys and studies will be undertaken: Survey of birds in flight, including species, density and distribution

	Collision risk analysis using above data Review of migratory behaviour and on-passage behaviour Review of collision risk and collision rates from existing offshore wind farms
Method of Impact Assessment	A collision risk analysis will be undertaken to assess the potential direct impacts of the presence of turbines and blades. This analysis will be on a per-species basis and will provide an indication of those species at greatest risk. This assessment will be related to the relative abundance and nature conservation status of each species and past studies from existing offshore wind farms to provide an overall assessment of the potential for the proposed development to significantly affect key species.

Potential Impact	**Barrier effects caused by turbines resulting in modification of flight routes (e.g. to feeding areas or migration)**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Regional, national and international bird communities To determine the potential for barrier effects, the following surveys and studies will be undertaken: Survey of birds in flight, including species, density and distribution Review of migratory behaviour and on-passage behaviour Review of flight behaviours around existing offshore wind farms
Method of Impact Assessment	The overall density and population size for each species using or passing through the wind farm site will be calculated. The estimated maximum population size will be compared against the 1% threshold for regional, national and international figures for each species. Assuming displacement of particular proportions of the population present (worst-case being 100%) ultimately allows the significance impact of the loss of the OWF to be assessed in standard EIA methodologies. The results will be cross-referenced against existing wind farm studies.

5.2.5.5 SITE-SPECIFIC SURVEY METHODOLOGY

BEST PRACTICE GUIDANCE

Guidance on offshore bird surveys is not currently available from Scottish Natural Heritage. However, guidance on surveys is available from the Collaboration for Offshore Wind Research in the Environment (COWRIE):

- Camphuysen *et al*. (2004). Towards standardised seabird at sea census techniques in connection with environmental impact assessments for offshore wind farms in the UK: a comparison of ship and aerial sampling methods for marine birds, and their applicability to offshore wind farm assessments. NIOZ report to COWRIE (Ref BAM-02-2002)
- MacLean *et al*. (2009). A review of assessment methodologies for offshore wind farms.

PROPOSED SURVEY PROGRAMME

The overall approach to the survey programme is to undertake two years of boat surveys and analysis. The results will be regularly reviewed with the statutory agencies (JNCC and SNH) in order to guide any additional survey campaign(s) and analyses for determining favourable conservation status (see section 5.2.6) and assessing data requirements for Appropriate Assessment.

BOAT-BASED SURVEYS

Boat-based surveys were commenced in April 2010. The survey methodology follows the technique for ship-based seabird surveys outlined by Camphuysen *et al*. (2004) and the recommendations to improve this methodology outlined by MacLean *et al*. (2009). The characteristic of this approach is the use of a line-transect survey method within a survey area that incorporates the proposed Eastern Development Areas as well as a buffer, extending to a distance of no less than 4 km from the position of the outer turbines.

Based on experience gained from numerous surveys of existing OWF projects, instead of the approach set out in Camphuysen *et al.* (2004), whereby snapshots are taken at 5 minute intervals, snapshots will instead be undertaken at distance intervals of every 1 minute. This will also allow a larger number of snapshots, and as such has a far greater prospect of accurate determination of the density of flying birds. As many of the target species will generally be encountered in flight, accurate determination of the density and flight heights of flying birds is thus seen to be critical to the value of the survey programme.

Please also note that four surveyors will be on the survey platform at all times.

The area to be surveyed includes a 4 km buffer around the site with transects orientated in an east-west direction. East-west transects routes have been selected as this places them generally perpendicular to the coast and potentially perpendicular to the majority of bird flights.

The requirements for the survey vessel are presented in Table 5-7.

Table 5-7: Minimum Survey Vessel Parameters

Characteristic	Parameters
Length	No less than 20 m No greater than 100 m
Forward viewing platform	No less than 5 m above sea level
Speed	10 knots (range 5 – 15 knots)

The boat based survey is line-transect method with a strip width of 300 m (Figure 5-7). The method is designed to enable distance sampling of data and calculation of densities. Birds, marine mammals and other megafauna (e.g. basking shark) are recorded. Observers are assigned an identification code, to allow additional analysis of results (MacLean *et al*., 2009). The following parameters are key components of the method:

- One surveyor records birds within a 90° forward arc and a second surveyor acts as a scribe/recorder. A third person will be present on the observation platform to aid the other two surveyors where necessary. The three people alternate roles to prevent fatigue.
- A forth surveyor acts as a dedicated marine mammal observer, and also notes down weather information, speed and records GIA route.
- Bird detection is undertaken by naked eye. Divers and seaduck, that are known to flush from the sea surface at distance from the survey vessel, are not expected to be present in significant

numbers in the spring and summer survey period. If significant numbers are observed then forward scanning with binoculars will be required to improve the detection of these species.
- Observations are made along the line transect with a strip width of 300 m maximum.
- Subdivision of survey bands at the following intervals: 0-50 m, 50-100 m, 100-200 m, 200-300 m, 300+ m perpendicular to ship.
- Records are taken in 1-minute sessions.
- Every 1 minute, 'snapshots' are undertaken in the zone that is a square block of air extending 300 m to the front and 300 m perpendicular from the boat. The number, height and behaviour of those birds in flight within the snapshot zone are recorded.
- Flight heights will be recorded in the following bands: <5m, 5-10 m, 10-20 m, 20-200 m, 200-300 m and >300 m.
- No bird observations in sea state five or more will be used (moderate waves, chance of some spray).
- No marine mammal observations in sea state four or more will be used.
- One set of transect surveys will be undertaken each month throughout the two years, except in the months of March and August where two surveys will be carried out.
- Transects will have a 2 km separation and distributed as identified above.
- Each survey track will be traversed at a constant speed (approximately 10 knots).
- The position of the vessel will be fixed regularly using GPS.

All those undertaking observations are trained to ESAS or JNCC standards. The surveyors are highly experienced with the survey and recording methods and bird identification, including familiarity with all relevant scarce and common marine species and with some knowledge of rarities and a full understanding of plumages and moults.

For each observation made during each of the boat based surveys, the following information is recorded:
- Species (using BTO two letter codes);
- Number (count);
- Distance from vessel (see below);
- Height of flight (see below);
- Direction (where applicable); and
- Additional information regarding, age, sex, plumage and behaviour wherever possible.

For each observation the distance from the vessel will be recorded using discrete distance bands as follows:

Band	**Distance**
A	0 – 50 m
B	50 – 100 m
C	100 – 200 m
D	200 – 300 m
E	300 m+

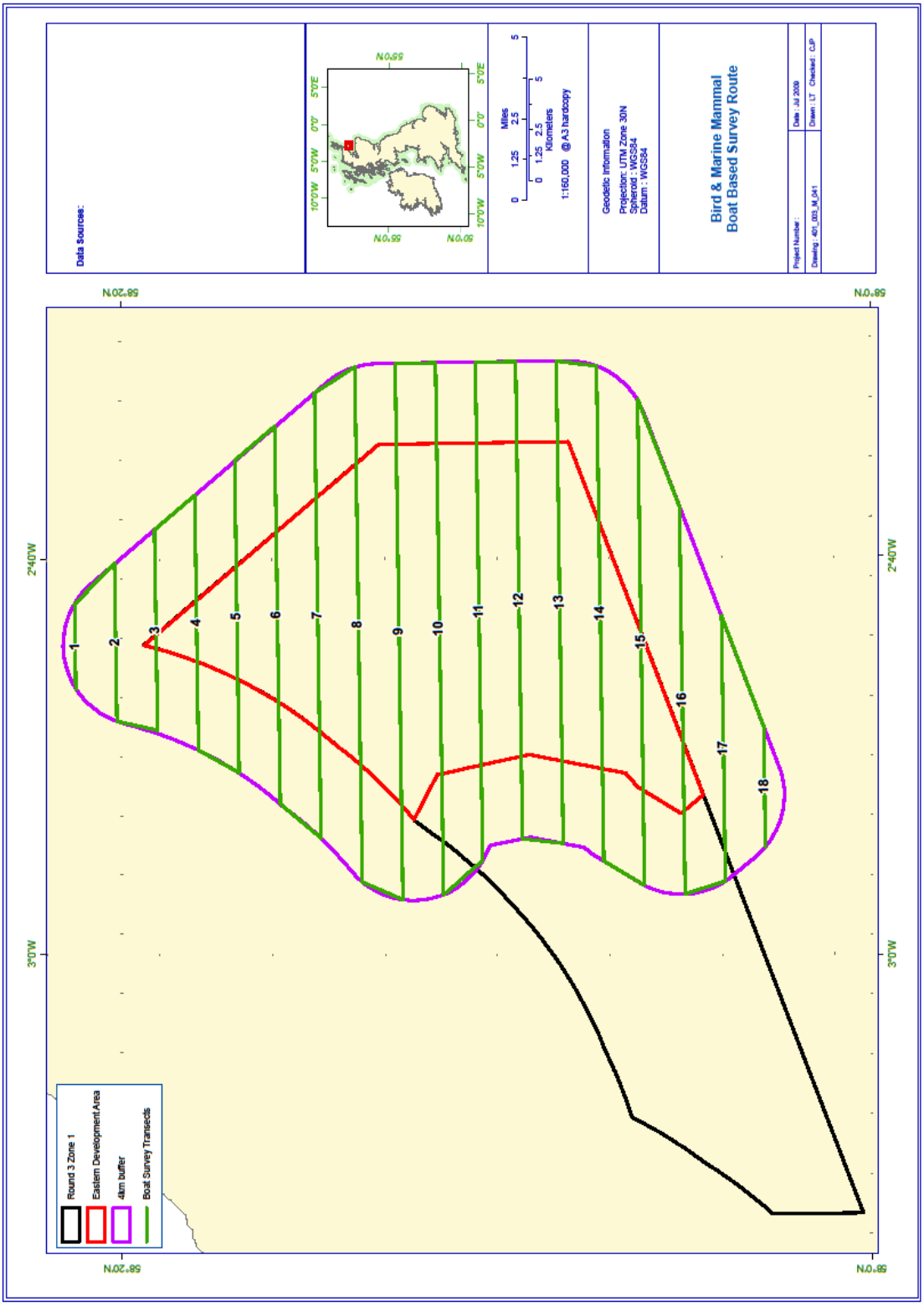


Figure 5-7: Illustration of boat survey transects and buffer zone

The flight height of birds will be recorded in discrete height categories as follows:

Band	**Distance**
A	0 – 5 m
B	5 – 10 m
C	10 – 20 m
D	20 – 200 m
E	200 – 300 m
F	300 m+

All bird data and a number of environmental variables affecting visibility and thus survey efficiency (e.g. rain, cloud cover, glare, wind speed and sea state) are recorded. Boat speed will be recorded at each snapshot location. Sea state will be recorded at the start of transects and when there are changes in sea state (MacLean *et al*., 2009).

Marine mammals and other megafauna sightings (e.g. basking shark) are recorded by a dedicated observer. The information to be recorded shall include:

- Species
- Time
- Group size, recording the minimum, maximum and best estimate, plus the number of calves where appropriate
- Age and sex, where possible
- Distance from vessel using a measuring stick
- Additional information regarding age and behaviour (i.e. normal swim, breaching, feeding) wherever possible
- Cue for sighting, i.e. breach, splash, blow

5.2.5.6 CUMULATIVE AND IN-COMBINATION IMPACT ASSESSMENT & SURVEY METHODOLOGIES

As discussed in section 5.2.4.7, COWRIE has recently issued new guidance on cumulative impact assessment for ornithology (King *et al.*, 2009), which use 'key features' tables to identify a list of species which may be at most risk of cumulative impacts.

The requirement for additional regional surveys will be considered by the MFOWDG and methodologies and assessment details issued as a separate document.

5.2.5.7 POTENTIAL MITIGATION METHODS

Potential mitigation measures for impacts to birds include micrositing of turbines, design of turbine lighting (where possible within aviation and navigation requirements), choice of construction techniques, use of standard vessel routes, and avoidance of rafting birds and foraging hotspots.

The mitigation measures proposed for the final wind farm sites will be dependent upon the final design of the site and the potential impacts as determined by the EIA studies. Options of mitigation will be discussed with the relevant authorities prior to ES submission.

5.2.6 DESIGNATED SITES

The national suites of sites providing statutory protection for flora, fauna, or geological or physiographical features include international sites (e.g. wetlands of international importance, RAMSAR sites), European sites (Special Protection Areas (SPAs) and Special Areas of Conservation (SACs)), and national sites (e.g. National Nature Reserves, Sites of Special Scientific Interest (SSSIs), and Marine Nature Reserves (MNRs)). In addition, under the Marine (Scotland) Act (2010) and the UK Marine & Coastal Act (2009), guidance and plans are being developed to designate Marine Protected Areas (MPAs). Work by Scottish Natural Heritage, JNCC and Marine Scotland, to identify marine features for which MPAs will be designated is currently ongoing (SNH, 2010) and sites have yet to be identified.

The potential effects of any proposed wind farm upon protected sites and their interest features need to be considered carefully. Where sites of international (Ramsar site) or European (SPA, SAC) importance are potentially affected, then the advice of the statutory nature conservation organisation will be required. If there is any indication of a likely significant effect (LSE) on any of these sites then SNH/JNCC may advise the Competent Authority that an Appropriate Assessment is required (see section 1.4).

5.2.6.1 BASELINE ENVIRONMENT

The proposed development site is not located within any site of conservation interest, designated or proposed to be designated. The outer limit of the inner Moray Firth SAC is approximately 17 km from Zone 1, and the nearest coastal SPA is the East Caithness Cliffs SPA approximately 19.95 km.

However, the Moray Firth contains many sites of national and international importance for wildlife, with species that may use the proposed development area for activities such as migration, feeding or resting. Several Special Areas of Conservation (SAC) are listed in Table 5-9 Special Protected Areas (SPAs) and Ramsar sites are listed in Table 5-8. Figure 5-8 illustrates the locations of coastal SPA and SACs.

There are also 45 Sites of Special Scientific Interest (SSSI); five Internationally Important Bird Areas (IBAs), including the Moray Firth Basin, Firths and Bays; Royal Society for the Protection of Bird (RSPB) and Scottish Wildlife Trust (SWT) reserves; Local Nature Reserves (LNR); and National Nature reserves (NNR) along the Moray Firth coast.

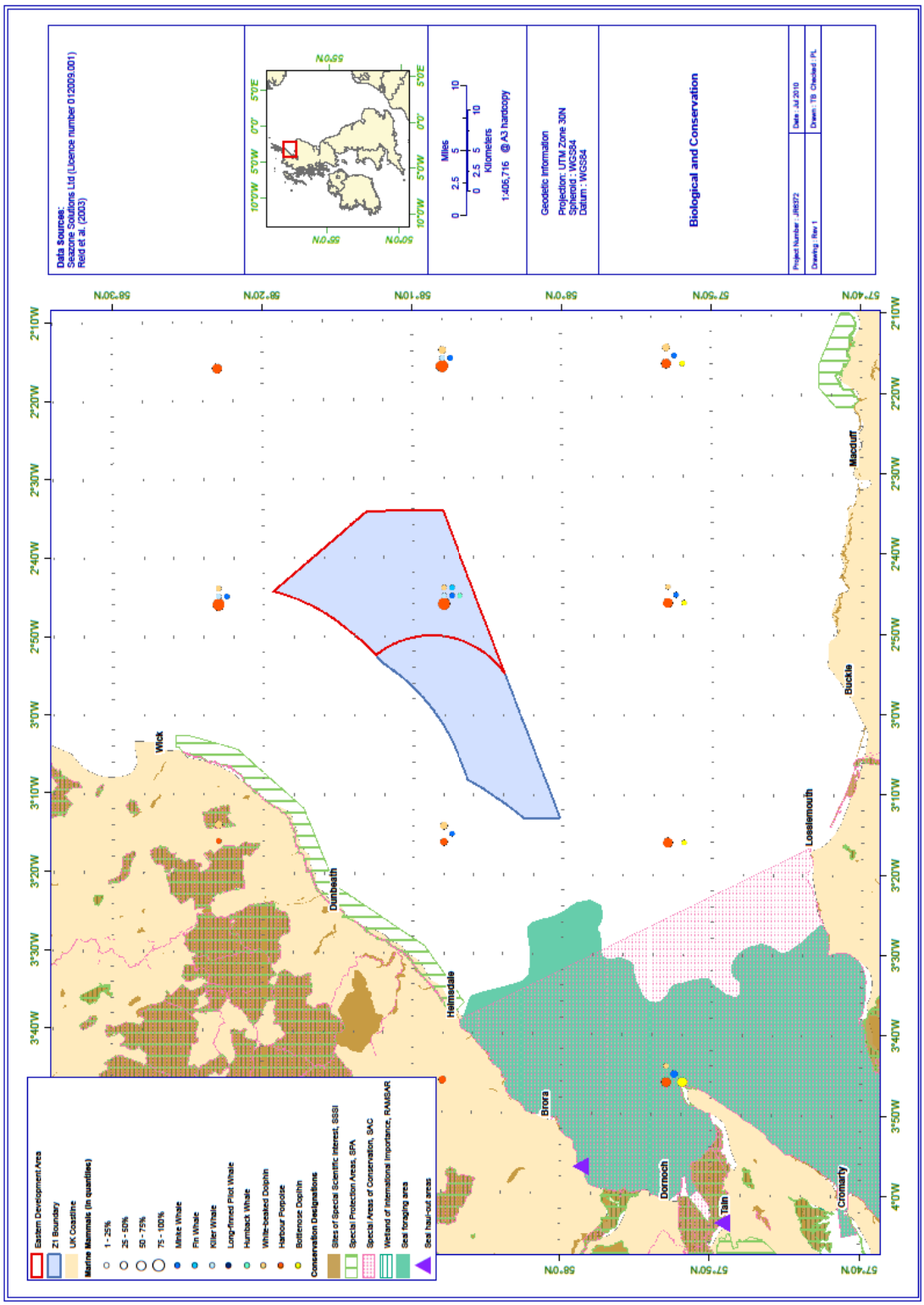


Figure 5-8: Location of coastal SPAs, SACs, seal haul out sites and frequency of marine mammal observations.

CONSERVATION SITES FOR BIRDS AND ASSOCIATED HABITAT

The Moray Firth coast has several Special Protection Areas (SPAs) established under the Birds' Directive (Table 5-8) (JNCC, 2009). SPAs provide protection to breeding and roosting sites; such protection is largely limited to land above mean low water springs in Scotland. In September 2009, marine extensions to existing seabird breeding colony SPAs, including the East Caithness Cliffs SPA and Troup Pennan & Lion's Head SPA, were granted because the sea adjacent to breeding colonies is considered important to seabirds for essential resting and maintenance activities.

Table 5-8: Summary of conservation sites for birds in the Moray Firth

Site	Status	Location & Area (Ha)	Qualifying features
North Caithness Cliffs	SPA	58°39'00"N 03°24'30"W 557.73 Ha	**Breeding season:** fulmar, guillemot, kittiwake, razorbill
East Caithness Cliffs	SPA/IBA	58°16'49"N 03°20'21"W 442.62 Ha	**Breeding season:** peregrine, guillemot, herring gull, kittiwake, razorbill, shag **Seabird assemblage:** international importance
Dornoch Firth and Loch Fleet	SPA/Ramsar	57°51'00"N 04°02'30"W 7836.33 Ha	**Breeding season:** osprey, Over winter: bar-tailed peregrine, guillemot, herring gull, kittiwake, razorbill, shag **Seabird assemblage:** international importance
Cromarty Firth	SPA/Ramsar	57°41'00"N 04°12'00"W 3766.24 Ha	**Breeding season:** common tern, osprey, **Over winter:** bar-tailed godwit, whooper swan, greylag goose **Waterfowl assemblage:** wetland of international importance
Inner Moray Firth	SPA/Ramsar	56°50'25"N 04°21'15"W 2339.23 Ha	**Breeding season:** common tern, osprey **Over winter:** bar-tailed godwit, greylag goose, red-breasted merganser, redshank, scaup **Waterfowl assemblage:** wetland of international importance
Moray Firth and Nairn Coast	SPA/Ramsar	57°38'54"N 03°43'48"W 2410.25 Ha	**Breeding season:** osprey **Over winter:** Bar-tailed godwit, greylag goose, pink-footed goose, redshank **Waterfowl assemblage:** wetland of international importance
Loch Flemmington	SPA	57°32'32"N 03°59'15"W 21 Ha	**Breeding season:** Slavonian grebe

Site	Status	Location & Area (Ha)	Qualifying features
Troup, Pennan and Lion's Head	SPA/IBA	57°41'00"N 02°15'05"W 174.22 Ha	**Breeding season:** kittiwake, guillemot **Seabird assemblage:** international importance
Loch Spynie	SPA	57°41'00"N 03°16'42"W 93.62	**Over winter:** greylag goose
Caithness Lochs	SPA	58°29'30"N 03°20'00"W 1378.45	**Over winter:** Greenland white-fronted goose, whooper swan, greylag goose
Loch of Strathbeg	SPA	57°37'24"N 01°53'00"W 615.94	**Breeding season:** Sandwich tern **Over winter:** barnacle goose, whooper swan, greylag goose, pink-footed goose **Waterfowl assemblage:** wetland of international importance

Source: JNCC (2009)

CONSERVATION SITES FOR DIADROMOUS FISH AND ASSOCIATED HABITAT

The north-east coast of Scotland has several rivers which are important to salmon and sea trout, a number of which have been designated as SACs for their populations of Atlantic salmon. Within the Moray Firth catchment area these include, the Rivers Spey, Moriston, Oykel, Berridale and Langwell waters (JNCC, 2009). Relatively little is known about the migration patterns of salmonids, however in the Moray Firth they are thought to follow the coastline, although a proportion of the population may travel diagonally across the Moray Firth passing by Wick and Fraserburgh (Shearer, 1992).

The River Spey supports important numbers of sea lamprey and they are listed as a primary reason for site selection of the River Spey SAC (DTI, 2004; JNCC, 2009). Eels are present in most, if not all, of the river systems along the Moray Firth coastline (DTI, 2004), but there is no tradition of exploiting them in Scotland.

The freshwater pearl mussel (*Margaritifera margaritifera*) is a rare and threatened species, which is listed in Annex II of the EU Habitats Directive. The life cycle of the freshwater pearl mussel is closely linked to that of salmonids fish. Therefore any potential impacts on salmonids may have implications for freshwater pearl mussels. Within the Moray Firth catchment area the Rivers Spey, Moriston, Oykel and Evelix, have been designated as SACs, for which the freshwater pearl mussel is primary feature. Freshwater pearl mussels inhabit cool, well-oxygenated soft water free of pollution or turbidity in fast-flowing rivers and streams with healthy salmon populations. The mussel spends its larval stage attached to the gills of salmonid fishes, attaching themselves during mid to late summer and then drop off the following spring to settle in the riverbed gravel where they grow to adulthood (JNCC, 2009).

CONSERVATION SITES FOR MARINE MAMMALS AND ASSOCIATED HABIT

In March 2005, the inner Moray Firth (with an outer boundary from Helmsdale on the north coast to Lossiemouth on the south coast) was designated as a marine Special Area of Conservation (SAC) for

the Moray Firth bottlenose dolphin population. Bottlenose dolphins are listed in Annex II of the Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats of wild flora and fauna). Abundance estimates indicate that the Moray Firth bottlenose dolphin population is small and genetically isolated, which make it particularly sensitive to any disturbance that may have potential consequences at both the individual and population level.

The Dornoch Firth and Morrich More was designated as an SAC in 2005, with harbour seals one of the designating features. The Moray Firth supports a population of approximately 1600 harbour seals, the largest on the east coast of Scotland (Thompson *et al*., 2007). A significant proportion of the inner Moray Firth population of harbour seals is found in the Dornoch Firth, which represents almost 2% of the UK population (JNCC, 2009). The species tends to be more localised than grey seals, staying in the same general area to breed, feed and rest, and do not form as large breeding colonies. Although there have been various conservation efforts, harbour seals in Scotland have recently shown dramatic declines in numbers over the past 8 years (SMRU, 2010).

Table 5-9: Summary of Special Areas of Conservation (SAC) in the Moray Firth

Site	Status	Location & Area (Ha)	Qualifying features
Moray Firth	SAC	57°49'00"N 03°43'36"W 151341.67 Ha	**Annex I Habitats (secondary feature):** Sandbanks which are slightly covered by seawater all of the time. **Annex II Species (primary feature)**: Bottlenose dolphins (*Tursiops truncatus*).
Dornoch Firth and Morrich More	SAC	57°51'00"N 04°02'30"W 8700.53 Ha	**Annex I Habitats (primary features)**: Estuary, mudflats and sandflats, *Saliornia* and other colonising annuals, Atlantic salt meadows (*Glauco-Puccinellietalia martitimae*), embryonic shifting dunes, white dunes, fixed dunes, decalcified fixed dunes, Atlantic decalcified fixed dunes, humid dune slacks and coastal dunes with *Juniperus* spp. **(secondary features):** sandbanks which are slightly covered by seawater all the time and reefs. **Annex II species (primary features)**: Otter *Lutra lutra* and Common Seal *Phoca vitulina*.
Culbin Bar	SAC	57°37'45"N 03°46'30"W 612.88 Ha	**Annex I Habitats (primary feature):** Perennial vegetation of stony banks. **(secondary features):** Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) and Embryonic shifting dunes. **Annex II species:** none
Lower River Spey – Spey	SAC	57°40'12"N 03°07'00"W	**Annex I Habitats (primary features):** Perennial vegetation of stony banks,

Site	Status	Location & Area (Ha)	Qualifying features
Bay		652.6 Ha	alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salison albae*). **Annex II species:** none
River Spey	SAC	57°22'15"N 03°30'00"W 5729.48	**Annex I Habitats:** none **Annex II species (primary features):** Freshwater pearl mussel (*Margaritifera margaritifera*), sea lamprey (*Petromyzon marinus*), Atlantic salmon (*Salmo salar*), otter (*Lutra lutra*)
River Thurso	SAC	58°25'20"N 03°28'00"W 355.58	**Annex I Habitats:** none **Annex II species (primary features):** Atlantic salmon (*Salmo salar*).
River Moriston	SAC	57°10'20"N 04°49'00"W 194.53 Ha	**Annex I Habitats:** none **Annex II species (primary features):** Freshwater pearl mussel (*Margaritifera margaritifera*) **(secondary feature)**: Atlantic salmon (*Salmo salar*).
River Oykel	SAC	57°58'20"N 04°44'00W 960.42 Ha	**Annex I Habitats:** none **Annex II species (primary feature):** Freshwater pearl mussel (*Margaritifera margaritifera*) **(secondary feature)**: Atlantic salmon (*Salmo salar*).
River Evelix	SAC	57°53'45"N 04°07'10"W 20.17 Ha	**Annex I Habitats:** none **Annex II species (primary feature):** Freshwater pearl mussel (*Margaritifera margaritifera*).
Berriedale and Langwell Waters	SAC	58°11'40"N 03°31'10"W 57.62 Ha	**Annex I Habitats:** none **Annex II species (primary feature):** Atlantic salmon (*Salmo salar*).
East Caithness Cliffs	SAC	58°16'49"N 03°20'21"W 442.6 Ha	**Annex I Habitats (primary feature):** vegetated sea cliffs of the Atlantic and Baltic coasts **Annex II species:** none
Mound Alderwood	SAC	57°57'50"N 04°05'30"W 297.33 Ha	**Annex I Habitats (primary feature):** Alluvial forests with *Alunus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicon albae*). **Annex II species:** none
Conon Islands	SAC	57°33'30"N 04$_o$26'45"W	**Annex I Habitats (primary)**: Alluvial forests with *Alnus glutinosa* and *Fraxinus*

Site	Status	Location & Area (Ha)	Qualifying features
		120.11 Ha	*excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) **Annex II species:** none

Source: JNCC (2009)

INSHORE AND OFFSHORE DESIGNATED SITES

The Smith Bank is an important area for fish and shellfish and is a known feeding ground for marine mammals and birds. In relation to birds, SNH and JNCC are currently investigating the designation of new SPA areas. There are 3 types of ornithological protection areas being investigated:

1. Extensions to existing SPAs. All candidate sites submitted to the Scottish Government were approved for SPA status (SNH, 2009). Extensions of the SPAs within the Moray Firth area were of 2km (see Appendix 1 and above).
2. Inshore feeding aggregations. Areas for seaduck and red-throated diver are being investigated. Candidate areas for red-throated divers are expected to be submitted to the Scottish Government in 2010.
3. Offshore feeding aggregations for other species to be identified. JNCC are currently investigating areas for terns, with candidate areas expected to be submitted in 2010.

In December 2009, JNCC released a series of maps indicating the areas of search for new SPA's (JNCC, 2009). Two areas within the Moray Firth have been identified. These include the inner Moray Firth, which is being investigated in relation to inshore aggregations of waterbirds and an area off Helmsdale within Scottish Territorial Waters, which is being investigated in relation to important seabird concentrations. There is also an area extending from Duncanbsy Head (to the north of the zone), which is also being investigated in relation to important seabird concentrations.

In addition, investigations into new SAC's are also progressing. Areas that are important for marine mammals (particularly bottlenose dolphin, harbour porpoise, grey seals and harbour seals) and areas of best conservation management for mobile species are also being investigated. Several offshore SACs have recently been proposed but there are no known plans to designate an offshore SAC within the outer Moray Firth (JNCC, 2010).

5.2.6.2 DATA GAPS

There is good data for nature conservation designating species which is available from SNH, JNCC or the landlords of the designated site. However, data for species of conservation importance within the proposed development area is not necessarily available. Data gaps associated with species are discussed in sections 5.2.3, 5.2.4 and 5.2.5. In addition, data on the distribution of Annex I habitats within the proposed development area is currently unavailable and surveys would be required.

5.2.6.3 ENVIRONMENTAL IMPACTS SCOPING

There is the potential for the proposed development area to affect a range of physical and biological characteristics that create direct or indirect impacts upon features of nature conservation interest. The potential effects listed in the below table were identified from relevant guidance notes, environmental statements published for other UK offshore wind farms and knowledge of potential nature conservation issues in and around the proposed development area.

Given the distance offshore of the proposed wind farm site, the key qualifying features that are **scoped in** for the assessment are birds, diadromous fish, marine mammal species and coastal habitats. Bats features are **scoped out** of this assessment because the SAC features are not migrating species.

Impact Description	Potential site specific impact	Potential cumulative and/or in-combination Impact
Adverse effects on qualifying features which will impacts on the integrity of designated sites of nature conservation importance (e.g. Ramsar, SPA, SAC, SSSI, NNR).	✓	✓
Adverse effects on Annex I habitats and Annex II species, not currently covered by any specific designation	✓	✓
Adverse effects on UK BAP habitats and species	✓	✓

5.2.6.4 SITE-SPECIFIC IMPACT ASSESSMENT METHODOLOGY

For each of the potential impacts described above a survey or study and method of impact assessment is described in the tables below.

Potential Impact(s)	**Adverse effects on qualifying features and the integrity of designated sites of nature conservation importance (e.g. SAC or SPA)**
Survey/Study Proposed to Assess Impact	Potentially sensitive receptors include: - Fish and shellfish species which are designating features - Bird species which are designating features - Marine mammal species which are designating features To determine the potential for impacts on qualifying species, the following surveys and studies will be undertaken: Review of nature conservation designating features and reasons Baseline EIA surveys (as per relevant sections 5.2.2.5, 5.2.3.5, 5.2.4.5, 5.2.5.5) Additional surveys to determine favourable conservation status (to be determined)
Method of	Potential impacts upon designated sites will be assessed via standard EIA

Impact Assessment	methodologies, using significance criteria agreed with the relevant statutory nature conservation agency. The results of relevant EIA baseline surveys (e.g. fish, birds and marine mammals) will be reviewed at 6 and 12 months (out of the 24 month survey period). Species of conservation significance will be assessed to determine whether any are likely to potentially incur impacts. Further studies will be undertaken in the second half of the survey campaign to provide information on the impact of favourable conservation status. It is anticipated that all data collected through field surveys within the EIA will be compatible with the requirements of Appropriate Assessment.

Potential Impact(s)	**Adverse effects on Annex I habitats and Annex II species** **Adverse effects on UK BAP habitats and species**
Survey/Study Proposed To Assess Impact	Potentially sensitive receptors include: - Fish and shellfish species which are designating features - Bird species which are designating features - Marine mammal species which are designating features - Habitats which are designating features To determine the potential for impacts on Annex I habitats, Annex II species and UK BAP habitats and species, the following surveys and studies will be undertaken: Literature review of habitats and species distribution Habitat distribution identification (see section 5.1.4.3) Coastal processes modelling (see section 5.1.4.3) Survey of marine benthic species density and distribution (see section 5.2.2.5) Survey of fish species density and distribution (see section 5.2.3.5) Survey of marine mammals density and distribution (see section 5.2.4.5) Survey of bird density and distribution (see section 5.2.5.5)
Method of Impact Assessment	Data from the geophysical survey of the site, in particular hi-resolution sidescan data and ground truthing, will be used to identify the potential distribution of Annex I and UK BAP habitats. The presence/absence of Annex II and UKBAP species within the site will be recorded via a combination of desk-based review of existing data-sets and data from relevant biological surveys. Potential impacts upon Annex I habitat, Annex II species and/or UK BAP habitat/species will be assessed via standard EIA methodologies, using significance criteria agreed with the relevant statutory nature conservation agency. Where species/habitats listed under the Habitats Directive are likely to be affected, there may be a requirement to provide information within the ES that enables the competent authority to undertake an Appropriate Assessment. It is anticipated that all data collected through field surveys within the EIA will be

	compatible with the requirements of Appropriate Assessment and therefore will not require further survey to be undertaken.

5.2.6.5 SITE SPECIFIC SURVEY METHODOLOGY

BEST PRACTICE GUIDANCE

The following references provide best practice guidance for use in assessing impact upon nature conservation:

- English Nature, RSPB, WWF-UK and BWEA (2001). Wind Farm Development and Nature Conservation: A Guidance Document for Nature Conservation Organisations and Developers when Consulting over Wind Farm Proposals in England, WWF-UK, 19pp;
- CEFAS, DEFRA, DTI and MCEU (2004). Offshore Wind Farms: Guidance Note for Environmental Impact Assessment in Respect of FEPA and CPA Requirements Version 2, Marine Consents Environment Unit, 48pp;
- DEFRA (2005). Nature conservation guidance on offshore wind farm development. A Guidance Note on the Implications of the EC Wild Birds and Habitats Directives for Developers Undertaking Offshore Windfarm Developments;
- SNH (2005a). A Handbook on Environmental Impact Assessment. Guidance for Competent Authorities, Consultees and Others Involved in the Environmental Impact Assessment Process in Scotland;
- ABPmer (2009a). Wet Renewable Energy and Marine Nature Conservation: Developing Strategies for Management; and
- IEEM (2009). Guidelines for Ecological Impact Assessment in Britain and Ireland - Marine and Coastal Consultation Document.

5.2.6.6 ADDITIONAL INFORMATION

The assessments for nature conservation will be undertaken as part of the species specific surveys. The survey programme will be designed to include the data collection required for assessing the impact on favourable conservation status and for meeting the requirements of the Habitats Regulations Assessment. All methodologies will be discussed and agreed with JNCC and SNH.

The impact assessment for nature conservation aspects will be presented in a separate chapter from the more general environmental receptor issues upon which the assessment are based.

SITES INCLUDED WITHIN THE ASSESSMENT

It is proposed that the initial assessment of impacts upon designated sites will be undertaken for the sites listed in Table 5-9 and Table 5-8 above, with the exception of the following SACS which do not have designating features that are likely to be directly or indirectly impacted by the proposed wind farm development:

- Culbin Bar
- Lower River Spey-Spey Bay
- East Caithness Cliffs
- Mound Alderwood
- Conon Islands

More distant designated sites may be included depending upon the outcome of the cumulative impacts MFOWDG collaboration work. Consultation with statutory agencies will be carried out in order to identify any sites that may potentially be identified as designated in the foreseeable future.

REVIEW AND STATUS OF QUALIFYING FEATURES

It is envisaged that during the proposed development area EIA works the potential impacts upon nature conservation interests in the area will be fully assessed. This will initially comprise of a desktop study utilising guidelines developed by nature conservation agencies and other key regulators. A number of existing data sets will be reviewed in the context of the pre-existing designations on or near the proposed development site in order to identify and assess potential impacts. This study will be supplemented by review of the following surveys: habitats, marine benthos and fish. Review of these surveys will allow identification of any potential Annex I, II or UK BAP habitats or species.

FAVOURABLE CONSERVATION STATUS

It is further proposed that there are 6 month and 12 month reviews of the data collected during the ornithology and marine mammal surveys, in order to allow early identification of any species of conservation significance that could potentially be impacted by the proposed offshore wind farm development. Should further surveys be required to determine the potential impact on favourable conservation status of species that are likely to be impact receptors, this requirement and survey methodology will be discussed with JNCC and SNH. It is therefore anticipated that there may be a requirement for further data collection over at least 12 months. Where further surveys will not provide a practical method for assessing favourable conservation status of receptor species, the use of alternative methods, such as computational modelling, will be investigated.

HABITATS REGULATIONS ASSESSMENT

In order to ensure that any Habitats Regulations Assessment process undertaken for this development is robust, it is proposed that early discussion will be undertaken with statutory consultees. It is also recommended that other relevant stakeholders, e.g. Moray Firth Partnership, RSPB, are consulted at an early stage. An early objective would be to identify the scope of any Appropriate Assessment and specific information requirements (over and above the current survey programme) that may be required.

5.2.6.7 CUMULATIVE AND IN-COMBINATION IMPACT ASSESSMENT & SURVEY METHODOLOGIES

As discussed in sections 5.2.4.7 and 5.2.5.6, MORL will use the King *et al*. (2009) method to scope the potential for cumulative impacts to birds, marine mammals and any SPAs or SACs for which species of these groups are designating features.

The methodologies and potential survey requirements by which cumulative effects will be assessed will be agreed with consultees as part of a future scoping exercise undertaken by the MFOWDG.

Potential cumulative and in-combination impacts of the proposed project on sites of nature conservation importance will be assessed via the EIA process on a site-by-site basis. This will include consultation with JNCC and SNH in order to ensure that all designated sites and potential designated sites are included. In the event that an Appropriate Assessment is required for the project then cumulative and in-combination assessment will also be included at this time.

5.2.6.8 POTENTIAL MITIGATION METHODS

Potential mitigation measures for impacts to nature conservation are included within the potential mitigation methods for fish (section 5.2.3.8), marine mammals (section 5.2.4.8) and ornithology (section 5.2.5.7). Other mitigation measures for protected habitats such as biotic reefs include micrositing of turbines and choice of construction techniques for wind farm infrastructure.

The mitigation measures proposed for the development area will be dependent upon the final design of the site and the potential impacts as determined by the EIA studies. Options of mitigation will be discussed with the relevant authorities prior to ES submission.

5.3 HUMAN ENVIRONMENT

The effects on the human environment are categorised as follows:

- Commercial Fisheries
- Commercial Navigation
- Military and Civil Aviation
- Abandoned Munitions
- Marine Waste Disposal and Dumping
- Offshore Oil and Gas
- Subsea Cables and Pipelines
- Marine Aggregate Extraction
- Landscape/Seascape and Visuals
- Archaeology and Cultural Heritage
- Marine Recreation and Amenity
- Socio-Economics
- Offshore Wind Farms

5.3.1.1 DATA SOURCES

The following data sources provide information on the existing human environment at the current time:

General:
- Marine Scotland Science (formerly known as Fisheries Research Services)
- UK Offshore Energy Strategic Environmental Assessment, DECC
- SEA 5: Strategic Environmental Assessment of parts of the northern and central North Sea to the east of the Scottish mainland, Orkney and Shetland, DTI
- Department of Energy and Climate Change (DECC)
- Scottish Government
- The Crown Estate
- The Beatrice Demonstrator project Environmental Statement
- Renewable UK (formerly the British Wind Energy Association)
- Scottish Natural Heritage (SNH)
- Joint Nature Conservation Council (JNCC)
- The National Trust

- Local Planning Authorities
- Universities

Additional sources for:

Commercial Fisheries –
- Scottish Fishermen's Federation
- North-east Inshore Fisheries Group
- National Fishermen's Federation Organisation
- Regional SFF affiliated fishermen's associations and produced organisations
- Local non-affiliated fishermen's associations, groups and individual skippers
- Marine Scotland District Fisheries inspectors
- Local harbourmasters
- Marine and Fisheries Agency
- SeaFish
- Fisheries Society of the British Isles
- Association of Salmon Fisheries Boards
- Local ports merchants and agents
- UK Oil and Gas (UKO&G)
- International Council for Exploration of the Seas
- EU Fisheries Committee Publications and Data Sets (Europa & Eurolex)
- Foreign National Fisheries Agencies (identified through the course of the EIA)

Commercial Navigation –
- Chamber of Shipping
- Marine and Coastguard Agency
- Northern Lighthouse Board
- Royal National Lifeboat Association
- Pilotage Association
- Forth Ports and other local port operators

Civil Aviation –
- Civil Aviation Authority
- NATS En Route Plc
- Helicopter Operators
- Local Airport Operators

Ministry of Defence –
- Ministry of Defence

Offshore Oil and Gas -
- Oil and Gas UK
- Ithaca

Subsea Cables and Pipelines
- UK Hydrographic Office
- Seafish Marine Services

Archaeology and Cultural Heritage
- Historic Scotland

Marine Recreation & Amenity –
- Visit Scotland
- Royal Yachting Association
- Scottish Canoe Association
- Angling Associations

5.3.2 COMMERCIAL FISHERIES

5.3.2.1 BASELINE ENVIRONMENT

ICES statistical rectangles are currently the smallest area statistical units used for the collation of fisheries data. Rectangle boundaries align to 1° longitude and 30' latitude and for the most part have sea areas equating to approximately 900 nautical miles. The eastern development area is located entirely within ICES rectangle 45E7, and assessment of the fisheries baseline provided below is based primarily upon data[3] for this rectangle. Activity in additional rectangles covering the inshore areas of the Moray Firth has also been preliminarily assessed with regard to possible export cable routes.

MFA/Marine Scotland fisheries statistics identify the following ten ports with the highest averaged (2000-2008) recorded landings from ICES rectangle 45E7, as given in Table 5-10 below.

Table 5-10: Averaged Annual Landings Values (2000-2008) into Ports (top 10) from ICES Rectangle 45E7

Port	Landings Values from 45E7	% of Total in 45E7
Fraserburgh	£685,806	42.8%
Buckie	£356,094	22.2%
Wick	£223,106	13.9%
Peterhead	£120,135	7.5%
Macduff	£85,931	5.4%
Scrabster	£37,667	2.4%
Aberdeen	£17,806	1.1%
Lochinver	£16,444	1.0%
Kinlochbervie	£14,737	0.9%
Ullapool	£11,318	0.7%

MFA/Marine Scotland fisheries statistics identify the following ten commercially important species with the highest averaged (2000-2008) recorded landings from ICES rectangle 45E7, as given in Table 5-11.

[3] MFA Fisheries Statistics, 2000-2008

Table 5-11: Averaged Annual Landings Values (2000-2008) by Species (top 10) from ICES Rectangle 45E7

Species	Landings Values from 45E7	% of Total in 45E7
Scallops	£917,910	57.3%
Nephrops (Norway Lobster)	£240,742	15.0%
Haddock	£204,324	12.8%
Monks (Anglers)	£120,668	7.5%
Squid	£34,637	2.2%
Cod	£18,686	1.2%
Megrim	£13,095	0.8%
Whiting	£9,135	0.6%
Herring	£7,675	0.5%
Other	£34,309	2.1%

Scallops account for the majority of the landings by value (57.3%) followed by *Nephrops* (15.0%) and demersal fish species (haddock and monks principally) to a lesser extent. Scallops are targeted by vessels towing toothed dredges attached to beams towed over the seabed. *Nephrops* are a burrowing shellfish targeted by both demersal trawlers and potting (creel) vessels. The principal methods for targeting demersal species such as haddock and monks are demersal trawlers and Scottish seines (flydraggers).

The squid fishery, although recording relatively low landings values in 45E7, is recognised to be seasonally important in the Moray Firth, constituting a substantial proportion of total Scottish squid landings. The highest landings (2000-2008) values are recorded in the southern portion of the Firth. The species is captured using headline 'box' demersal trawl gear, or alternatively by 'jiggers' (a series of barbed lures attached to a vertically dropped line which is 'jigged' up and down).

There are relatively very low recorded landings values of pelagic species in the Moray Firth.

Analysis of fisheries statistics by vessel category (2000-2008) shows that the great majority of fishing effort within 45E7 is undertaken by vessels greater than 15 m in length. Only a small proportion is between 10-15 m and there are no vessels with recorded fishing effort of less than 10 m.

As a result of the restrictions placed upon availability of data regarding foreign vessel activity in UK waters, consultation and liaison with fishing interests active in the region will be required to establish the full extent of foreign vessel activity in the area. However, preliminary assessment of obtained data sets (Over-flight sightings, MFA/Marine Scotland) shows there to be very little recorded activity of foreign vessels within the Moray Firth.

5.3.2.2 DATA GAPS

Sufficient data is available to make assessment for the potential impact to fisheries on a site basis.

5.3.2.3 ENVIRONMENTAL IMPACTS SCOPING

Based on available literature, the following are perceived to be the potential impacts on commercial fisheries as a result of wind farms within the marine environment:

Impact Description	Potential site specific impact	Potential cumulative and/or in-combination Impact
Presence of seabed obstacles	✓	
Adverse impacts on commercially exploited species	✓	✓
Increased steaming times to fishing grounds	✓	✓
Safety issues for fishing vessels	✓	✓
Complete loss or restricted access to traditional fishing grounds	✓	✓
Interference with fisheries activities	✓	✓

5.3.2.4 SITE-SPECIFIC IMPACT ASSESSMENT METHODOLOGY

For each of the potential impacts described above a survey or study and method of impact assessment is described in the tables below.

Potential Impact(s)	**Presence of seabed obstacles**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts to gear safety arising from the development of the wind farm, the following survey will be undertaken: Side-scan swathe bathymetry (see section 5.1.4.4)
Method of Impact Assessment	The baseline character of the seabed features will be determined during the EIA stage to understand whether there are any current hazards to fishing gear safety. It is intended that this baseline will be compared to post-construction surveys to identify any hazards to gear safety associated with the construction of the wind farm.

Potential Impact(s)	**Adverse impacts on commercially exploited species** **Increased steaming times to fishing grounds** **Complete loss or restricted access to traditional fishing grounds** **Interference with fishing activities**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts as listed above, the following studies will be undertaken: Description of fisheries in the area Assessment of landings data

	Assessment of effort data
Method of Impact Assessment	In the case of each impact, the assessment will take account of: the spatial extent of effect the duration of effect the scale of effect recoverability of the receptor importance of the receptor

Potential Impact(s)	**Safety issues for fishing vessels**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts to navigational safety, the following study will be undertaken: Navigational risk assessment (see section 0)
Method of Impact Assessment	A navigational risk assessment will assess the risk associated with ship to ship collision, vessel grounding, collision with wind turbine array infrastructure and the potential impact on communication systems.

5.3.2.5 SITE SPECIFIC SURVEY METHODOLOGY

BEST PRACTICE GUIDANCE

The following references provide best practice guidance for use in assessing impact upon commercial fisheries:

- BWEA (2002). Best Practice Guidelines for Consultation for Offshore Renewable Developers
- CEFAS (2004). Guidance note for Environmental Impact Assessment in respect of FEPA and CPA requirements, version 2 – June 2004
- BERR (2008). Fishing Liaison with offshore wind and wet renewables group (FLOWW) recommendations for fisheries liaison
- OSPAR (2008). Guidance on Environmental Considerations for Offshore Wind Farm Development. Reference number: 2003-8

5.3.2.6 ADDITIONAL INFORMATION

To assist the assessment of potential impacts of the proposed development upon commercial fisheries, consultation will be undertaken with the relevant national and local marine fisheries bodies and fishermen's associations and representatives.

OTHER SURVEYS TO BE USED TO IDENTIFY IMPACTS

- Vessel routing surveys are described in section 0

5.3.2.7 CUMULATIVE AND IN-COMBINATION IMPACT ASSESSMENT & SURVEY METHODOLOGIES

In addition to the potential impacts of the development on the existing commercial fisheries baseline, the cumulative and in-combination impacts will be separately considered using the impact assessment methodology provided above.

5.3.2.8 Potential Mitigation Methods

The mitigation measures proposed for the development area will be dependent upon the final design of the site and the potential impacts as determined by the EIA studies. Options of mitigation will be discussed with the relevant authorities prior to ES submission.

5.3.3 Shipping & Navigation

5.3.3.1 Baseline Environment

This section presents an overview of the navigational features within and adjacent to the Round 3 zone to provide context for the potential impacts within the proposed development area. The main navigational features relate to the offshore installations in the area (Beatrice and Jacky) and the demonstrator offshore wind turbines associated with Beatrice site (Figure 5-13).

The main ports in the area are Inverness, Cromarty Firth and Invergordon for commercial shipping as well as the busy fishing ports of Fraserburgh, Banff and Buckie. It is also noted that the fabrication yards located at Nigg and Invergordon are utilised for constructing offshore structures as well as for refitting offshore drilling rigs. Rigs are often laid up in the Cromarty Firth whilst undergoing refurbishment or awaiting contracts.

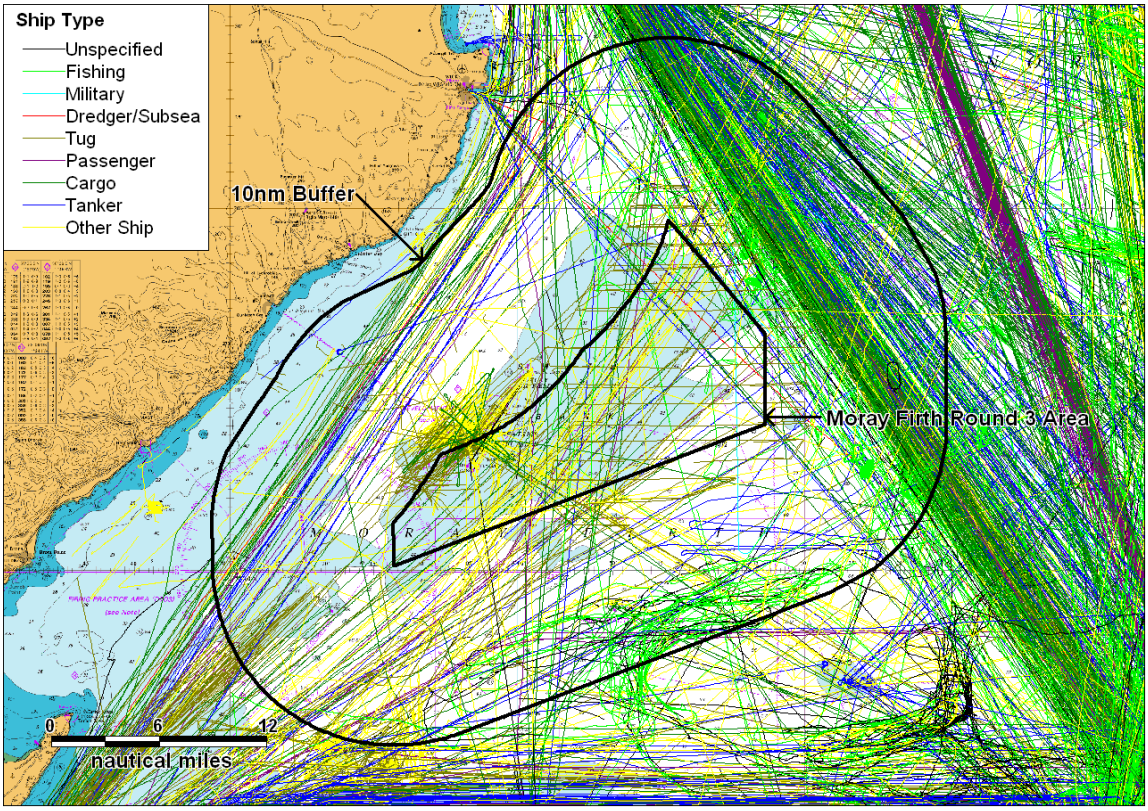
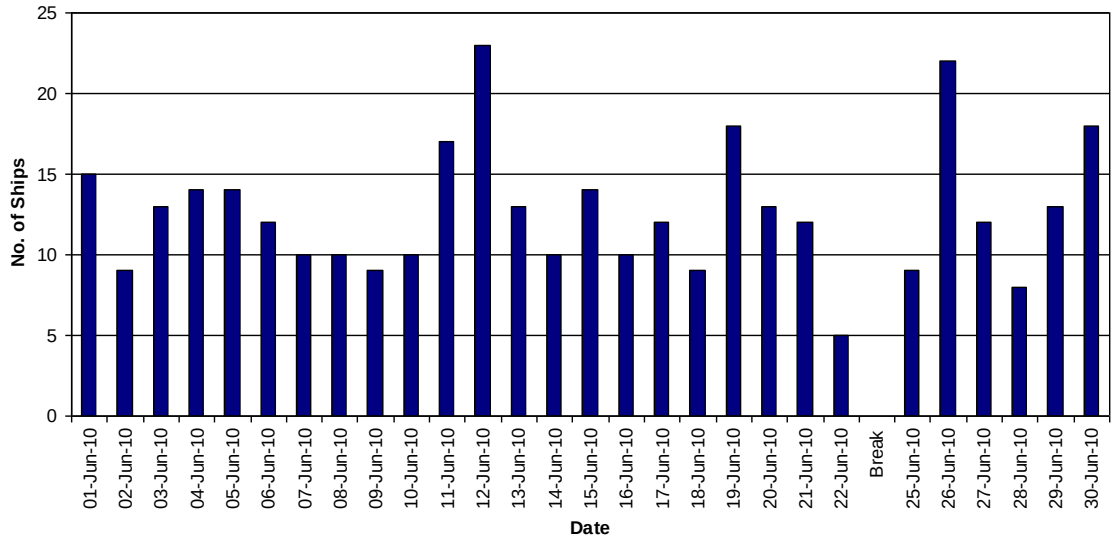


Figure 5-9: Detailed plots of AIS tracks by ship type (June 2010, excluding survey vessel)

Merchant Shipping

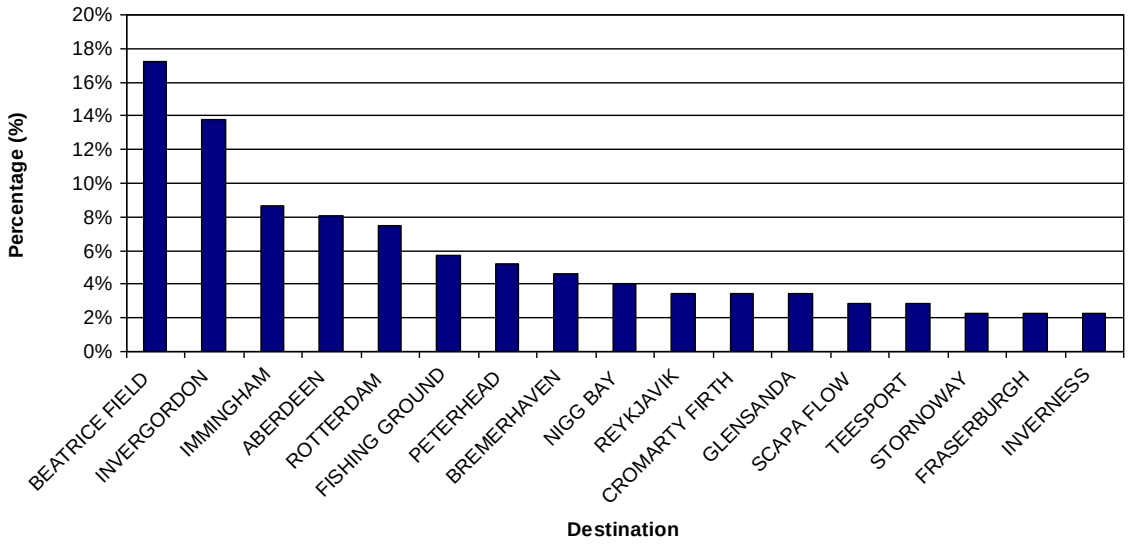
Figure 5-9 illustrates the shipping movements in the area based on an AIS shipping survey performed in June 2010. (AIS typically covers ships above 300 gross tonnes).

An average of 13 ships per day was recorded passing within 10 nautical miles (nm) of the Moray Firth Round 3 Zone during June 2010. The daily variations are presented in Graph 1.



Graph 1: Daily Count of Ships Recorded on AIS Passing within 10nm of Zone - June 2010 (Excluding Survey Vessel)

The main destinations of vessels passing within 10nm of the Zone are shown in Graph 2.



Graph 2: Destinations of Vessels Passing within 10nm of Moray Firth Zone - June 2010

From a commercial vessel perspective the Moray Firth is generally not a busy area. There are three main shipping routes passing within 10nm of the Moray Firth Round 3 area.

Most traffic (fishing & cargo/tankers) is recorded on the busy route heading to/from the Pentland Firth, passing to the east of the Zone.

The second route passes west of the Beatrice Oil Field Development Area and mainly comprises tankers and cargo vessels heading between Invergordon / Inverness and the Pentland Firth, with larger tankers headed for Nigg pilotage station. Passenger cruise vessels also use this route heading between Invergordon / Inverness and the Northern Isles and Norway.

The third shipping route is composed of offshore vessels supporting the Beatrice and Jacky Oil Fields.

Fishing Vessels

The main fishing activity recorded in the vicinity of the Moray Firth Round 3 area based on fisheries surveillance data (sightings and satellite) is from demersal trawlers, potters and scallop dredgers.

The vast majority of these are UK-registered and associated with nearby Scottish NE fishing ports such as Banff, Buckie and Wick.

Recreational Vessels

There are a number of recreational vessel activities taking place in the Moray Firth. Marinas are located at various points along the coastline, with the nearest being at Helmsdale, Lybster, Wick and Lossiemouth.

Three medium-use cruising routes [4] pass through the area between Wick and various NE locations (e.g., Lossiemouth, Buckie and Whitehills). There is also a light-use route [5] between Lossiemouth and the Northern Isles.

There is also recreational traffic associated with the Caledonian Canal which has a northern entrance at Inverness.

[4] Popular routes on which some recreational craft will be seen at most times during summer daylight hours.

[5] Routes known to be in common use but which do not qualify for medium or heavy classification.

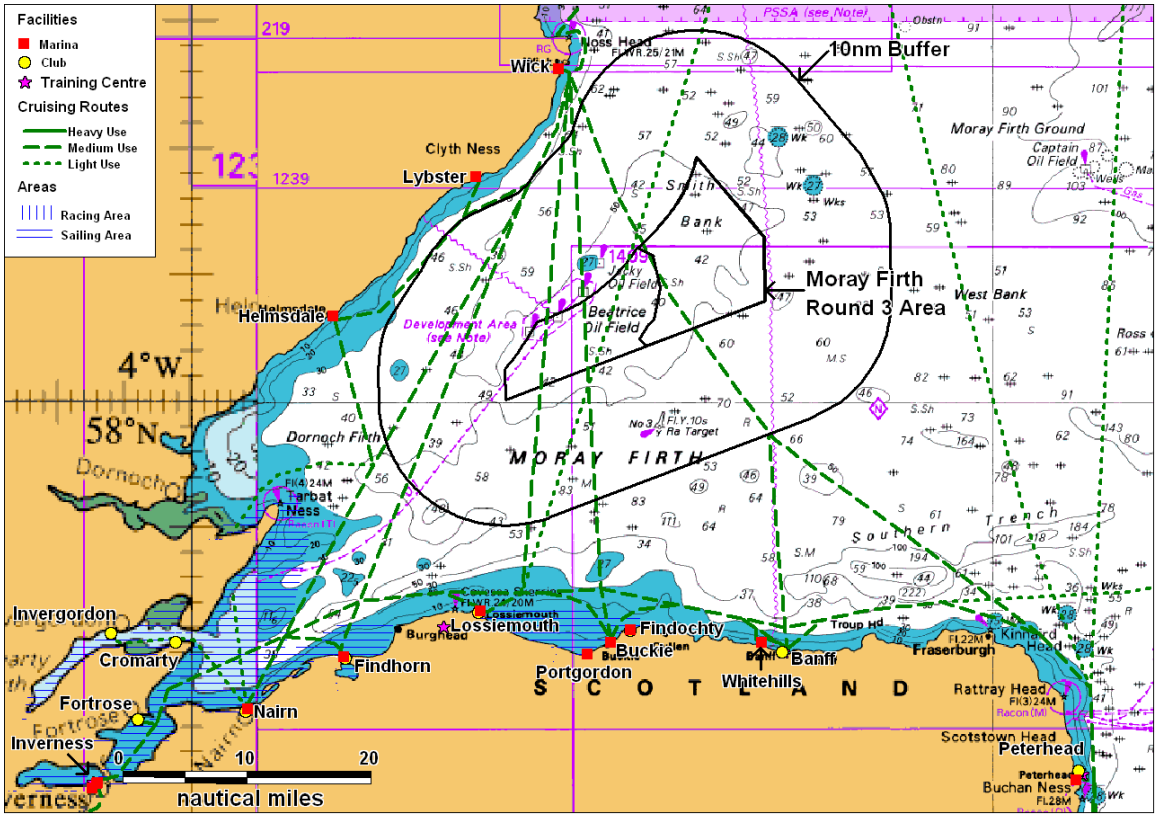


Figure 5-10: Overview of navigation related recreational activity relative to Moray Firth Round 3 Zone

5.3.3.2 DATA GAPS

AIS data for the Moray Firth is available which predominantly covers commercial vessels over 300grt, although an increasing number of fishing vessels are having AIS fitted. Additional data is being collated using radar tracking for non-AIS vessels as well as further AIS data being collected in the region to help identify seasonal variations in vessel movements, e.g., passenger cruise ships.

5.3.3.3 ENVIRONMENTAL IMPACTS SCOPING

Based on experience from previous assessments of offshore wind farm developments, the following are perceived to be the main potential impacts on navigation and shipping as a result of the proposed wind farms:

Impact Description	Potential site specific impact	Potential cumulative and/or in-combination Impact
Re-Routeing of Shipping	✓	✓
Increased collision risk (vessel to vessel and vessel to turbine) during operation as well as during high levels of activities during construction operations	✓	✓
Cable interactions with anchors/fishing gear	✓	✓
Inhibited Search & Rescue operation	✓	✓
Interference of turbines with marine radar impacting on navigational safety	✓	✓

5.3.3.4 SITE-SPECIFIC IMPACT ASSESSMENT METHODOLOGY

For each of the potential impacts described above a survey or study and method of impact assessment is described in the tables below.

Potential Impact(s)	**Re-Routeing of Shipping** **Collision Risk** **Risk of Cable Interaction** **Inhibited Search & Rescue** **Radar Impacts on shipping**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts on shipping, a vessel traffic survey of the area will be performed in line with MCA's Marine Guidance Note 371 (M+F): *Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response Issues* This will be used as one of the inputs to the Marine Navigational Risk Assessment which will be carried out as per the recommended methodology outlined in the DTI (now DECC) publication Guidance on the *Assessment of the Impact of Offshore Wind Farms: Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms* (the 'DTI Methodology').
Method of Impact Assessment	The data collected during the vessel traffic survey of the area will be used in the assessment of the impacts listed above. The risk assessment will be carried out using a formal safety assessment process centred on a Hazard workshop and resulting Hazard register. An overview of the methodology to be applied is presented in Figure 5-11.

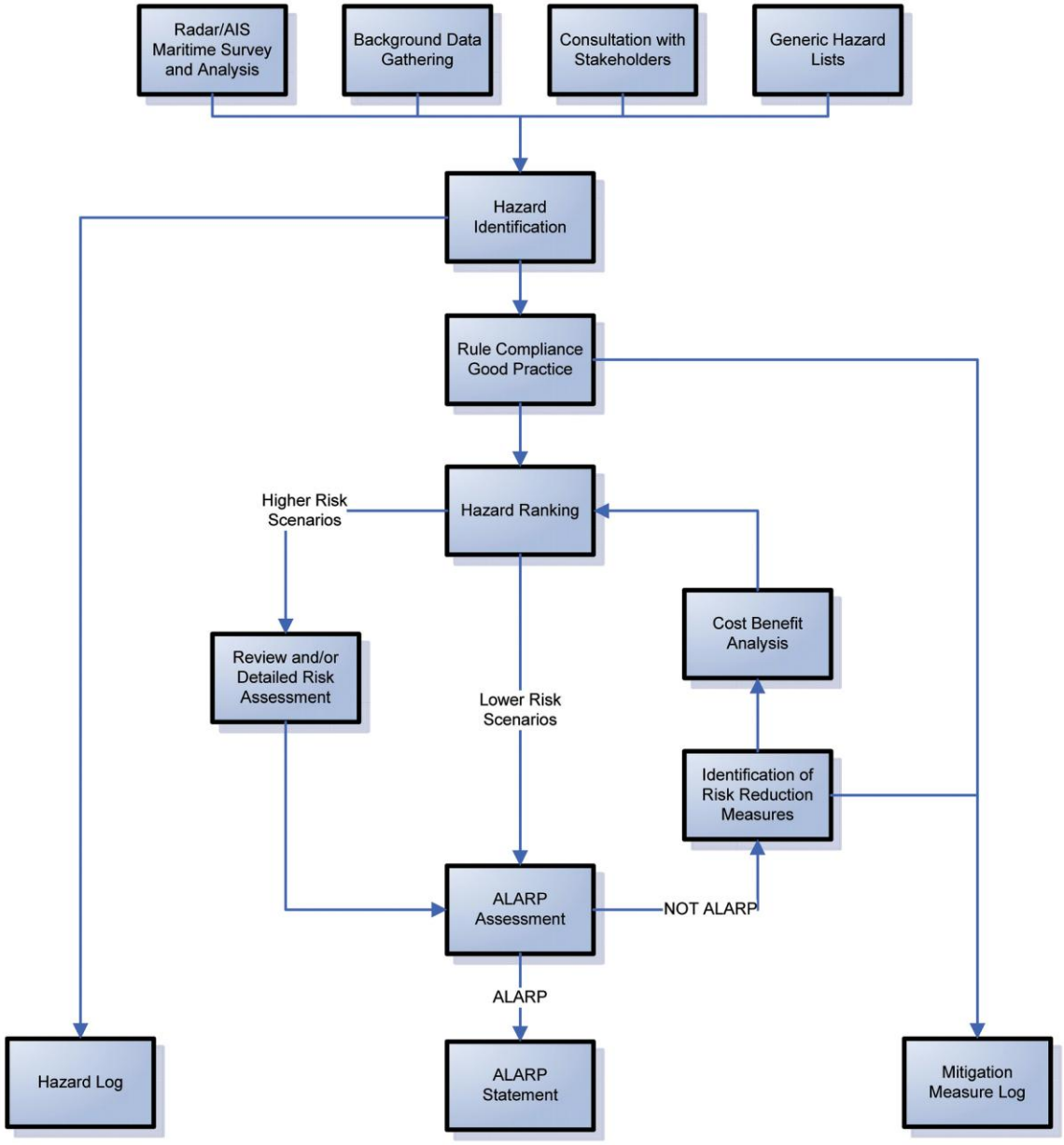


Figure 5-11 Navigational Risk Assessment methodology.

Site specific survey methodology

BEST PRACTICE GUIDANCE

The assessment will be undertaken in line with the following guidance:

- DTI (2005a). Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms.
- Marine Guidance Note 371: Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response Issues.

5.3.3.5 SUMMARY OF METHODOLOGY

VESSEL TRAFFIC SURVEYS

A detailed site-specific assessment of the existing traffic will be performed in accordance with MGN 371(M&F). This will involve AIS and radar surveys carried out over different times of year to cover both seasonal and tidal variations. In addition to the surveys, further validation will be carried out through consultation with local harbour masters, Vessel Masters and Operators. This will ensure the best available data is used to assess the navigational impact of the site and subsequent decision-making to minimise obstruction and risk to navigation.

NAVIGATIONAL RISK ASSESSMENT

A Navigational Risk Assessment will be prepared which will assess the:

1. Base case vessel activity without wind farm level of risk
2. Base case vessel activity with wind farm level of risk
3. Future case vessel activity without wind farm level of risk
4. Future case vessel activity with wind farm level of risk

Some displacement impacts on shipping and navigation may include but not be limited to:

- Additional voyage distances.
- An increase in vessel encounters and the creation of ‘choke points’.
- A reduction in the available depth and width of navigable water.

Navigation and collision avoidance impacts may arise from, for example:

- Structures hindering the view of navigational features and other vessels.
- Interference with electronic navigation and communication equipment.

Published studies into effects on marine radio navigation and communications systems will be consulted (for example the 2004 QinetiQ/MCA report into investigations undertaken at North Hoyle Wind Farm and the 2007 BWEA report into effects on radar at Kentish Flats).

The level of impact will be assessed in accordance with the relevant guidelines from the DTI Methodology.

Prior to the commencement of the Navigation Risk Assessment, consultation will be entered into with key navigational stakeholders and an ongoing dialogue will be maintained as the risk assessment process progresses

5.3.3.6 Cumulative and In-combination Impact Assessment & Survey Methodologies

Cumulative and in-combination issues associated with the offshore oil and gas activities as well as the adjacent offshore wind farm activities in the area will be evaluated. The methodologies and potential survey requirements by which cumulative and in-combination effects will be assessed will be agreed with consultees as part of a future scoping exercise undertaken by the MFOWDG.

5.3.3.7 Potential Mitigation Methods

Potential mitigation measures for impacts to navigation include:

- specialist lighting and markings for turbines;
- additional buoyage in the area;
- the use of safety zones (if appropriate);
- routeing measures;
- guard vessels during construction; and
- publication of details through Notice to Mariners and chart updates via the UK Hydrographic Office and Kingfisher awareness charts.

The mitigation measures proposed for the development area will be dependent upon the final design of the site and the potential impacts as determined by the Navigation Risk Assessment. Mitigation options will be discussed with the relevant stakeholders prior to ES submission.

5.3.4 Civil Aviation

5.3.4.1 Baseline Environment

Radar
NATS En Route Ltd (NERL) operates a primary surveillance radar at Allanshill, west of Fraserburgh. This is used to provide air traffic services to helicopters and fixed wing aircraft operating to the north and north east of Aberdeen. The initial screening by Pager Power (Knights, 2009) indicates that turbines in the Eastern Development Area will be visible to this radar and therefore will potentially cause an impact on this radar. This issue was considered possible to solve.

Helicopters
Helicopters operating between Aberdeen and the Atlantic Rim oil platforms west of Shetland fly along Helicopter Main Route X-Ray (HMR X) which crosses both the Eastern and Western Development Areas. These helicopters normally fly at altitudes which will be unaffected by the presence of wind turbines. However in some weather conditions they may wish to fly at less than 1,500 feet. Obstacle clearance from the turbines would then become an issue. Obstacle clearance may also be an issue for helicopters performing emergency rescue operations at sea (including on oil platforms).

Helicopters are used to access the Beatrice oil platforms. When weather conditions preclude visual flight helicopters operating to and from these platforms carry out instrument approach procedures. CAA guidance CAP 764 recommends an obstacle-free zone of 6nm around the platforms in order to protect these procedures. The Eastern Development Area is out with the 6 nm zone around the Beatrice platforms and therefore is not anticipated to have any impact on these helicopter operations.

5.3.4.2 ENVIRONMENTAL IMPACTS SCOPING

Based on the report by Knights (2009), the following potential impacts are scoped in:

Impact Description	Potential site specific impact	Potential cumulative and/or in-combination Impact
Effects on radar	✓	✓
Obstacle clearance for helicopters	✓	✓

5.3.4.3 SITE-SPECIFIC IMPACT ASSESSMENT METHODOLOGY

For each of the potential impacts described above a survey or study and method of impact assessment is described in the tables below.

Potential Impact(s)	**Effects on radar** **Obstacle clearance for helicopters**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts to radar systems and issues associated with obstacle clearance, the following studies will be undertaken: - Radar modelling - Air traffic/airspace operational assessment - Helicopter approach procedures assessment
Method of Impact Assessment	Radar modelling will be undertaken to determine the extent of radar visibility and the predicted effects on radar performance. The air traffic/airspace operational assessment will analyse traffic flows and airspace structure to determine the operational impact of any effects on radar. The helicopter approach procedures assessment will analyse the vertical and horizontal profiles of existing and future procedures and use meteorological data to predict the frequency with which helicopter approaches to the Beatrice platforms may be affected by the development. This will be undertaken in consultation with the Civil Aviation Authority, NATS and helicopter operators.

5.3.4.4 Cumulative and In-combination Impact Assessment & Survey Methodologies

The methodologies and potential survey requirements by which cumulative and in-combination effects will be assessed will be agreed with consultees as part of a future scoping exercise undertaken by the MFOWDG.

5.3.4.5 Potential Mitigation Methods

Potential mitigation measures for impacts to civil aviation include specialist lighting and markings for turbines, updates to charts for the area and alteration of helicopter flight procedures in the area. Other mitigation measures may be required but are dependent on site specific issues (e.g. impacts to radar) and may involve radar technical upgrades.

The mitigation measures proposed for the development area will be dependent upon the final design of the site and the potential impacts as determined by the EIA studies. Options of mitigation will be discussed with the relevant authorities prior to ES submission.

5.3.5 Ministry of Defence

5.3.5.1 Baseline Environment

Military Practice Areas
Figure 5-12 illustrates the location of Ministry of Defence (MOD) practice areas within the outer Moray Firth. The Eastern Development Area is located partly within D809(S), which is used by the Royal Air Force (RAF) for a wide variety of air flying, gunnery and subsurface exercises at altitudes up to 55,000 ft. The southern parts of the Development Areas are also located within danger area D807, which is used by the RAF for live firing, bombing and sonobuoy training from the surface to 1,500 ft altitude. A response to a proforma issued by MORL in 2010 states that the MOD will object to any turbines located within Area D807 unless a suitable solution can be agreed.

Military Radar
RAF Lossiemouth is currently Britain's main base for Tornado GR4s and is located to the west of the town of Lossiemouth in Moray. RAF Kinloss is located west of Lossiemouth and is home to all of the maritime patrol aircraft in the RAF. An initial screening exercise of the potential impacts on aviation was undertaken by Pager Power (Knights, 2009). The study identified that the proposed development area would have a potential impact on the RAF Lossiemouth Primary Surveillance Radar. This issue was considered "possible to solve". The MOD response to a proforma issued by MORL in 2010 states that MOD will object to any turbines located within line of sight of the Lossiemouth radar unless a suitable solution can be agreed.

5.3.5.2 Environmental Impacts Scoping

Based on available literature, the following are perceived to be the potential impacts on the Ministry of Defence and associated military activities as a result of the proposed wind farm:

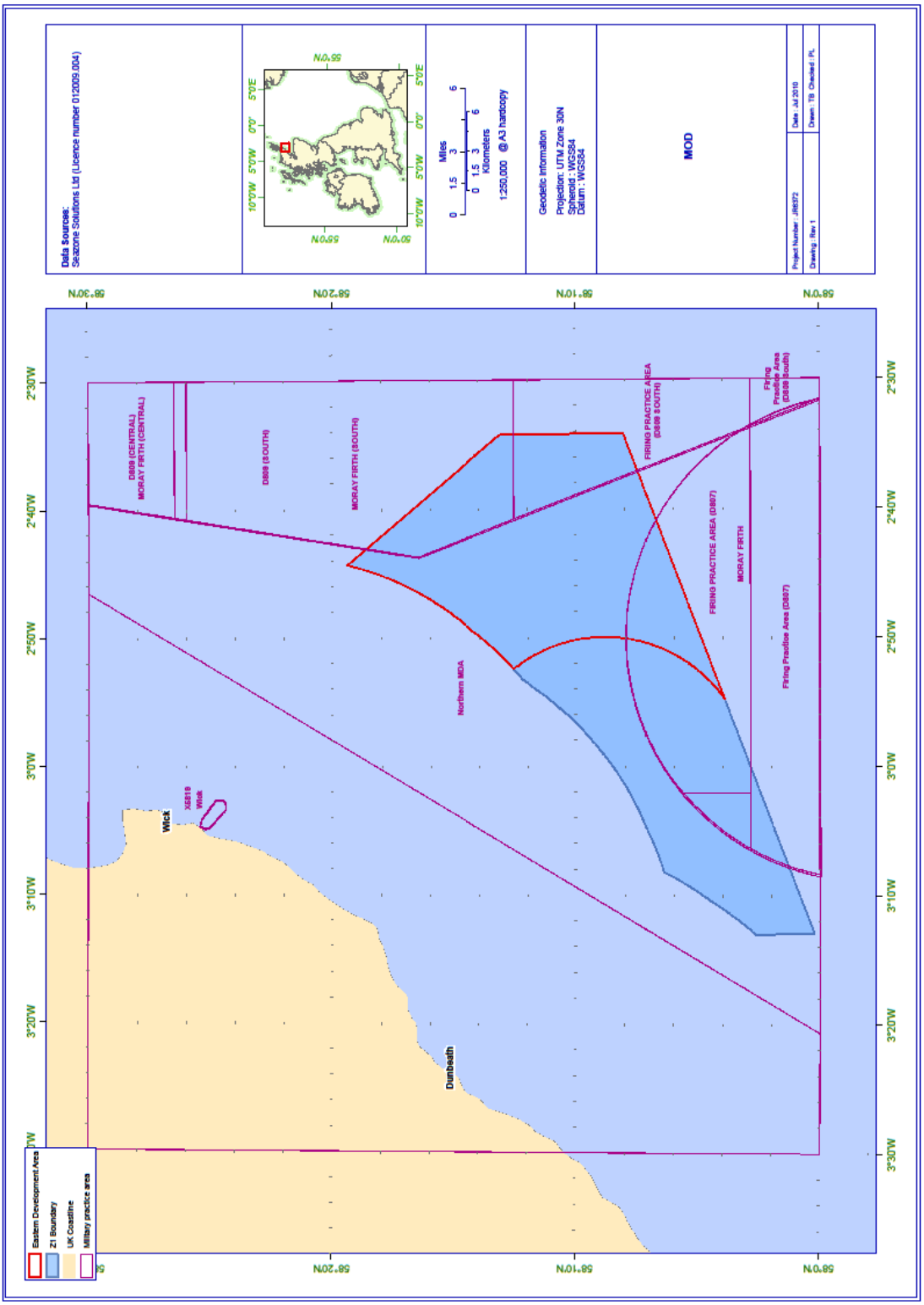


Figure 5-12: Ministry of Defence practice areas in the outer Moray Firth.

Impact Description	Potential site specific impact	Potential cumulative and/or in-combination Impact
Creation of obstacles to low flying aircraft	✓	n/a
Effects on radar	✓	✓

5.3.5.3 SITE-SPECIFIC IMPACT ASSESSMENT METHODOLOGY

For each of the potential impacts described above a survey or study and method of impact assessment is described in the tables below.

Potential Impact(s)	**Creation of obstacles to low flying aircraft in D807**
Method of Impact Assessment	Determination of the nature and frequency of use of D807 and any variation in use of different parts of the area. This will be undertaken in consultation with the Ministry of Defence.

Potential Impact(s)	**Effects on radars**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts to radar systems, the following studies will be undertaken: - Radar modelling - Air traffic/airspace operational assessment
Method of Impact Assessment	Radar modelling will be undertaken to determine the extent of radar visibility and the predicted effects on radar performance. The air traffic/airspace operational assessment will analyse traffic flows and airspace structure to determine the operational impact of any effects on radar.

5.3.5.4 CUMULATIVE AND IN-COMBINATION IMPACT ASSESSMENT & SURVEY METHODOLOGIES

The methodologies and potential survey requirements by which cumulative and in-combination effects will be assessed will be agreed with consultees as part of a future scoping exercise undertaken by the MFOWDG.

5.3.5.5 Potential Mitigation Methods

Potential mitigation measures for impacts on MOD activities include specialist lighting and markings for turbines, turbine siting and discussion of training area boundaries. Other mitigation measures associated with radar impacts may be required but are dependent on detailed impact assessment.

The mitigation measures proposed for the final offshore wind sites will be dependent upon the final design of the site and the potential impacts as determined by the EIA studies. Options of mitigation will be discussed with the relevant authorities prior to ES submission.

5.3.6 Telecommunications

5.3.6.1 Baseline Environment

An initial screening exercise of the potential impacts on telecommunications was undertaken by Pager Power in 2009 (Knights, 2009). The study identified that the Eastern Development Area would have no issues relating to microwave links, scanning telemetry or non-aviation radar and would not cause TV or radio interference.

5.3.6.2 Environmental Impacts Scoping

There are anticipated to be no issues on microwave links, scanning telemetry, non-aviation radar or TV and radio transmissions. However, as this conclusion is only based on a pre-screening assessment further consultation with relevant consultees will be undertaken to confirm whether these issues can be scoped out.

5.3.7 Marine Waste Disposal, Dumping and Dredging

5.3.7.1 Baseline Environment

There are, at present, no licensed areas for dredging aggregates within the Moray Firth. The nearest licensed sites for dredging are in the Tay Estuary and Firth of Forth (Hartley Anderson, 2004; Crown Estate, 2008). Regular deposition of dredged aggregates occurs within the Moray Firth with a total of 14,294 tonnes of aggregates deposited in the Moray Firth in 2005 and a further 31,375 tonnes deposited near the entrance to the Firth. The disposal sites are, however, all located near the south coast of the Firth (Apache, 2006; Hartley Anderson, 2004; Ithaca, 2008) such that there are no designated dredge sites or spoil dumps in the vicinity of the proposed development area. There is also a disposal site located near Wick on the north coast of the firth (DECC, 2009) but this also is not in close proximity to the proposed development area.

5.3.7.2 Environmental Impacts Scoping

There are no disposal or dumping sites within the proposed development area therefore, **the potential for impacts on disposal sites is scoped out**.

There are no aggregate areas within the Moray Firth, therefore, **the potential for impacts on the aggregate industry are scoped out.**

5.3.8 OFFSHORE OIL AND GAS

5.3.8.1 BASELINE ENVIRONMENT

Oil field development is the principal oil and gas activity within the Moray Firth.

The proposed development area lies wholly or partly within 6 blocks, in which there are 7 extant or provisional licenses held by operators (Table 5-12).

Table 5-12: Extant oil production licenses in the outer Moray Firth.

License Name	Block/Quad	Operator	Licence Type	Expiry Date
P89	12/21 12/22 12/23 12/23a	BG International Ltd	Production	25 Nov 2011
P1701	12/22b	Caithness Petroleum	Production – promote	Provisional licence
P1723	12/23b	Caithness Petroleum	Production – traditional	Provisional licence
P1301	12/21a	Ithaca Energy (UK) Limited	Production - traditional	2 Aug 2020
P1392	12/21c	Ithaca Energy (UK) Limited	Production - traditional	22 Dec 2031
P982	12/26a	Ithaca Energy (UK) Limited	Production - traditional	23 Dec 2034
P1392	12/26c	Ithaca Energy (UK) Limited	Production - traditional	22 Dec 2031

Infrastructure currently exists on associated with the Beatrice field (Block 11/30a) and the Jacky field (Block 12/21c) which are both operated by Ithaca Energy (UK) Ltd (Figure 5-13). The majority of pipelines and cables within the Moray Firth are also concentrated in these areas. There are also plans for a new field called Polly which will potentially be located to the east of the existing infrastructure (within the zone 1 boundary) (Ithaca, 2009).

The Beatrice development includes three platforms: Beatrice Alpha, Beatrice Bravo and Beatrice Charlie. There is also a midline structure which is between Beatrice Alpha and the Jacky platform which was installed during late 2008. The two Beatrice Demonstrator Wind Farm turbines are also located in the vicinity of the platforms. This infrastructure is located to the north-west of the proposed development area.

Four wells have been drilled within the proposed development area. There have been many other wells drilled in these blocks (UK Deal, 2010) and as the consultation process progresses these will be examined in more detail. Further drilling activity is anticipated and relevant stakeholders will be contacted.

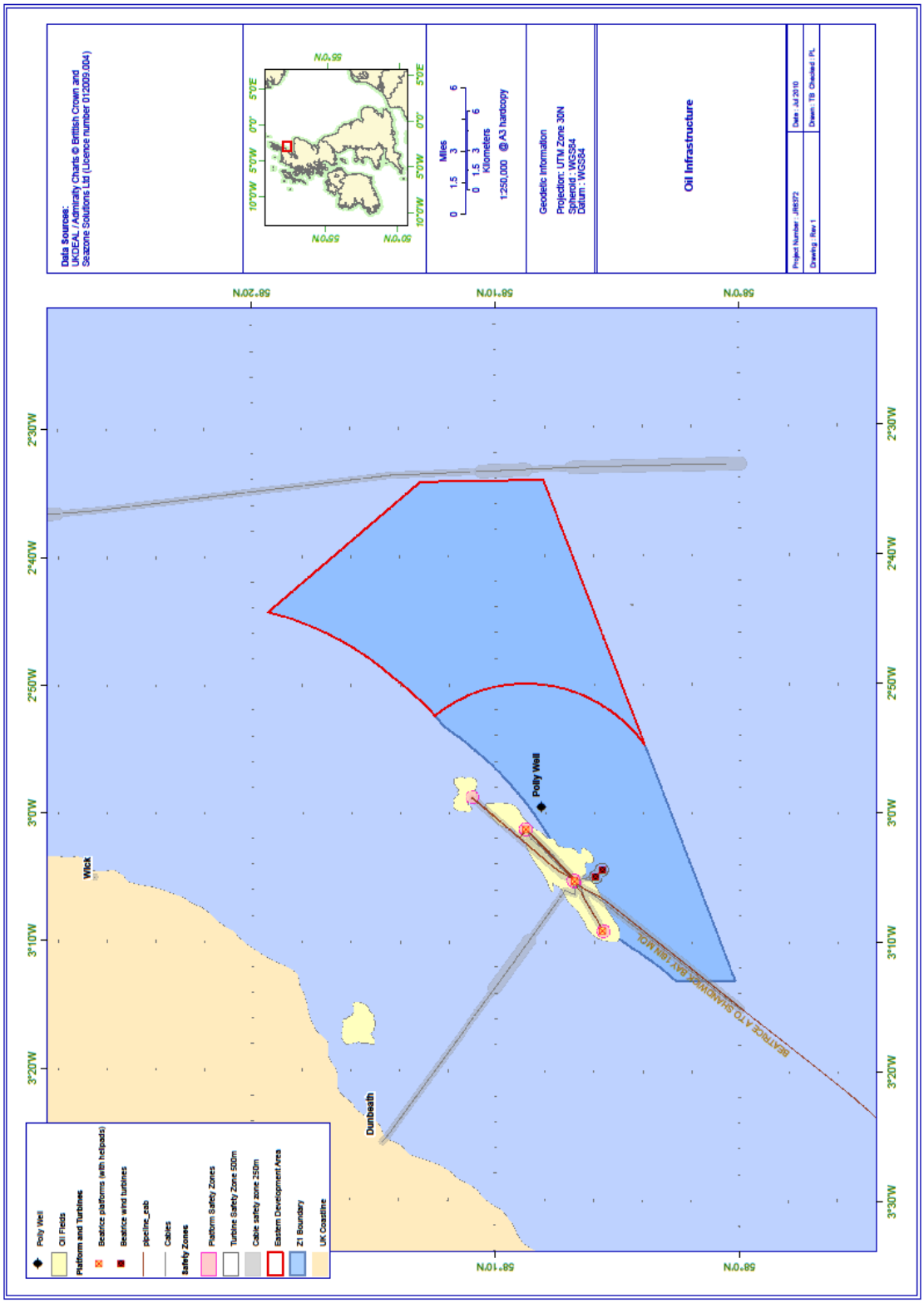


Figure 5-13: Oil infrastructure within the outer Moray Firth

Applications for blocks within the 26th Seaward Licensing Round for oil and gas are to be accepted as of 28th April 2010 (DECC, 2010). All seaward acreage not currently under lease will be on offer. This includes acreage within which the proposed development area is located.

5.3.8.2 DATA GAPS

With the exception of information on the 26th seaward licensing round, there is sufficient information on oil assets within the Moray Firth. Additional information on future plans is anticipated to be obtained from consultation with relevant stakeholders.

5.3.8.3 ENVIRONMENTAL IMPACTS SCOPING

There is no infrastructure within the eastern development area and access to the platforms is not routed through the development area. Therefore, **the potential for impacts on oil infrastructure is scoped out**.

5.3.8.4 CUMULATIVE AND IN-COMBINATION IMPACT ASSESSMENT & SURVEY METHODOLOGIES

The methodologies and potential survey requirements by which cumulative and in-combination effects will be assessed will be agreed with consultees as part of a future scoping exercise undertaken by the MFOWDG.

5.3.9 SUBSEA CABLES AND PIPELINES

5.3.9.1 BASELINE ENVIRONMENT

Figure 5-13 illustrates the locations of cables and pipelines within the outer Moray Firth. Cables associated with the Beatrice and Jacky oil fields are present in the north and west of the zone. There are telecommunication and submarine power cables within the Moray Firth but these are located outside of the Round 3 zone. There are no known sub-sea cables at present across the proposed development area.

The telecommunications cable (SHEFA-2 Seg.9) runs from the Orkney Islands to the Scottish coast west of Fraserburgh and essentially passes across the entrance of the Outer Moray Firth, 24 km to the east of Block 12/21c (Ithaca, 2008; Kingfisher, 2008). The route of telecommunications cable (SHEFA-2 Seg.9) is approximately 0.5 – 1 km east of the development area. However, the works restriction zone of 1,000m overlaps with the eastern boundary of the development area.

Scottish Hydro Electric Tranmission Limited (SHETL) is obliged to develop a transmission connection for the renewable energy projects that have been consented on the Shetland Isles (e.g. Viking Wind Farm project). SHETL have proposed a High Voltage Direct Current connection between the converted station at Upper Kergord, Shetland and Blackhillock, Scotland, for which the subsea section would potentially cross the Moray Firth Round 3 zone. SHETL has suggested that the subsea cable installation is planned for construction between Q4 2012 to Q3 2013. However, to date, consents for the construction of the subsea cable installation have not been applied for.

SHETL are also proposing an offshore HVDC node, which will support marine energy transmission from the Pentland Firth area to Peterhead. Current plans suggest that the location of the node will be adjacent to the northern boundary of the eastern development area (SSE, 2010).

The Beatrice Offshore Wind Farm is also proposed to the north of the proposed development area. The location of the export cable is not currently known.

5.3.9.2 ENVIRONMENTAL IMPACTS SCOPING

There are no pipelines within or in proximity to the zone. Therefore, the impacts on pipelines are **scoped out**.

Based on available literature, the following are perceived to be the potential impacts on cables as a result of wind farms within the marine environment:

Impact Description	**Potential site specific impact**	**Potential cumulative and/or in-combination Impact**
Impacts on safety (associated with turbine location and associated construction/operation works within works restriction zone)	✓	x

5.3.9.3 SITE SPECIFIC IMPACT METHODOLOGY

Potential Impact(s)	**Impact on navigational safety (associated with works restriction zone)**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts to safety, the following study will be undertaken: Navigational risk assessment (section 5.3.3)
Method of Impact Assessment	A navigational risk assessment will assess the risk associated with collision with wind turbine array infrastructure.

5.3.9.4 SITE SPECIFIC SURVEY METHODOLOGY - SUMMARY

CONSULTATION

With the exception to impacts to safety, information gathered through consultation will be the main technique used to guide the requirements for potential impact assessment studies and possible mitigation requirements. The main aim of the consultation will be to understand the future proposals for oil field development and gain information for in-combination impact assessments.

NAVIGATIONAL RISK ASSESSMENT

Navigation risk assessments are described in section 5.3.3.

5.3.9.5 POTENTIAL MITIGATION MEASURES

Potential mitigation measures for impacts to cables include micrositing of turbines.

The mitigation measures proposed for the final offshore wind sites will be dependent upon the final design of the site and the potential impacts as determined by the EIA studies. Options of mitigation will be discussed with the relevant authorities prior to ES submission.

5.3.10 SEASCAPE, LANDSCAPE AND VISUAL RECEPTORS

Seascape is defined as *"the coastal landscape and adjoining areas of open water, including views from land to sea, from sea to land and along the coastline"* (DTI, 2005b). The impact upon landscape, seascape and visual resources is dependent upon a range of interacting factors, including, among others: the Zone of Theoretical Visibility (ZTV); the visual sensitivity of the area; the sensitivity of the landscape and seascape; meteorological conditions; the design and layout of the development; and, the location of the development. The completion of a seascape analysis allows the significance of effects of a proposal on the landscape, seascape and visual resources to be assessed, as well as effects on the setting of historic landscapes and monuments, with reference to established methodology and guidance.

5.3.10.1 BASELINE ENVIRONMENT

Strategic seascape assessments for offshore wind

A strategic seascape assessment for offshore wind development has been completed for Scotland, which is based upon regional seascape units (Scott *et al*., 2005). However, the assessment did not factor in all potential receptors and a bespoke methodology was used that assessed sensitivity and capacity based on only one development scenario (100 turbines, 150 m high set in an off-set grid layout and covering 25 km^2 and located 8 km offshore). The assessment investigated the potential impact on seascape as capacity for development, which is derived from an assessment of the visibility of wind farms and the sensitivity and value of the seascapes. The capacity ratings are comparative and range from 1 (higher capacity) to 5 (lower capacity).

The proposed development area is approximately 25 km off the coast, to the north east of the Moray Firth estuary.

The following information has been taken from Scott *et al*. (2005).

The regional seascape units/areas of relevance to the proposed wind farm are:

- Area 5: North Aberdeenshire/Morayshire Coast;
- Area 6: Moray Firth; and
- Area 7: East Caithness & Sutherland

The seascape types that are found within these seascape units/areas are:

- Type 1: Remote High Cliffs;
- Type 2: Rocky coastline / open sea views;
- Type 3: Depression coastline / open views;
- Type 4: Outer firths;
    - Subtype 4a: Smaller & less developed outer firths;
- Type 5: Developed inner firths;
- Type 6: Narrow coastal shelf.
- Type 11: Less developed inner firths.

The key characteristics and sensitivity of the seascape units/areas are set out below:

Area 5: North Aberdeenshire/Morayshire Coast

- North-facing generally "straight" coastline with small indentations, few significant headlands and with open views to North Sea;
- Low cliffs/rocky coastline predominates;
- Farmland backs coast and this generally comprises a low lying gently rolling open plain with some remnant heathland present in places;
- Small and widely spaced settlements clustered in the main at base of cliffs or inlets, many of these are of historic interest and all have a strong relationship to the coast.

The sensitivity of this area to offshore wind farm developments, as assessed by Scott *et al*. (2005), is considered to be Low-Medium.

Area 6: Moray Firth

- Long sandy beaches interspersed with low rocky headlands;
- Backed by gently rolling arable farmed plain of varying width;
- Small hills on Black Isle contain a narrow coastal edge;
- Well settled coastal fringe around Nairn and Inverness; sparser patter of traditional fishing villages on Outer Firth;
- Dornoch Firth and Loch Fleet less populated, narrower and more contained;
- Some isolated industry, bridges and infrastructure with oil platforms a feature;
- Views focus on the sea and firths – mountains a focus to west;
- Firth used for recreation, including sailing, dolphin watching.

The sensitivity of this area to offshore wind farm developments, as assessed by Scott *et al*. (2005), is considered to be Medium.

Area 7: East Caithness & Sutherland

- Predominately low rocky coastline with few significant indentations or headlands, low cliffs are present in some areas;
- Narrow coastal shelf a feature and this is tightly constrained by inland hills which direct views over sea and along strongly linear edge, usually farmed in strips;

- Communications located within coastal shelf;
- Tight knit villages and some crafting on coastal edge or located at base of cliffs – many of these have a strong traditional character;
- Occasional sandy bays further north in Caithness backed by low lying and more extensive farmland.

The sensitivity of this Area to offshore wind farm developments is considered to be Medium.

Seascape assessments based upon turbines with a height of 160 m have also been done for the Round 2 strategic areas (BMT Cordah Ltd, 2003). The potential visual effect on the seascape units is defined in terms of high sensitivity, medium sensitivity and preferred unit. The significance of the effect within these areas is determined by distance offshore and the sensitivity of the unit. The DTI (2005) also suggested that the limit of visual significance of Round 2 offshore wind farms within a national seascape unit was 35 km. Based on these reports, the zones of visual influence have been defined as:

- <8 km: highest potential impact upon seascape;
- 8-13 km: high potential impact on seascape;
- 13-24 km: moderate potential impact on seascape;
- 24-35 km: low potential impact on seascape; and
- >35 km: negligible potential impact on seascape.

Using these impact boundaries the proposed development area is located within the low potential effect band, i.e. between 24-35 km offshore. However, it is likely that the turbines within the eastern development area could exceed 160m. Figure 5-14 is an initial ZTV for the project based on turbines 5MW turbines. The 'seascape impact buffers' are illustrated on the same figure.

Seascape assessments for the Beatrice demonstrator project

The Beatrice demonstrator 5 MW turbines lie approximately 22 km from the shore (Talisman Energy, 2006) to the south of the proposed development area (Figure 5-13). An extensive seascape, landscape and visual impact assessment (SLVIA) (Horner & Maclennan, 2005) was carried out during the Beatrice Demonstrator Project Environmental Impact Assessment, and reported in the Environmental Statement (Talisman Energy, 2006). Given the distance offshore of the 5 MW turbines, the existing information about the visual impact of the Beatrice demonstrator project can be used with some confidence to provide *general* information about the potential visual effects of the proposed development area.

It was agreed in consultation with SNH that the Beatrice demonstrator SLVIA was conducted within a radius 65 km from the proposed development. The radius of the study area was greater than the best practice guidance of 35 km because of the size of the turbines (5 MW turbine with blade tips at 151 m, set in isolation against the open surroundings) and "the high clarity of visibility that can occur when looking over the sea during exceptional weather conditions, *especially in a northwards direction when the sun is at a low angle from behind*" (Horner & MacLennan, 2005). The reasons for increasing the study area were to enable an assessment to be made of the likely visibility of the demonstrator turbines from far distances. The viewpoints selected for the study were chosen with regard to sites and locations that were of particular importance for tourism. The viewpoints or assessment locations were chosen to reflect roadside viewpoints, areas of visitor activity and specialised landscapes such as Garden and Designed Landscapes.

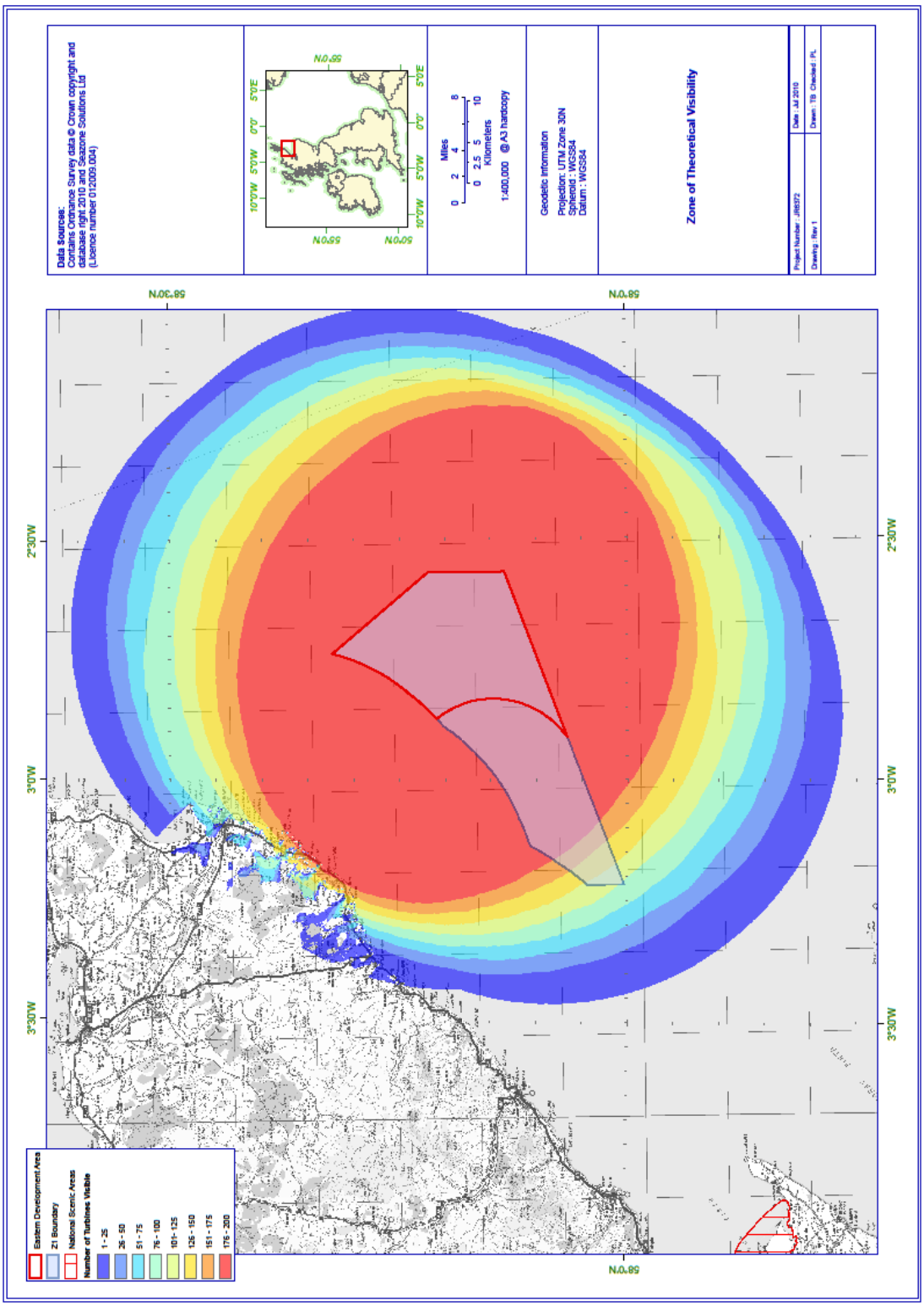


Figure 5-14: Zone of Theoretical Visibility with seascape impact boundaries.

In summary, the turbines would not be visible from any major settlement. However, it was concluded that the Beatrice demonstrator project would have a slight adverse effect on the landscape and visual baseline conditions during construction and operation, although the impacts associated with the construction phase were considered to be temporary adverse effects. Overall, these effects were considered to be non-significant.

5.3.10.2 DATA GAPS

A study to determine cumulative and in-combination viewpoints will be required. Site visits to viewpoints and the production of site specific ZTVs will also be required.

5.3.10.3 ENVIRONMENTAL IMPACTS SCOPING

Based on available literature, the following are perceived to be the potential impacts on the seascape, landscape and visuals as a result of wind farms within the marine environment:

Impact Description	Potential site specific impact	Potential cumulative and/or in-combination Impact
Change in visual resource	✓	✓
Change in landscape character	✓	✓
Change in the setting of a historic environment feature	✓	✓

5.3.10.4 SITE SPECIFIC IMPACT METHODOLOGY

For each of the potential impacts described above a survey or study and method of impact assessment is described in the tables below.

Potential Impact(s)	**Change in landscape and seascape character during construction, operation and decommissioning of the wind farm:** **Indirect effects on designated landscapes:** **Direct and indirect effects on undesignated seascapes.** **Indirect effects on undesignated landscapes.**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts on landscape character, the following studies will be undertaken: Desk-based study using a ZTV. Field work to confirm desk-based study and for descriptions of landscape character areas and seascape units/areas.
Method of Impact Assessment	The SVIA will be undertaken with due regard to best practice guidance set out in: Department of Trade and Industry, Guidance on the Assessment of Impact of Offshore Wind Farms: Seascape and Visual Impact Report (November 2005); Horner and MacLennan and Envision, Visual Representation of Windfarms: Good

	Practice Guidance (2006), for Scottish Natural Heritage, The Scottish Renewables Forum and the Scottish Society of Directors of Planning; and, Landscape Institute and Institute of Environmental Management and Assessment Guidelines for Landscape and Visual Impact Assessment': Second Edition (2002).

Potential Impact(s)	**Change in visual resources during construction, operation and decommissioning of the wind farm:** **Views from designated landscapes.** **Views from publicly accessible historic environment features.** **Views from Core Paths.** **Views from other promoted paths.** **Views from other public rights of way.** **Views from other publicly accessible land.** **Views from residential properties.** **Potential marine based views.**
Survey/Study Proposed to Assess Impact	To determine the potential for effects on visual resources, the following studies will be undertaken: Desk-based study using a ZTV. Consultation with consultees to reach agreement on viewpoints. Assessment of meteorological data for visibility for the past 10 years. Assessment of sea use/users. Field work to confirm desk-based study and for descriptions of chosen viewpoints.
Method of Impact Assessment	The SVIA will be undertaken with due regard to best practice guidance set out in: Department of Trade and Industry, Guidance on the Assessment of Impact of Offshore Wind Farms: Seascape and Visual Impact Report (November 2005); Horner and MacLennan and Envision, Visual Representation of Wind Farms: Good Practice Guidance (2006), for Scottish Natural Heritage, The Scottish Renewables Forum and the Scottish Society of Directors of Planning; and, Landscape Institute and Institute of Environmental Management and Assessment Guidelines for Landscape and Visual Impact Assessment': Second Edition (2002).

Potential Impact(s)	**Change in setting of historic environment feature during construction, operation and decommissioning of the wind farm:** **Indirect effects on designated features:** **Indirect effects on undesignated features e.g. historic landscape character.**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts on landscape character, the following studies will be undertaken: Desk-based study using a ZTV. Field work to confirm desk-based study and for descriptions of historic environment features or character areas.
Method of Impact Assessment	The assessment of effects on the setting of historic monuments will be undertaken with due regard to best practice guidance set out in: Wessex Archaeology for COWRIE, Historic Environment Guidance for the Offshore Renewable Sector (2007).

5.3.10.5 SITE SPECIFIC SURVEY METHODOLOGY

BEST PRACTICE GUIDANCE

- Hill *et al*. (2001). Guide to Best Practice in Seascape Assessment
- Landscape Institute and Institute of Environmental Management and Assessment (2002). Guidelines for Landscape and Visual Impact Assessment. 2nd edition
- Swanick, C. & Land Use Consultants (2002). Landscape Character Assessment: Guidance for England and Scotland
- University of Newcastle (2002). Visual Assessment of Windfarms Best Practice
- DTI (2005). Guidance on the Assessment of Impact of Offshore Wind Farms: Seascape and Visual Impact Report
- Scott *et al*. (2005). An assessment of the sensitivity and capacity of the Scottish seascape in relation to offshore windfarms
- Scottish Natural Heritage (2005). Cumulative Effects of Wind Farms: Version 2.
- Horner and MacLennan & Envision (2006). Visual Representation of Windfarms: Good Practice Guidance
- Scottish Natural Heritage (2007). Visual Representation of Windfarms: Good Practice Guidance.
- Wessex Archaeology Limited (2007). Historic environment guidance for the offshore renewable energy sector
- COWRIE (2008). Guidance for assessment of cumulative impacts on the historic environment from offshore renewable energy
- Historic Scotland (2009). Managing Change in the Historic Environment: Setting.
- Historic Scotland (2009). Scoping of Development Proposals: Assessment of Impact on the Setting of the Historic Environment Resource – some general considerations
- DECC (2009). UK Offshore Energy Strategic Environmental Assessment: Future Leasing for Offshore Wind Farms and Licensing for Offshore Oil and Gas Storage, Environmental Report
- Scottish Natural Heritage (2009). Siting and Designing windfarms in the landscape. Version 1

5.3.10.6 SUMMARY OF METHODOLOGY

IDENTIFICATION OF POTENTIAL EFFECTS AND PROPOSED ASSESSMENT METHODOLOGY

Using industry guidance contained within the relevant documents referred to below, the SVIA will undertake the following:

- A scoping exercise and consultation with statutory and non-statutory consultees to establish valued regional and local landscape and seascape resources and viewpoints;
- Baseline studies of existing landscape and seascape and historic environment resources and visual receptors incorporating national level conclusions;
- Assess the sensitivity of those resources and receptors to the proposals;
- Provide advice on any mitigation that may be possible, e.g. layout, and incorporate agreed mitigation into the scheme description;
- Propose and agree monitoring;
- Identify the potential effects of the proposal on the landscape, seascape and historic environment resources and visual receptors during the construction, operation and decommissioning phases of the project and assess the significance of these effects;

- A cumulative assessment on the combined effects of the proposed development in combination with any other major developments that lie within the agreed study area. A list of such developments would be agreed with the relevant authorities; and
- Present the finding in the Environmental Statement (ES) and Non-technical Summary (NTS).

5.3.10.7 CUMULATIVE AND IN-COMBINATION IMPACT ASSESSMENT & SURVEY METHODOLOGIES

The methodologies and potential survey requirements by which cumulative and in-combination effects will be assessed will be agreed with consultees as part of a future scoping exercise undertaken by the MFOWDG.

It is anticipated that the methodology will adhere to established practice in relation to Seascape and Visual Impact Assessment, which takes account of cumulative effects (e.g. DTI, 2005; Scottish Natural Heritage, 2005).

5.3.10.8 POTENTIAL MITIGATION METHODS

Potential mitigation measures for impacts to seascape, landscape and visual receptors include distance from coastline and the proposed development area is currently located adjacent to the 12 nm limit. Turbine colouring may also be used to help mitigate impacts.

The mitigation measures proposed for the development area will be dependent upon the final design of the site and the potential impacts as determined by the EIA studies. Options of mitigation will be discussed with the relevant authorities prior to ES submission.

5.3.11 ARCHAEOLOGY AND CULTURAL HERITAGE

Cultural heritage and archaeological remains are located on and below the seabed. Archaeological remains that are protected include wrecks and wreckage of historical, archaeological or artistic importance designated as protected or dangerous under the Protection of Wrecks Act (1973), military remains designated under the Protection of Military Remains Act (1986) and Scheduled Monuments designated under the Ancient Monuments and Archaeology Act (1979). It is an offence to cause damage to protected archaeological remains and in some cases where a restricted zone exists around the remains, a licence is required before any works or salvage can be undertaken within this zone. Restricted zones can vary in diameter. Obstructions and foul ground areas can also represent wrecks but have not been classified as such because they have not been fully investigated.

It is acknowledged that the seas around Britain contain many archaeological sites and remains. Such sites reflect the changing nature of both the coastline around Britain and the activities of the country throughout previous centuries, and broadly include:

- Archaeological landscapes formed when parts of the UK seas were still dry land;
- Remains and sites, including but not limited to shipwrecks, evidence of Britain's early history; and
- More recent sites, reflecting Britain's role as a major naval, mercantile, industrial and imperial power.

5.3.11.1 BASELINE ENVIRONMENT

A total of 375 marine archaeology sites have been identified along the Moray Firth coastline from surveys commissioned by Historic Scotland. Most of these are intertidal sites (Talisman, 2005). In addition to marine archaeological sites within the Moray Firth, there are many ship and aircraft wrecks in the area. The strategic importance of the Moray Firth area to the navy during WWI and WWII; the concentration of much of the North Sea fishing fleet in coastal ports along the north east coast of Scotland; the importance of maritime trade routes in the area, and the treacherous nature of near shore waters has lead to this area containing numerous wrecks.

There are three charted wrecks within the north section of the proposed development area (Figure 5-15). They are currently not protected historical sites and at this stage. However, it is noted that wrecks can be classified within the lifetime of a project.

To the north-east of the proposed development area, the wreck of HMS Exmouth is located at 58°18'467''N 2°28'938''W. This is a protected wreck and has an exclusion zone of 750 m radius. Within controlled sites, it is an offence to tamper with, damage, move or unearth any remains, enter any hatch or opening or conduct diving, salvage or excavation operations for the purposes of investigating or recording the remains, unless authorised by licence.

Fleming (2004) stated that it was difficult to predict the potential for pre-historic remains within the central North Sea, but there was a low probability of finding *in situ* remains in the offshore environment because of the strong currents, exposure to North Atlantic storms, thin sediment cover and large areas of exposed bedrock in this area. The probability of finding remains within the region was greater in more sheltered coastal areas. However, there has not been a detailed study of the proposed development area.

5.3.11.2 DATA GAPS

There is a lack of site specific survey data and it is therefore anticipated that such data will be required for the impact assessment process.

5.3.11.3 ENVIRONMENTAL IMPACTS SCOPING

Based on available literature, the following are perceived to be the potential impacts on the archaeology and cultural heritage as a result of wind farms within the marine environment:

Impact Description	**Potential site specific impact**	**Potential cumulative and/or in-combination Impact**
Contamination, damage or loss of archaeological remains in or on the seabed	✓	x
De-stabilisation of sites through changed sedimentary regimes	✓	x

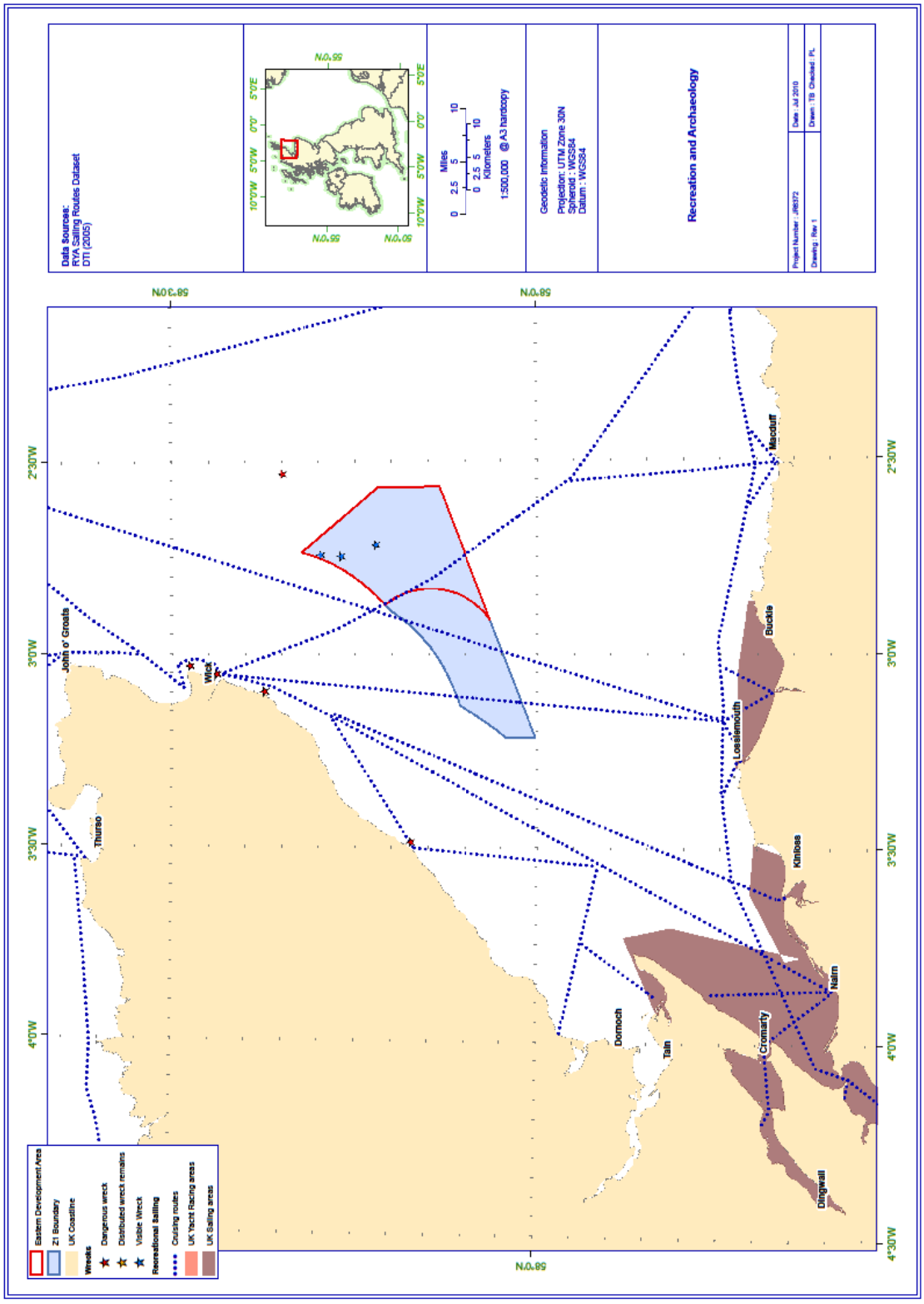


Figure 5-15: Underwater wrecks and recreational sailing routes within the outer Moray Firth.

There are a number of shipwrecks located across the study area; none of those within or immediately adjacent to the STW sites are protected. Turbine and cable placement would seek to avoid any features of historical interest on the seabed and it is expected that the chance of accidental disturbance of features will be minimal. During operation impacts will be limited to potential indirect effects associated with altered patterns of seabed sediment erosion and accretion. Therefore, the potential for cumulative and in-combination impacts on archaeology and cultural heritage are **scoped out**.

5.3.11.4 SITE SPECIFIC IMPACT METHODOLOGY

For each of the potential impacts described above a survey or study and method of impact assessment is described in the tables below.

Potential Impact(s)	**Contamination, damage or loss of archaeological remains in or on the seabed**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts on existing archaeological remains, the following studies will be undertaken: Assessment of archaeological potential and significance Geophysical survey (see section 5.1.4.4)
Method of Impact Assessment	The assessment of archaeological potential and significance will be used to identify the potential archaeological remains within the area and their importance. The potential for impact upon these features will be assessed using a risk assessment of the direct impacts of turbine location and construction methods.

Potential Impact(s)	**Destabilisation of sites through changed sedimentary processes**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts on existing archaeological remains, the following studies will be undertaken: Assessment of archaeological potential and significance Geophysical survey (see section 5.1.4.4) Metocean studies (see section 5.1.4.4)
Method of Impact Assessment	The assessment of archaeological potential and significance will be used to identify the potential archaeological remains within the area and their importance. The potential for impact upon these features will be assessed in relation to the results of the potential for changes in the sediment transport regime (e.g. the potential to cause burial or exposure of features).

5.3.11.5 SITE SPECIFIC SURVEY METHODOLOGY

BEST PRACTICE GUIDANCE

The scope will follow the non-statutory *Code of Practice for Seabed Developers* produced by the Joint Nautical Archaeology Policy Committee, and, where applicable, following the following guidance and legislation:

- Article 303 of the United Nations Convention on the Law of the Sea (UNCLOS)
- Article 2.ii. The European Convention on the Protection of the Archaeological Heritage (revised) (The Valetta Convention)
- Planning Advice Note 42 "Advice on the handling of archaeological matters within the planning process"
- Scottish Planning Policy 23 "Planning and the Historic Environment"
- Protection of Wrecks Act 1973
- The Ancient Monuments and Archaeological Areas Act 1979
- Protection of Military Remains Act 1986
- The Merchant Shipping Act 1995
- Historic Scotland Archaeological Procedure, Paper 4, 1996
- BMAPA & English Heritage (2003). Marine Aggregate Dredging and the Historic Environment: Guidance Note
- Wessex Archaeology Ltd (2007). Historic environment guidance for the offshore renewable energy sector

5.3.11.6 SUMMARY OF METHODOLOGY

ARCHAEOLOGICAL POTENTIAL AND SIGNIFICANCE

The assessment would include collation of existing documentary evidence from a variety of sources in order to predict the likely character and extent of archaeological remains at the site. The desk-study would be supplemented by assessments of field data collected as part of the geophysical survey, benthic and geotechnical campaigns, (if engineering data becomes available during the EIA process). For instance, review of swathe bathymetry, side-scan sonar and sub-bottom profiling can be used to identify features of archaeological relevance, such as river valleys or beaches (Fleming, 2004). The analysis of grab and if available, core samples, also allows an assessment of the potential for submerged landscapes through sedimentary facies and human activity.

It should be noted that if any offshore wreck material is recovered, the developer will inform the Receiver of Wreck under Section 236 of The Merchant Shipping Act 1995, and await further instruction.

OTHER SURVEYS/STUDIES TO BE USED TO IDENTIFY IMPACTS

Geophysical, geotechnical and metocean surveys are described in section 5.1.4.4.

5.3.11.7 POTENTIAL MITIGATION METHODS

Potential mitigation measures for impacts to archaeology and cultural heritage include micrositing of turbines, choice of construction techniques, use of scour mats around turbine bases (if required), the use of a written scheme of investigation and a finds protocol.

The mitigation measures proposed for the development area will be dependent upon the final design of the site and the potential impacts as determined by the EIA studies. Options of mitigation will be discussed with the relevant authorities prior to ES submission.

5.3.12 SOCIO-ECONOMICS

5.3.12.1 BASELINE ENVIRONMENT

The development area is bounded to the west by the eastern coastline of the Highlands and to the south by the northern coastline of the Grampians and Aberdeenshire.

The largest population centre on eastern coastline of the Highlands is Inverness, which is also the largest population centre in the Highlands. Other main population centres on the coastline include Wick, Helmsdale, Brora, Golspie, Dornoch, Tain, Fortrose, Avoich, Inverness, Nairn, and Lossiemouth. Within the Highlands, the public sector is the greatest employer within the Highlands, followed by distribution, hotels and catering and then banking, finance and insurance. Manufacturing and construction are also relatively large employment sectors comprising of approximately 15% of the workforce. Unemployment within the region has risen since 2008, with 0.9% of the working age populace in long-term unemployment in 2010. Within the region, Inverness has the most number of people in long-term unemployment but Wick has the highest percentage (The Highland Council, 2010).

Within the northern section of the Highlands, the Caithness and North Sutherland Regeneration Partnership are taking forward a regional action plan to assist diversity the economy of the region. Projects in the development priorities include development at Wick Harbour, development at Scrabster Harbour, Caithness engineering, the relocation of businesses to this area, transport connections and IT connectivity (CNSRP, 2010).

The Banff and Buchan regions form the northern section of the Aberdeenshire coastline. The main population centres along the coastline are Buckie, Banff and Fraserburgh. Statistics from 2008 indicated that within Banff and Buchan, public services form the largest employment sector followed by manufacturing and then distribution, hotels and restaurants. Construction accounts for approximately 5% of employment. In 2007, unemployment with Banff and Buchan accounted for 27.8% of unemployment with Aberdeenshire (Aberdeenshire Council, 2008).

The development of offshore infrastructure can have an impact on the local economy through local spending, use of services and goods and employment. The economic impact will be most significant during the construction and operation and maintenance phases with the economic spend spread over many years. As a rule of thumb it is considered that for every megawatt installed, approximately £1 million of economic expenditure occurs, of which a portion will be within the local area (DTI, 2002). As well as economic benefits, wider beneficial effects will arise through the development of renewable energy, and will include reduced greenhouse gas emissions, energy consumption and education opportunities.

It is possible that specific sectors, such as commercial fisheries and tourism, will have concerns regarding the knock-on economic effects of wind farm development, resulting from, for example, restricted access to fishing grounds or altered visual character.

Tourism

The Moray Firth can be divided into two distinct regions of interest: the Highlands (covering the northeast coastline from Wick to Nairn); and Aberdeen and Grampian (covering the coastal trail from Elgin through to Stonehaven). During 2006 it was estimated that UK residents took 1.93 million tourist trips to the Highlands of Scotland and spent £479 m in the area. Overseas visitors took 0.54m trips. Tourism related employment accounted for 13.8% of the workforce in the area. Over the same time period it was estimated that UK residents took 1.5 million tourist trips to Aberdeen and Grampian and spent £275 m in the area. Overseas visitors took 0.25m trips. Employment in the tourism sector accounted for 8% of employment. Within these regions, the WDCS wildlife centre in Spey Bay was within top visitor attractions in Grampian and Aberdeenshire (Visit Scotland, 2010).

The tourism industry in the two areas is to a significant degree based upon the diverse and extensive coastal landscape (which includes sandy beaches, estuaries, cliffs and coves), and the wildlife that this supports. The Moray Firth provides a wide variety of land- and water-based recreational activities. Primary land-based activities include walking, cycling and orienteering. Along the coastline, many coastal pathways attract residents and visitors with respect to the wildlife and scenic coastal landscapes. Other land-based activities include off-road cycling and horse riding in forested areas and rock climbing along some of the coastal cliff sites. In addition, some of the best known golf courses in Scotland are located at Royal Dornoch and Nairn.

The primary water-based activities include sailing and wild-life watching. Eight sailing clubs and approximately 460 yachts and dinghies are based in the Moray Firth. Other activities include wind-surfing, surfing, scuba diving, power-boating and water skiing. The easily accessible and scenic beaches also encourage swimming and beach activities. Angling within the rivers surrounding the Moray Firth also contributes significantly to the economy. Dolphin watching trips are run in the Moray Firth all year round, providing tourists with the chance to observe dolphins, whales, basking sharks, seals and marine birds.

The last 10 to 15 years has seen general tourism in the area decline, but an increase in the establishment of niche tourist activities. Eco-tourism is a growing industry within the area, with visitors appreciating its varied and unspoilt scenery, and rich wildlife.

The proposed development area is approximately 22.2 km from the nearest coastline, and is little used at present for tourism or recreation with recreational yachts occasionally cruising through the area (Figure 5-15).

5.3.12.2 DATA GAPS

It is considered that local, regional and national Government and other relevant stakeholder groups hold sufficient data for the region and that further data collection will not be required.

5.3.12.3 ENVIRONMENTAL IMPACTS SCOPING

Based on available literature, the following are perceived to be the potential impacts on marine recreation and amenity as a result of wind farms within the marine environment:

Impact Description	Potential site specific impact	Potential cumulative and/or in-combination Impact
Impact to security of energy supply	✓	✓
Changes to local employment opportunities	✓	✓
Changes to expenditure within the local economy associated with goods and services	✓	✓
Impacts on economics of other marine users (e.g. fisheries or tourism/recreation)	✓	✓
Impacts on educational opportunities	✓	✓

Impacts on tourism and recreational activities will result from temporary disruption caused by construction activities. The limited seaborne activity, primarily sailing, will experience temporary disruption during the offshore works, while coastal activities may be affected by highly localised disruption at cable landfall and substation locations. In addition, the minimum safe (air) clearances between sea level conditions at mean high water springs (MHWS) and wind turbine rotors should be suitable for the vessels types identified in a traffic survey but generally should not be less than 22 metres (RYA, 2005; MGN 371). Any potential impacts on marine recreation activities involving navigation are covered in section 5.3.3.

Secondary effects on tourism and recreation associated with seascape, landscape and visual character, will be addressed under those topic headings.

5.3.12.4 SITE-SPECIFIC IMPACT ASSESSMENT METHODOLOGY

For each of the potential impacts described above a survey or study and method of impact assessment is described in the table below.

Potential Impact(s)	**Impact to security of energy supply** **Changes in expenditure within the local economy** **Changes to local employment patterns** **Economic impacts on other marine users** **Impacts on educational opportunities**
Survey/Study Proposed to Assess Impact	To determine the potential for impacts on socio-economic receptors, the following studies will be undertaken: Review of the national & regional economy Review of regional socio-economic strategies Review of socio-economic impacts associated with offshore wind development
Method of Impact Assessment	A socio-economic, tourism and recreation impact assessment will consider the effects of the proposed development on socio-economic activity, local and regional tourism and recreational marine users during the construction, operation and decommissioning of the proposed offshore wind farm.

	There are no recognised standards or methodologies for assessing these effects in an offshore wind farm EIA to date, however all relevant guidance and existing studies will be used to undertake the assessment. Furthermore, guidance from stakeholders and professional bodies will be drawn upon to inform the socio-economic, tourism and recreation impact assessment.

5.3.12.5 SITE SPECIFIC SURVEY METHODOLOGY

BEST PRACTICE GUIDANCE

There is currently no best practice guidance associated with the assessment of impacts on socio-economic factors, however the following UK infrastructure guidance should be considered within the assessment:

- Infrastructure UK, Strategy For National Infrastructure, March 2010.

5.3.12.6 SUMMARY OF METHODOLOGIES

The key method of assessment will be to undertake a literature review of available information on socio-economic receptors along the east coast of Scotland. This review will be coupled with consultation with relevant stakeholders.

5.3.12.7 CUMULATIVE AND IN-COMBINATION IMPACT ASSESSMENT & SURVEY METHODOLOGIES

The methodologies and potential survey requirements by which cumulative and in-combination effects will be assessed will be agreed with consultees as part of a future scoping exercise undertaken by the MFOWDG.

It is likely that assessment of effects will be undertaken on a site-specific basis and based on a review of available literature relating to the socio-economic effects of offshore wind farm development. It is anticipated that the developers will subsequently share information to enable an informed assessment of cumulative effects within their EIAs.

5.3.12.8 POTENTIAL MITIGATION METHODS

Potential mitigation measures for impacts to socio-economics will be site and region specific. The mitigation measures proposed for the development area will be dependent upon the final design of the site and the potential impacts as determined by the EIA studies. Options of mitigation will be discussed with the relevant authorities prior to ES submission.

5.3.13 OFFSHORE WIND FARMS

5.3.13.1 BASELINE ENVIRONMENT

There are no existing offshore wind farms within the study area, although there are two 5 MW turbines (the Beatrice demonstrator project) which are part of the Beatrice oil field infrastructure. In addition, the Beatrice Offshore Wind Farm, an offshore wind farm of 920 MW, is proposed for development to the north-east of the proposed development area (Figure 5-13). At present The Crown Estate has awarded the Beatrice Offshore Wind Limited an exclusivity agreement, which enables the developer to explore the potential of the sites for offshore wind. Granting of a seabed lease, which will allow wind farm construction to proceed, will be subject to the outcome of a SEA for offshore wind that is expected to be completed during 2010, and subject to other statutory consents being obtained by developers.

To the south of the study area there are proposed offshore wind farm sites off Aberdeen and in the outer Firth of Forth and Tay region (Table 5-13).

Table 5-13: Existing and proposed offshore wind farms

Project	Description	Location	Status
Inch Cape	Installation of approx. 181 wind turbines, with approx. capacity 905MW	Approx. 15.5 km east of the Angus coastline	Application for consent expected 2011 earliest
Neart na Gaoithe	Approx. capacity 420MW	Approx. 15 km east of Fife Ness on the Fife coastline	Application for consent expected 2011 earliest
Forth Array	Approx. capacity 415MW	Approx. 17 km east of St Abbs on the Northumberland coastline	Application for consent expected 2011 earliest
Firth of Forth Round 3 Zone	Approx. capacity 3,465MW	Outside of the 12 nm territorial waters limit, east of the Firth of Forth	Application for consent expected 2013 earliest
Beatrice	Approx. capacity 920MW	Outer Moray Firth	Application for consent expected 2011 earliest
Beatrice Demonstrator Project	2 turbines with max. capacity 10MW	Outer Moray Firth	Operational since 2006
Aberdeen Offshore Wind Farm	5 turbines, approx. capacity 115MW	1.5 – 5km east of the Aberdeen coastline	Not yet awarded

5.3.13.2 ENVIRONMENTAL IMPACTS SCOPING

Cumulative impacts associated with the development of other wind farms are discussed in the above sections.

5.4 STRUCTURE OF EIA

The Environmental Statement is likely to presented in the following format:

Volume 1: Environmental Impact Assessment

Chapter 1 – Introduction
Chapter 2 – Legal and Policy Framework
Chapter 3 – Approach to EIA
Chapter 4 – Site Selection and Consideration of Alternatives
Chapter 5 – Project Description
Chapter 6 – Environmental Setting
Chapter 6 – Physical Impact Assessment
1. Metocean and coastal processes
2. Underwater noise

Chapter 7 – Biological Impact Assessment
1. Marine Ecology
2. Fish and Shellfish
3. Marine Mammals
4. Ornithology
5. Designated Sites (including summary of information to support Appropriate Assessment)

Chapter 8 – Human Impact Assessment
1. Commercial Fisheries
2. Commercial Navigation
3. Civil Aviation
4. Ministry of Defence
5. Seascape, Landscape and Visuals
6. Archaeology & Cultural Heritage
7. Socio-economics

Chapter 9 – Evaluation of Environmental Effects, Proposed Mitigation and Monitoring
Chapter 10 – References

Volume 2: Technical Reports

Cumulative and in-combination impact assessments will be presented within the relevant sections.

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Consultation

Stakeholders and the wider public are invited to provide comments and feedback on the Scoping Report, in addition, information on potential special constraints to windfarm siting is also welcomed.

The consultation period runs from 31 August to 30 November 2010. Please direct all feedback to:

Craig Milroy
Stakeholder Manager
Moray Offshore Renewables Ltd
EDPR UK
40 Princes Street
EDINBURGH EH2 2BY
Tel. 0131 556 7602
craig.milroy@edprenovaveis.com

edp renewables

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